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NUCLEAR REGULATORY COMMISSION

Title: Louisiana Energy Services

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ADJUDICATIONS STAFF

Docket Number: 70-3103-ML

Location: Hobbs, New Mexico

Date: Monday, February 7th, 2005

Work Order No.: NRC-186 Pages: 340 - 872

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ATOMIC SAFETY AND LICENSING BOARD
(ASLB)

+ + + + +

HEARING

In the Matter of:

LOUISIANA ENERGY SERVICES, L.P.	Docket Nos. 70-3103-ML
(National Enrichment Facility)	ASLBP No. 04-826-01-ML

Monday, February 7th, 2005

Conference Room
Lea County Event Center
5101 Lovington Highway
Hobbs, New Mexico

The above-entitled matter came on for hearing, pursuant to notice, at 9:30 a.m.

BEFORE:

G. PAUL BOLLWERK, III	Chair
PAUL B. ABRAMSON	Administrative Law Judge
CHARLES N. KELBER	Administrative Law Judge

APPEARANCES:

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Also Present:

GEORGE A. HARPER, P.E.
ROGER L. PEERY
ALAN TOBLIN
ROD KRICH
JAMES PARK
GEORGE RICE

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KEY
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A-Admitted into evidence
R-Rejected
W-Withdrawn
TUA-Taken under advisement

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1 P-R-O-C-E-E-D-I-N-G-S

2 9:21 a.m.

3 CHAIR BOLLWERK: Let's go ahead and go on

4 the record, please.

5 Good morning. Today this Atomic Safety

6 and Licensing Board is here to conduct an evidentiary

7 hearing regarding certain of the environmental issues

8 in the Louisiana Energy Services LP proceeding.

9 As we noted, in our Hearing Notice of

10 January 7th, 2005, the Board is here to receive

11 testimony and exhibits, and allow the cross

12 examination of witnesses relating to certain matters

13 at issue in this proceeding, regarding the December

14 2003 application of Louisiana Energy Services, or LES,

15 for a license under 10CFR17, for authorization to

16 posses and use source byproduct, and special nuclear

17 material, in order to enrich natural uranium to a

18 maximum of five percent uranium 235, or U-235, by the

19 gas centrifuge process.

20 Which Louisiana Energy Services proposes

21 to do at a facility denominated as a National

22 Enrichment Facility, or NEF, to be constructed near

23 Eunice, New Mexico.

24 Specifically, the Board will hear evidence

25 regarding challenges by Intervenors, Nuclear

1 Information Resource Service, and Public Citizen, or
2 NIRS/PC, to either the environmental report portion of
3 the Louisiana Energy Services application, or the NRC
4 Staff's September 2004 Draft Environmental Impact
5 Statement, or DEIS.
6 In addition, as I will outline in more
7 detail a little later, on Saturday of this week, the
8 Board will entertain oral limited appearance
9 statements from members of the public in connection
10 with this proceeding.
11 As the January 7th Hearing Notice
12 indicated, the issues we will be considering, over the
13 next several days, include NIRS/PC Environmental
14 Contention 1, also referred to as EC-1, concerning
15 facility impacts upon ground and surface water;
16 Contention NIRS EC-2, regarding facility impacts upon
17 water supplies; Contention NIRS/PC EC-4, concerning
18 impacts of waste storage; and Contention NIRS/PC EC-7,
19 regarding the need for the facility.
20 However, before we begin hearing evidence
21 on these three contentions, or these four contentions,
22 there are several other matters that I would like to
23 bring to the attention of those attending today's
24 proceeding.
25 The first is the matter of public

1 attendance at the hearing sessions on these four
2 issues. The evidentiary session on Contention NIRS/PC
3 EC-1, that we will begin today, will be open to the
4 public.
5 The Board is then scheduled to hear
6 evidence regarding Contention NIRS/PC EC-4, followed
7 by EC-2, and then EC-7. Because it is anticipated
8 that the testimony of LES witness Schnoebelen, it is
9 S-C-H-N-O-E-B-E-L-E-N, Schnoebelen, regarding
10 Contention EC-7, will include confidential proprietary
11 business information, the evidentiary presentation
12 regarding this witness will be closed to the public.
13 Until recently we had anticipated that
14 this would be the only closed session. However, in a
15 February 4th, 2005 filing, LES has advised that one of
16 its exhibits to be admitted in connection with
17 Contention EC-4 also is proprietary, so as to require
18 that any discussion regarding that exhibit would need
19 to be closed, as well. And when that point in the
20 proceeding comes we will deal with it at that point.
21 As I noted, at the outset, the issues
22 before the Board today concern environmental matters.
23 Under our current schedule for this proceeding, we
24 will be holding additional evidentiary sessions in the
25 fall of this year admitted technical contentions on,

1 among other things, the adequacy of the LES radiation
2 protection program, disposal and decommissioning cost
3 estimates, and natural gas related accident risks.
4 Finally, as I mentioned at the beginning,
5 the Board will be conducting oral limited appearance
6 sessions on Saturday morning and afternoon of this
7 week. Those sessions are scheduled for Saturday,
8 February 12th, from 10 a.m. to noon, and 2 p.m. to 4
9 p.m., at the Eunice Community Center, 1115 Avenue I in
10 Eunice.
11 Further, as was indicated in the January
12 7th Notice, the Board anticipates holding additional
13 oral limited appearance sessions in the Hobbs area, in
14 conjunction with the evidentiary hearings currently
15 scheduled for the fall of 2005.
16 The Board will make information regarding
17 those sessions available as the time for those
18 hearings draws near.
19 By way of additional explanation, limited
20 appearance sessions provide members of the public, who
21 are not parties, or directly affiliated with parties
22 to the proceeding, with an opportunity to make a brief
23 oral presentation to the Board, regarding any
24 concerns, or matters, relating to this proceeding,
25 that they wish to bring to the Board's attention.

1 The time allotted for each statement,
2 normally, will be no more than five minutes, but may
3 be further limited, depending on the number of persons
4 who have pre-registered, to make an oral statement,
5 and others who may be present at the designated times.
6 Also, as we indicated in our January 7th
7 Notice, oral limited appearance statements will be
8 entertained during the hours mentioned, or such lesser
9 time as may be necessary to accommodate the speakers
10 who are present.
11 If, however, all scheduled and unscheduled
12 speakers, present at a session, have made a
13 presentation, the Licensing Board reserves the right
14 to terminate the session before the noticed ending
15 time.
16 We would like to encourage anyone who is
17 interested in addressing the Board, later in the week,
18 and who has not previously registered by email or fax,
19 to sign up today. To this end we have provided sign-
20 up sheets on the table, over here to my right, that
21 you can fill out during a break, or at lunch time.
22 If, however, you are already pre-
23 registered, you need not do so again. Moreover,
24 anyone is free, any time, to submit a written limited
25 appearance statement, setting forth their views

1 regarding this proceeding, by mail, fax, or email, by
2 sending it to the office of the Secretary of the NRC,
3 with a copy to the Chairman of this Licensing Board,
4 at the addresses given in the January 7th Notice.
5 Before we move on to the parties
6 evidentiary presentations on Contention NIRS/PC EC-1,
7 I would like to introduce the Board members. To my
8 left is Dr. Charles Kelber. Dr. Kelber, a nuclear
9 physicist, is a full-time member of the Atomic Safety
10 and Licensing Board Panel.
11 To my right is Dr. Paul Abramson. Dr.
12 Abramson, who is both a physicist, and an attorney, is
13 a full-time member of the Panel. My name is Paul
14 Bollwerk, and I'm an attorney, a full-time Panel
15 member, and the Chairman of this Licensing Board.
16 At this point I would like to have the
17 representatives, or counsel for the parties, identify
18 themselves for the record. Why don't we start with
19 the representatives for the Attorney General of New
20 Mexico, followed by NIRS/PC, then move to counsel for
21 Applicant, Louisiana Energy Services, and finally to
22 NRC Staff counsel.
23 MR. COPPIN: Thank you, Mr. Chairman.
24 Chris Coppin, representing the New Mexico Attorney
25 General's office.

1 CHAIR BOLLWERK: Thank you, we are glad to
2 have you with us.
3 MR. COPPIN: Thank you.
4 MR. LOVEJOY: Good morning, Your Honor.
5 I'm Lindsay Lovejoy, representing NIRS/PC, and with me
6 at counsel table is Mr. Douglas Malherek, from Public
7 Citizen, and George Rice, our expert witness on EC-1
8 and EC-2.
9 MR. CURTISS: Mr. Chairman, I'm Jim
10 Curtiss with Winston & Strawn, representing Louisiana
11 Energy Services. With me, at the table here, are Dave
12 Repka of Winston & Strawn, and Marty O'Neill. We also
13 have here John Lawrence, who is the General Counsel of
14 LES, as well as Rod Krich, who is the vice president
15 of licensing, safety, and nuclear engineering.
16 MS. CLARK: Good morning. I'm Lisa Clark.
17 And with me, at counsel table, are Darani Reddick and
18 David Cummings. Sitting behind me is Mr. Alan Toblin,
19 our expert for EC-1, and James Park, who is a member
20 of the Staff.
21 CHAIR BOLLWERK: All right. And I would
22 note, for the record, that the New Mexico Environment
23 Department, which is also a party in this proceeding,
24 was contacted and indicated that they did not wish to
25 be present during these sessions today. But they were

1 advised that we were going to be holding a hearing
2 today.
3 All right. I would note, for the record,
4 that the presentations to the Board, during these
5 evidentiary sessions, will be limited to NIRS/PC,
6 whose admitted environmental contentions are the
7 subject of these evidentiary hearing sessions, LES and
8 the NRC Staff.
9 With all that said, we would like to make
10 mention of one matter before beginning the evidentiary
11 presentations. On February 5th, en limine, to exclude
12 certain portions of the pre-filed rebuttal testimony
13 of Dr. Makhijani. It is M-A-K-H-I-J-A-N-I, concerning
14 Contention NIRS/PC EC-4.
15 In a February 6th, 2005 pleading, LES has
16 indicated it supports the Staff's Motion. It is our
17 intention, at the time that Dr. Makhijani's testimony
18 is offered for inclusion in the record, relative to
19 contention NIRS/PC EC-4, to provide NIRS/PC an
20 opportunity to respond to the Staff's motion.
21 And I suspect you want to do that orally.
22 But if you want to put something in writing, I will
23 leave it up to you as to how you wish to respond.
24 MR. LOVEJOY: Thank you. I think I will
25 respond orally.

1 CHAIR BOLLWERK: All right, we will
2 probably deal with that, EC-4 could be starting
3 tomorrow, so that will be --
4 MR. LOVEJOY: Thank you, Your Honor.
5 CHAIR BOLLWERK: All right. With that
6 introduction we are ready to begin the evidentiary
7 presentations on the admitted NIRS/PC environmental
8 matters.
9 In this regard we previously indicated we
10 would offer counsel, for the parties, a brief
11 opportunity to provide an opening statement outlining
12 their respective positions, regarding the admitted
13 contentions.
14 As will be the case with the evidentiary
15 presentations, we will begin with LES, followed by the
16 NRC Staff, and then NIRS/PC. And as we begin I would
17 like to ask that all cell phones in the hearing room
18 be turned off, and note that this will be the rule
19 throughout the proceeding.
20 So, again, if you have a cell phone,
21 please turn it off. If you need to make a phone call
22 feel free to leave the hearing room, but the cell
23 phones should be off in the hearing. And I would
24 appreciate it very much if you would do that.
25 Mr. Curtiss, then?

1 MR. CURTISS: Thank you, Mr. Chairman, I
2 only have a few brief remarks, and following up on the
3 points that you have made.
4 As you have indicated, this hearing
5 focuses on four environmental contentions, and as
6 such, we would submit that the question for the Board,
7 for each of the four contentions, is whether the
8 requisite hard look has been taken under NEPA, as each
9 one of these contentions is, in fact, a NEPA issue.
10 And whether the Staff, in taking that hard
11 look, has been supported by the Applicant with the
12 necessary information for the Staff to undertake its
13 evaluation on each of these issues, and reach its
14 determination based upon its obligation under NEPA.
15 I think it is important to emphasize that
16 this proceeding, with respect to each of the
17 contentions, is not a groundwater discharge permit
18 proceeding and, indeed, there is a proceeding
19 underway, at the state level, on exactly that issue.
20 Nor is this a proceeding to review the
21 Applicant's withdrawal of water that might be
22 necessary to support the plant.
23 And, finally, this isn't a proceeding to
24 license the construction and operation of a
25 deconversion facility. As I indicated, at the outset,

1 this is a NEPA proceeding where the question is, has
2 sufficient information been rpesented by the
3 Applicant, and addressed by the Staff in its Draft
4 Environmental Impact Statement, upon which the Staff
5 can reach its conclusions.
6 Just briefly, I will summarize what you
7 will hear on each of the four contentions this week.
8 With respect to EC-1, the contention that we will
9 begin with today, I think you will hear, from the LES
10 experts, that there is a substantial amount of data on
11 the geological, and hydrogeological conditions, at the
12 proposed site.
13 Some of this information is drawn from the
14 site characterization efforts at the adjacent WCS
15 site, as well as the information that was the subject
16 of the regulatory review for the nearby landfill.
17 And, indeed, that leads to a point that we
18 think is important to emphasize. The proposed NEF
19 site is located in this specific area for a very good
20 reason. This is a location and a site that has
21 substantial environmental information that has been
22 prepared.
23 And I think you will hear that from the
24 LES experts. And, indeed, with the decisions
25 previously taken, and unrelated to this proceeding, to

1 permit a RCRA facility adjacent to this site, at the
2 WCS site, to permit a landfill in the vicinity of the
3 site.
4 We would submit those decisions,
5 themselves, would not have been taken if there was, in
6 fact, the potential that those facilities would have
7 an adverse effect on the groundwater.
8 And, indeed, I think you will find, based
9 upon the expert testimony of LES witnesses that there
10 is substantial information, consistent with the
11 findings and conclusions that were reached, and
12 drawing upon the information that is available, in
13 this vicinity, that indicates that a substantial and
14 thorough characterization effort has been undertaken.
15 On EC-2 I think you will hear that the
16 proposed facility will use a very modest amount of
17 water from the area around the site, approximately 71
18 acre feet per year. Indeed, you will hear from LES'
19 expert panel, that the officials responsible for
20 making the determinations relative to the water usage
21 of this plant, the local officials, have determined
22 that the amount of water to be used by this facility
23 is so modest that it can be accommodated well within
24 the available and projected water that is available in
25 the vicinity.

1 With respect to EC-4, the contention that
2 addresses the impact of a deconversion facility, I
3 must say I will apologize, in advance, for the volume
4 of the exhibits that LES will be submitting. But the
5 programmatic environmental impact statement, the DOE
6 environmental impact statements for the two
7 deconversion facilities that are being built, I think
8 stand for the proposition that there has been thorough
9 and comprehensive evaluation of the impacts of
10 building a deconversion facility.
11 With respect to the issues raised in this
12 proceeding by Intervenor NIRS/PC, they fundamentally
13 involve the question of a concern about an anhydrous
14 HF process that might be used in this facility.
15 You will hear, from LES' panel, that based
16 upon a decision that was reached in late January, that
17 LES does not intend to use the anhydrous HF option, so
18 we believe that a large part of the concerns raised in
19 the testimony of NIRS' witnesses is, in fact, moot.
20 And on EC-7, the question of whether there
21 is a need for this facility, you will hear two things.
22 One, you will hear, from one of the world's experts on
23 the evaluation of supply and demand considerations
24 associated with the enrichment market, that there is
25 a need for this facility. And I think that testimony

1 will be quite compelling.

2 But, more importantly, I think you will

3 hear that LES has contracted for over 67 percent of

4 the output of this facility, over the first ten years

5 of operation, which we will submit is an outstanding

6 and irrefutable demonstration of the need for this

7 facility. And that will be presented by our panel on

8 EC-7.

9 In sum I think you will find, or I hope

10 you will find, that both the Applicant, and the

11 extensive environmental information that has been

12 gathered, and assembled, relative to these four

13 environmental contentions, has in fact done a thorough

14 job in its environmental report, of presenting the

15 information on the impacts of this facility, relative

16 to the concerns that have been raised.

17 And I think you will also find, and we

18 would submit that the Staff has met its requisite

19 burden, in its Draft Environmental Impact Statement,

20 to take a hard look at the environmental impacts

21 associated with building and operating this facility.

22 Thank you.

23 CHAIR BOLLWERK: Thank you, sir. Ms.

24 Clark?

25 MS. CLARK: Thank you, Your Honor. I

1 would just like to briefly reiterate, again, what the
2 Staff's burden is in respect to this proceeding. And,
3 once again, that is to take a hard look at the
4 environmental impacts of this facility.
5 As you will hear, later today, and as we
6 have expressed in our testimony, we believe that the
7 Staff has met this burden with respect to each of the
8 aspects that are the subject of the contentions in the
9 proceeding today.
10 However, it is important to bear in mind
11 that while the Staff has done a very complete and
12 thorough analysis, the Staff is also, has a great deal
13 of discretion in determining how that evaluation
14 should be conducted.
15 In other words, it is not necessary for
16 the Staff to analyze each and every aspect, every
17 potential impact that might result. And this is an
18 important aspect to keep in mind because it is easy to
19 get drawn into an analysis of all the things the Staff
20 might have done, or the Staff could have done.
21 But the bottom line is whether the Staff
22 took a hard look. And I just want to keep that in
23 perspective when we hear the testimony today. Thank
24 you.
25 CHAIR BOLLWERK: Thank you. Mr. Lovejoy?

1 MR. LOVEJOY: Thank you, Your Honor.
2 While co-Counsel have pointed out the hard look
3 standard, and I couldn't agree more, that is the one
4 that we have to apply here.
5 If the Panel would indulge me, for just a
6 moment, I can't restrain myself from observing that
7 there are other issues involving a plant of this
8 nature and this magnitude which, for reasons that the
9 Panel has expressed, are not going to be examined in
10 this hearing.
11 And they are matters such as the
12 proliferation impact of a facility like this, and the
13 question of, well, the impact on our utility industry
14 and waste disposal issues.
15 It may be that these are not appropriate
16 for this proceeding. They are, definitely, matters of
17 highest natural importance that need to be addressed
18 by our government.
19 I am also struck, if you will indulge me
20 for 20 more seconds, I was a participant in the
21 certification proceedings for the Waste Isolation
22 Pilot Plan, which was certified by EPA, as you may
23 know, in 1999.
24 I am struck by the difference in the
25 process. In the WIPP proceeding, which went by

1 rulemaking, it took a matter of some years. And I
2 think most of the participants got to the point where
3 we had evolved toward a decision that a lot of people
4 were content with.
5 I'm just wondering whether the issues that
6 we are giving a few days to aren't issues that
7 actually are entitled to much more exploration. But
8 that I will just leave there.
9 This week, and perhaps we will finish this
10 week, you will be hearing from NIRS/PC, on these four
11 Environmental Contentions, the gentleman who is going
12 to present evidence on two of them, Mr. George Rice,
13 is sitting to my left.
14 He will give you a brief description of
15 the nature of the site, and in general a description
16 of the nature of the work needing to be done, so that
17 it is possible to take a hard look at the impacts on
18 groundwater at this site, on the water bearing strata
19 of this proposed facility.
20 We know there is water down there, there
21 are fractures. And URENCO, or LES, plans to build
22 both lined and unlined basins on the site, and septic
23 systems. And we do not have a good analysis of where
24 the water from those systems will go.
25 As to EC-2, we will hear from Mr. Rice,

1 that there has been no realistic impact of this
2 facility, realistic assessment of the impact of this
3 facility on the water source for a community where
4 this facility will be in place for 30 or 40 years.
5 The key is the looking forward analysis.
6 From Dr. Makhijani, concerning Contention EC-4, we
7 will hear evidence about the impact of a single
8 activity implied in the construction and operation of
9 an enrichment plant, and that is the construction and
10 operation of the deconversion facility to serve it
11 because the UF-6 needs to be put in a stable form.
12 The analysis of impacts includes an
13 analysis, as NEPA requires, of appropriate
14 alternatives and you will hear, and I submit, that it
15 is a little early to be deciding what all the
16 alternatives will -- what the solution among all those
17 alternatives will be.
18 Last we have the question of need to be
19 served by the facility. LES has put forward, and the
20 Staff has essentially agreed to, an analysis of the
21 supply and demand for enrichment services in the next
22 few decades.
23 Dr. Michael Sheehan will explain, on our
24 behalf, that this showing is inadequate, since there
25 is a great deal of capacity present that is not

1 counted in that analysis, and we are not sure of
2 enrichment capacity. He will explain that LES has
3 created its supposed projected shortage by excluding
4 sources of supply that are actually available.
5 We are dealing here with the environmental
6 issues, only, and the technical issues, and issues
7 involving the safety analysis report, as Judge
8 Bollwerk has said, are for another day. Thank you.
9 CHAIR BOLLWERK: Thank you, sir. Then I
10 guess, at this point, we are ready to swear in the
11 first panel of witnesses. So if LES would like to
12 present those individuals?
13 MR. REPKA: We are prepared. LES would
14 like to call its expert witnesses on Contention EC-1,
15 Mr. George A. Harper, and Roger L. Peery.
16 CHAIR BOLLWERK: And, just as an administrative
17 matter, if the parties will indulge me, what I'd like
18 to do is once we have the witness basically in
19 testimony on the record, then move to an
20 identification of the particular exhibits that that
21 witness will be supporting with brief identification
22 of each one.
23 I recognize it takes a little time. But,
24 as a former Appeal Board member and looking at
25 Appellant records, it's always good to have each one

1 of those set forth. It just makes the whole thing
2 cleaner.
3 MR. REPKA: Yes, sir. We're prepared to
4 do that.
5 CHAIR BOLLWERK: Okay. I appreciate that.
6 MR. REPKA: Gentlemen, could you please
7 identify yourselves for the record? I'll start on the
8 left.
9 WITNESS HARPER: I'm George A. Harper.
10 And I'm a Manager of Regulatory Compliance at Areva
11 Framatome·ANP, Marlboro Massachusettes. And I'm on
12 contract to LES.
13 CHAIR BOLLWERK: All right, let me swear
14 in the witnesses.
15 Whereupon,
16 GEORGE A. HARPER
17 ROGER L. PEERY
18 were called as witness by Counsel for the Applicant
19 and, having been duly sworn, assumed the witness
20 stand, were examined and testified as follows:
21 MR. REPKA: All right. Why don't you go
22 ahead and give us your name again, please?
23 WITNESS HARPER: I'm George Harper. And
24 I'm a Manager of Regulatory Compliance at Areva
25 Framatome ANP in Marlboro, Massachusettes. And my

1 company is under contract to LES to prepare the
2 environmental report and the New Mexico groundwater
3 discharge permit.
4 WITNESS PEERY: I'm Roger L. Peery. I'm
5 with John Shomacker and Associates out of Albuquerque,
6 New Mexico. I'm the CEO and a Senior Hydrogeologist
7 there.
8 Our company has been working on the issues
9 related to the hydrogeologic setting of the site and
10 the issues related to water supply.
11 MR. REPKA: Gentlemen, I will start with
12 your direct testimony. Do you have in front of you a
13 document entitled Pre-Filed Testimony of George A.
14 Harper and Roger L. Peery on behalf of Louisiana
15 Energy Services LP concerning Contention NIRS/PC EC-1,
16 impacts upon ground and surface water? And that's
17 dated January 7th, 2005.
18 WITNESS HARPER: Yes, I do.
19 WITNESS PEERY: Yes, we do.
20 MR. REPKA: Do you recognize that document
21 as your testimony?
22 WITNESS HARPER: Yes.
23 WITNESS PEERY: Yes.
24 MR. REPKA: Was it prepared by you or
25 under your supervision?

1 WITNESS HARPER: Yes.

2 WITNESS PEERY: Yes.

3 MR. REPKA: Do you have any corrections or

4 revisions you need to make to that testimony here this

5 morning?

6 WITNESS HARPER: Yes we do.

7 MR. REPKA: Okay, Mr. Harper, I'll start

8 with you. Do you want to walk us through?

9 WITNESS HARPER: The first correction

10 would be on page 14 of the direct testimony.

11 MR. REPKA: And, before you do that, let

12 me just state for the benefit of the parties, the

13 copies we've made to submit to the Court Reporter

14 today, we've hand-marked these on here.

15 They're minor corrections. And we just

16 ask that everybody mark their copies as we go along.

17 WITNESS HARPER: Okay. First, on page 14,

18 on the 9th line, between 6,600 and 50 milligrams per

19 liter and the period end of that sentence, I'd like to

20 add open parentheses, WCS data, close parentheses, in

21 2,500 to 6,400 milligrams per liter, open parentheses,

22 NW-2 data, close parentheses.

23 CHAIR BOLLWERK: Do you need that

24 repeated?

25 MR. LOVEJOY: Please.

1 WITNESS HARPER: Page 14, line nine.

2 CHAIR BOLLWERK: Very slowly.

3 WITNESS HARPER: Okay. Between 6,600 and
4 50 milligrams per liter end of period ending that
5 sentence I would like to add open parentheses, WCS
6 data, close parentheses, and 2,500 to 6,400 milligrams
7 per liter, open parentheses, NW2 data, close
8 parentheses.

9 CHAIR BOLLWERK: So you are associating a
10 citation and an additional figure, and then another
11 citation to the --

12 WITNESS HARPER: Some additional data --

13 CHAIR BOLLWERK: -- end of the sentence.

14 WITNESS HARPER: Correct.

15 CHAIR BOLLWERK: Everybody get that? Is
16 that clear to everyone?

17 MR. REPKA: All right, the next one?

18 WITNESS HARPER: The next one is on page
19 21, the first word in the fifth line. It's an extra
20 word, uranium. And it can be deleted without any
21 change to the meaning of the sentence.

22 JUDGE ABRAMSON: So the sentence or the
23 phrase reads, going to the line above, TEEB over 30
24 years were assumed to infiltrate.

25 MR. REPKA: Next.

1 WITNESS HARPER: The next is on page 23 on
2 the third line down, the sixth word, conservative. I
3 would like to strike that word. And, on the fourth
4 line, the number 11 should be a number two.
5 That phrase would read basin would be dry
6 for 2 to 12 months of the year.
7 MR. REPKA: Okay.
8 WITNESS HARPER: The next is on page 37.
9 The last two words on that page, as stated, should be
10 stricken. And then on page 38, the first word
11 previously and the comma should be stricken.
12 And then, before the, I would like to add
13 A-T.
14 MR. REPKA: So, the sentence would begin
15 with an at?
16 WITNESS HARPER: Correct. And then, in
17 the middle of the sentence there, after the word well,
18 I'd like to strike the word also and then insert at
19 that location between well and will, location, a well.
20 MR. REPKA: So, the sentence would begin,
21 if I have this correctly, at the upgradient background
22 monitoring well location, a well will be screened to
23 monitor, etcetera.
24 WITNESS HARPER: Correct. The next
25 correction is on page 40. The numerical value, we

1 have 1,350. It should read 1,370. Change the five to
2 a seven.
3 MR. REPKA: Where on page 40, sorry?
4 WITNESS HARPER: I'm sorry, the second
5 line from the bottom.
6 JUDGE ABRAMSON: What should it read?
7 WITNESS HARPER: It should read 1,370
8 versus the 1,350 that's stated. And then, in that
9 same line, we'd like to strike the parenthetical see
10 LES Exhibit 11.
11 MR. REPKA: That's an Exhibit LES is no
12 longer offering.
13 WITNESS PEERY: On page 41 the second line
14 from the bottom is a parenthetical referencing LES
15 Exhibit 12. We'd like to strike that.
16 MR. REPKA: Again, that's an exhibit LES
17 is no longer offering. Do you gentlemen have any
18 other changes on this document?
19 WITNESS HARPER: No.
20 WITNESS PEERY: No.
21 MR. REPKA: With those changes, is the
22 document true and correct to the best of your
23 knowledge and belief?
24 WITNESS HARPER: Yes, it is.
25 WITNESS PEERY: Yes, it is.

1 MR. REPKA: And, do you adopt it as your
2 direct pre-filed testimony in this case?
3 WITNESS HARPER: Yes, I do.
4 WITNESS PEERY: Yes, I do.
5 CHAIR BOLLWERK: Can I just raise one
6 question before we -- on page 31 you say you're
7 striking the LES Exhibit number. Does that mean
8 you're striking the citation in front of that which
9 says see NRC Staff response, da, da?
10 MR. REPKA: No. This seven to 11, it's
11 still a reference to staff discovery response. It's
12 just the document itself is not being offered into
13 evidence by LES.
14 So it still has a page citation to that
15 document.
16 CHAIR BOLLWERK: All right. Is it being
17 offered by anybody else?
18 MR. LOVEJOY: Yes, I believe it is one of
19 our exhibits.
20 CHAIR BOLLWERK: Okay. I'm not trying to
21 get into the weeds here. I just want to make sure
22 we're not --
23 JUDGE ABRAMSON: If, in fact it still
24 references -- I wonder if it might be better to just
25 indicate it's a reference to NIRS/PC exhibit and put

1 the NIRS/PC exhibit number.

2 MR. LOVEJOY: Forty-two.

3 JUDGE ABRAMSON: NIRS/PC 42.

4 CHAIR BOLLWERK: So we're going to now add

5 -- we're going to put the parenthetical back in and

6 put -- I'm sorry, NIRS/PC 42 in parenthesis. Any

7 problems with that from --

8 MR. REPKA: No, that's fine.

9 CHAIR BOLLWERK: All right. We'll make

10 that to the copies before we hand them to the Court

11 Reporter.

12 JUDGE ABRAMSON: On the same topic, Mr.

13 Repka, going back to page 40 where we're striking LES

14 Exhibit 11, is there a reference that's necessarily

15 for this data? Or is it unnecessary now?

16 MR. REPKA: It is an analytical report.

17 And we felt the witness can speak to it and we don't

18 need the citation or don't need to offer it into

19 evidence.

20 CHAIR BOLLWERK: All right. Let me then

21 see if there's any objections from either of the

22 parties to the admission of the testimony. Do you

23 need a second to look at these changes?

24 MR. LOVEJOY: I will say that the Board

25 has said at various times that if an expert is

1 referring to something or relying on it then it really
2 should be put in evidence.
3 CHAIR BOLLWERK: That has been our general
4 approach.
5 MR. LOVEJOY: So, if there's a value for
6 TDS, then I don't think it's general knowledge. It
7 must come from some source.
8 MR. REPKA: We can certainly provide it
9 and offer it into evidence if the Board feels that's
10 necessarily.
11 CHAIR BOLLWERK: Again, the point here has
12 been to try to -- as we've pointed out, as NIRS/PC,
13 has done, to make sure that if there's a reference to
14 something and it's not in the record some place, we
15 can't pull it out of the air.
16 So, on the whole, I'm not trying to add
17 exhibits to the record, but discretion being the
18 better part of valor, if you want it in the
19 evidentiary materials, it's probably better to have it
20 in there.
21 MR. REPKA: We will offer that. And we'll
22 come back after the next opportunity to find copies
23 and offer that in.
24 CHAIR BOLLWERK: All right. So you want
25 to keep the citation then?

1 MR. REPKA: Okay.

2 CHAIR BOLLWERK: So, if that's the case,
3 then we keep the reference to the exhibit number
4 that's there and don't make the deletion.

5 MR. REPKA: All right. But the change in
6 terms of 1,370 is correct though.

7 CHAIR BOLLWERK: That is correct. All
8 right, all that being said, let me turn to Mr. Lovejoy
9 again and see if there is any other problems?

10 MR. LOVEJOY: I see none, Your Honor.

11 CHAIR BOLLWERK: All right, Staff?

12 MS. CLARK: No objection.

13 CHAIR BOLLWERK: All right. Then the
14 testimony of George A. Harper and Roger L. Peery on
15 behalf of Louisiana Energy Services concerning
16 Contention NIRS/PC EC-1, impacts upon ground and
17 surface water, should be admitted into the record as
18 if read.

19 (Whereupon, the Direct Pre-Filed testimony
20 of Mr. Harper and Mr. Peery were inserted into the
21 record as if having been read.)

January 7, 2005

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	Docket No. 70-3103-ML
Louisiana Energy Services, L.P.	)	
	)	ASLBP No. 04-826-01-ML
(National Enrichment Facility)	)	

PREFILED TESTIMONY OF GEORGE A. HARPER AND ROGER L. PEERY ON BEHALF OF LOUISIANA ENERGY SERVICES, L.P. CONCERNING CONTENTION NIRS/PC EC-1 ("IMPACTS UPON GROUND AND SURFACE WATER")

I. WITNESS BACKGROUND

A. George A. Harper ("GAH")

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

A1. (GAH) My name is George A. Harper. I am employed as the Manager of Regulatory Compliance Programs at Framatome ANP ("FANP") in Marlborough, Massachusetts.

Q2. Please describe your current responsibilities.

A2. (GAH) As Manager of Regulatory Compliance Programs at FANP, I manage over 50 scientists, engineers, and technicians in the Regulatory Compliance Programs Department. This department provides an array of services, including, for example, services related to: health and safety, environmental science and engineering, health physics, radiation protection, quality assurance, and laboratory radiological analyses. In this capacity, I both perform and oversee various environmental analyses and safety evaluations in support of nuclear facility design, licensing, and operations.

Q3. Please summarize your educational and professional qualifications.

A3. (GAH) I hold B.S. and M.S. degrees in Civil Engineering from the University of Massachusetts. In addition to earning those degrees, I have completed numerous technical training courses on a variety of engineering and hydrology-related topics. Also, I am a Registered Professional Engineer in Massachusetts, New Hampshire, and Maine, as well as a member of the American Society of Civil Engineers. I have over 25 years of experience in engineering, environmental, licensing, and regulatory compliance matters, many of which have involved nuclear facilities. This experience includes analyzing environmental, hydrologic, hydraulic, seismic, geotechnical, groundwater, tornado and tornado missile, and probabilistic risk assessment issues relating to nuclear facilities. A more detailed account of my education, training, and experience, including a discussion of representative projects, is set forth the statement of my professional qualifications attached hereto.

Q4. Are you familiar with the proposed National Enrichment Facility ("NEF") and the operations that will take place there?

A4. (GAH) Yes.

Q5. What is the basis of your familiarity with the NEF?

A5. (GAH) Louisiana Energy Services, L.P. ("LES"), applicant in this matter, contracted FANP to assist it in the preparation of the NEF license application, including the NEF Environmental Report. As the manager of Regulatory Compliance Programs, I managed a team of FANP employees involved in preparing the NEF Environmental Report. I also prepared specific portions of the Environmental Report and the Safety Analysis Report, and participated in the preparation of the Integrated Safety Analysis. Finally, I managed and contributed to the preparation of required state permit applications, including LES's New Mexico Groundwater

Discharge Permit. As such, I am familiar with the portions of LES's license application, as well as other permit applications, relating to the NEF's potential impacts on water resources.

Q6. What is the purpose of your testimony?

A6. (GAH) As stated above, my testimony relates generally to the potential impacts of the NEF on ground and surface water. This issue is the subject of Contention NIRS/PC EC-1 ("Impacts on Ground and Surface Water"). The principal purpose of my testimony, therefore, is to respond to specific claims made by NIRS/PC relative to the potential impacts of the NEF on ground and surface water. In doing so, I will focus on issues relating to the management of facility effluents and site runoff, the general design and operation of the NEF site engineered basins and systems that will be installed to contain contaminated and potentially contaminated effluent and runoff, non-NRC authorizations that relate to the protection of ground water at the site, and certain aspects of NEF site hydrology and hydrogeology.

B. <u>Roger L. Peery ("RLP")</u>

Q7. Please state your name, occupation, and by whom you are employed.

A7. (RLP) My name is Roger L. Peery. I am employed as the Chief Executive Officer and a Senior Hydrogeologist at John Shomaker & Associates, Inc. in Albuquerque, New Mexico.

Q8. Please describe your current responsibilities.

A8. (RLP) As a Senior Hydrogeologist at John Shomaker & Associates, Inc., I am responsible for managing projects involving a variety of hydrogeological and water-resources evaluations. As CEO, I also am involved in the business operations of the company.

Q9. Please summarize your educational and professional qualifications.

A9. (RLP) I hold a B.S. in Geology and an M.S. in Water Resources from the University of New Mexico. In addition to those degree programs, I have completed numerous technical training courses in the areas of hydrology, hydrogeology, and groundwater remediation. Further, I am a registered Professional Geologist in Wyoming and Texas (New Mexico does not register geologists), and a member of the American Institute of Professional Geologists. I have over 15 years of work experience as a hydrogeologist. For example, I managed the investigation and remediation of sites containing groundwater contaminated by leaking underground-storage tanks; performed groundwater flow modeling, aquifer test pumping and interpretation of test data, and evaluations of ground water in storage; evaluated and developed water resources within the State of New Mexico; and sited and supervised the installation of numerous water wells and monitoring wells, including wells exceeding depths of 3,000 feet. I also have provided expert testimony on water resources issues on numerous occasions before various commissions and committees within the State of New Mexico, including the New Mexico Office of the State Engineer hearing examiners. A detailed statement of my professional qualifications is attached hereto.

Q10. Are you familiar with the proposed National Enrichment Facility ("NEF") and the operations that will take place there?

A10. (RLP) Yes.

Q11. What is the basis of your familiarity with the NEF?

A11. (RLP) I was hired by LES as an expert witness on hydrogeological and water resources issues in this proceeding. In this capacity, I have carefully reviewed relevant portions of NEF license application (including the NEF Environmental Report), the NRC Staff's draft environmental impact statement ("DEIS"), and extensive supporting materials, such as

hydrogeologic investigations of the NEF site and other sites in vicinity of NEF and relevant scientific literature. In view of this knowledge, and my training and experience in hydrogeological and water-resources issues, I am prepared to testify regarding the potential impacts of the NEF on ground and surface water.

Q12. What is the purpose of your testimony?

A12. (RLP) As stated above, my testimony relates generally to the potential impacts of the NEF on ground and surface water. This issue is the subject of Contention NIRS/PC EC-1 ("Impacts on Ground and Surface Water"). The principal purpose of my testimony, therefore, is to respond to specific claims made by NIRS/PC relative to the potential impacts of the NEF on ground and surface water. In doing so, I will focus on issues relating to NEF site geology and hydrogeology, including the underlying lithology; to describe the collection and/or interpretation of hydrogeological data relevant to the NEF site; and to discuss postulated groundwater flow conditions beneath the NEF site, including the fate of liquids collected in the facility's engineered basins and the postulated transport of liquids collected by the facility septic systems.

II. REGULATORY BACKGROUND – APPLICABLE NRC REQUIREMENTS

Q13. Please describe the NRC regulatory requirements, and any related NRC guidance, applicable to the assessment of potential impacts of a proposed facility on water resources under the National Environmental Policy Act ("NEPA").

A13. (GAH) To implement and ensure compliance with the requirements of NEPA, the NRC has issued 10 C.F.R. Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Pursuant to 10 C.F.R. § 51.45, an applicant for an NRC license must prepare an environmental report. That report must contain, among other things, a description of the proposed action, a statement of its purposes, a description of the environment affected, and discussion of a number of specified environmental considerations, including, among others, a discussion of the impact of the proposed action on the environment. The applicant's environmental report provides the basis for the NRC Staff's environmental impact statement concerning the proposed action.

To assist materials license applicants such as LES in the preparation of their environmental reports, the NRC Staff has issued NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs – Final Report" (August 2003). That document states that the environmental report "present a detailed and thorough description of each affected resource for evaluation of potential impacts to the environment." The two affected resources relevant to this testimony and Contention NIRS/PC EC-1 are "geology and soils" and "water resources." With respect to the former, Section 6.3.3 of NUREG-1748 states that the applicant should identify the "geological, seismological, and geotechnical characteristics of the site and vicinity." This includes information regarding stratigraphy and structures, such as descriptions of geological units, major structural and tectonic

features, and any other significant geological conditions, and soil characteristics. With respect to the latter, Section 6.3.4 of NUREG-1748 states that an applicant should describe site-specific and regional data on the physical and hydrological characteristics of ground and surface water in sufficient detail to provide the basic data for the evaluation of impacts on water bodies, aquifers, and aquatic ecosystems. Section 6.4.4, in turn, provides that an applicant should evaluate impacts on water use and water quality and identify the potential impacts for both radiological and non-radiological effluents, including impacts on the physical, chemical, and biological water-quality characteristics of ground and surface water. Sections 6.3.4 and Section 6.4.4 provide very detailed lists of the specific types of information and evaluations sought by the NRC Staff in an applicant's environmental report.

Q14. In your view, has LES complied with these requirements and related guidance?

A14. (GAH) Yes.

Q15 Please state the basis for this conclusion.

A15. The NEF Environmental Report provides detailed information concerning water resources at the site and potential impacts on those resources. This information coincides closely with the specific types of data and evaluations sought by the NRC Staff in NUREG-1748. To the extent the NRC Staff requested additional information on the subject of water resources through the "RAI" process, LES provided this information and revised the NEF Environmental Report, to reflect that information, as appropriate.

In summary, Section 3.3 of the NEF Environmental Report describes the regional and local geology as well soil characteristics. Section 3.4 of the Environmental Report describes site surface and groundwater resources, including, among other things, surface hydrology, water quality, pre-existing environmental conditions, water rights and resources, potential contaminant

sources, and groundwater characteristics. Section 4.4 of the NEF Environmental Report discusses potential impacts of the facility construction and operation on water resources. This section addresses, among other things, applicable federal and state permits; receiving waters; potential impacts on groundwater quality; potential impacts on hydrological systems (though no surface water is present at the NEF site); and site-specific structures, systems, and measures to preclude contamination of water resources. Section 6.1 of the NEF Environmental Report describes in detail LES's proposed radiological monitoring program (effluent and environmental monitoring), and Section 6.2 sets forth LES's proposed physiochemical monitoring program (which provides for monitoring of non-radiological facility effluents, stormwater, environmental media (e.g., soil and vegetation), meteorological conditions) (*see* LES Exhibits 1 and 2).

Q16. In your expert opinion, does the NEF Environmental Report contain a complete and adequate assessment of the potential environmental impacts of the proposed NEF on surface and ground water?

A16. (GAH) Yes.

Q17. Please provide the basis for this conclusion.

A17. In providing the data and evaluations sought by the NRC Staff, LES has, in fact, performed a complete and adequate assessment of the potential environmental impacts of the proposed NEF on site surface and ground water. In short, the potential for adverse impacts on water resources at the NEF site is very low in view of: (1) highly favorable site hydrological and hydrogeological conditions; (2) LES's obligation to control levels of contaminants in facility effluents; (3) LES's commitment to discharge process effluents and sanitary wastewater only to engineered basins and leach fields, respectively, and to collect site runoff in retention/detention

basins; and (4) LES's commitment to implement adequate environmental monitoring and measurements programs to detect any releases to the environment.

III. SITE CHARACTERIZATION EFFORTS

Q18. Please explain how LES characterized and evaluated geological and hydrogeological conditions at the NEF site.

A18. (GAH, RLP) The geology and hydrogeology of the site vicinity are well understood as a result of prior site investigations and studies performed at sites in proximity to the proposed NEF site. In particular, the Waste Control Specialists ("WCS") site in Texas approximately 0.5 mile from the NEF site boundary, the Lea County Municipal Landfill site located immediately south of State Highway 234 near the southeast corner of the proposed NEF site, and the formerly proposed Atomic Vapor Laser Isotope Separation ("AVLIS") site adjacent to the NEF site have all been thoroughly studied in recent years in preparation for construction of other these existing/proposed facilities.

The WCS facility, which is a Resource Conservation and Recovery Act-permitted facility that disposes of hazardous material by land burial, is located east/northeast of the proposed NEF site, just across the state line in Texas. WCS has performed numerous subsurface investigations for the purpose of delineating and monitoring site subsurface hydrogeologic conditions. The proposed AVLIS facility was to be located on Section 33, on a site abutting the NEF site to the east. Information from these sites is pertinent to the NEF site given their proximity to the site.

A review of the documents and related materials associated with the WCS, Lea County Municipal Landfill, and AVLIS sites provided LES with an in-depth understanding of geological and hydrogeological conditions associated with the NEF site. *See*, e.g., *Atomic Vapor Laser Isotope Separation (AVLIS), New Mexico, Technical Appendices*, submitted by the State of New

Mexico and Waste Control Specialists, LLC; *Geology of the WCS-Flying W Ranch, Andrews County, Texas*, Prepared for Andrews Industrial Foundation, Texas Tech University Water Resources Center (Apr. 2000); Waste Control Specialists, *Section VI, Geology Report*, prepared for Waste Control Specialists, prepared by Cook-Joyce, Inc., and Intera, Inc. (Feb. 2004) ((in Attachment 6 to Exhibit 3). In addition, LES performed additional field investigations at the NEF site and site vicinity to supplement, where necessary, information about regional or site-specific conditions (*see Hydrogeologic Investigation, Section 32; Township 21 Range 38, Eunice, New Mexico*, Cook-Joyce, Inc. (Nov. 19, 2003); *Report of Preliminary Subsurface Exploration, Proposed National Enrichment Facility, Lea County, New Mexico*, MACTEC Engineering and Consulting, Inc. (Oct. 17, 2003) (in Attachment 6 to Exhibit 3). In fact, LES selected Cook-Joyce, Inc., Engineering and Consulting ("CJI") to assist in the development and conduct of the NEF site groundwater field investigation program due to CJI's extensive experience in performing similar investigations at the nearby WCS site. As we will discuss further in response to Contention NIRS/PC EC-1, our comparison of the WCS and AVLIS information to that obtained by LES at the NEF site affirm the applicability of the nearby data to the NEF site.

Q19. Please describe the additional investigations performed by LES in connection with the NEF site.

A19. (GAH, RLP) CJI performed a field investigation at the NEF site in September 2003 on behalf of LES to further evaluate hydrogeologic conditions at the NEF site. In particular, the investigation sought to ascertain the hydrogeologic conditions associated with the uppermost water-bearing zone beneath the NEF site. The investigation included the installation of nine soil borings (oriented on a three-by-three grid) to determine: (1) the depth to the Chinle

Formation "red beds," and (2) whether any saturated conditions were present in the alluvial sediments overlying the red beds. The land surface elevation was surveyed at each of the nine borehole locations to allow for computation of the top of the red bed formation (approximately 23 to 46 feet below ground surface). This information was combined with similar information from the WCS site to produce an elevation map of the top of the red bed formation. Because groundwater was not encountered in the shallow alluvium, CJI installed three monitoring wells in a siltstone/silty sandstone unit located at a depth of approximately 220 feet below ground surface, *i.e.*, the shallowest occurrence of saturated conditions beneath the NEF site. Of the three wells installed, only one well (MW-2) has produced any water. Ground water from MW-2 has been sampled at quarterly intervals for radiological and non-radiological analysis.

In addition, in September 2003, LES, through contractors Lockwood Greene and Mactec Engineering and Consulting, performed a preliminary geotechnical exploration for the proposed NEF for site construction and engineering purposes. This investigation consisted of drilling five test borings in the proposed building area to depths ranging from 40 to 100 feet below ground surface using hollow-stem auger and split-spoon sampling. The geotechnical properties of selected soil samples were determined through laboratory analysis.

IV. REGIONAL AND SITE GEOLOGY

Q20. Please describe the principal geological characteristics of the region in which the NEF site is located.

A20. (RLP) The NEF site is located near the boundary of two sections of the Southern High Great Plains Province, with the Plains section (Llano Estacado) lying to the east, and the Pecos Plains section lying to the west. The dominant geologic feature of the region is the Permian Basin. This is a massive subsurface bedrock structure consisting of a large thickness of

originally flat-lying, bedded, sedimentary rock that now has a significant downward flexure. The NEF site is located within the Central Basin Platform area of the Permian Basin. This area divides the Permian Basin into the Midland and Delaware subbasins. This area is considered to be structurally stable, *i.e.*, no major tectonic activity has occurred within the Permian Basin area since the Laramide Orogeny, which ended about 35-million years ago (*see* Figure 3.3-2 of LES Exhibit 1).

With respect to stratigraphy, the top of the Permian deposits are approximately 434 meters (1,425 feet) below ground surface at the proposed site. They are overlain by sedimentary rocks of the Triassic-aged Dockum Group. The upper formation of the Dockum Group is the Chinle Formation, a tight claystone and siltstone layer. The Chinle Formation, also referred to as the "red beds," is overlain by the Tertiary-age Ogallala, Gatuna, or Antlers Formations, all of which are alluvial deposits (*i.e.*, unconsolidated terrestrial sediments composed of sorted or unsorted sand, gravel, and clay that have been deposited by water). The Ogallala Formation, however, is not found at the proposed NEF site. In some areas near the NEF site, but not on the NEF site, a caliche layer (*i.e.*, a crust or layer of hard subsoil encrusted with calcium-carbonate) can be found extending to the surface. Quaternary-age dune sands frequently overlie the Tertiary alluvial deposits.

Q21. Please describe the principal geological features of the NEF site.

A21. (RLP) The major geologic features underlying the site generally parallel those of the region. Surface exposures consist mainly of Quaternary-aged eolian and piedmont sediments typical of those found along the far eastern margin of the Pecos River Valley. These include the reddish-brown, fine to loamy-fine dune sands of the Brownsfield-Springer Association (also known as the Blackwater Draw Formation). Underlying these sediments are the Gatuna and

Antlers Formations (Pleistocene/mid-Pliocene-aged). These are Pecos River Valley alluvial deposits comprising sand and silty sand with sand and gravel at the base. In some areas near the site, these deposits are interbedded with caliche near the surface or are underlain by a layer of caliche. The alluvial deposits are underlain by the Chinle Formation, which consists of Triassic-aged claystone, siltstone, sandstone, and silty clay (*i.e.*, the "red beds"). The Chinle Formation, in turn, is underlain by the Santa Rosa Formation, which includes sandy red beds, conglomerates, and shales. The Santa Rosa Formation overlies the Permian deposits (*i.e.*, muddy sandstone and shale red beds) of the Dewey Lake Formation. (*see* Table 3.3-1 and Figure 3.3-5 of LES Exhibit 1).

V. SITE HYDROLOGY AND HYDROGEOLOGY

Q22. Please describe the principal hydrogeological features of the NEF site.

A22. (GAH, RLP) Potential groundwater resources beneath the NEF site are limited. Furthermore, the site is not located within the recharge area of any sole source or major aquifer. The shallow alluvial soils beneath the site (*i.e.*, within 1 to 55 feet below ground surface), which consist primarily of relatively fine grained, silts, sands and silty sands, with some pockets of sand and gravel, are dry due to low rainfall rates and a high evapotranspiration rate. Accordingly, natural recharge to groundwater is not inferred to be taking place beneath the site.

As stated previously, the shallow alluvium is underlain by the Chinle Formation red beds, *i.e.*, Triassic-aged claystone, siltstone, sandstone, and silty clay. The Chinle red beds are over 1,000-feet thick and, as discussed further herein, have a very low permeability. The shallowest saturated zone beneath the NEF site occurs within the Chinle red beds at a depth of about 214 to 222 ft below the ground surface. The permeability of this approximately 15-foot thick siltstone to silty sandstone unit is fairly low, as evidenced by the slow rate at which monitor wells

completed in this unit – at both the NEF and WCS sites – have produced water. As stated above, in September 2003, LES installed three monitor wells with screened intervals in this unit. Only one of these monitor wells, MW-2, located near the northeast corner of the site, has produced any water. Similarly, monitoring wells screened in this same unit to the east of the site on the WCS property also have shown slow recovery after drilling and sampling operations, with some wells not equilibrating between sampling events (on the order of one or more months). In addition, based on chemical analyses of water samples taken to date from MW-2, it appears that the water quality in this unit is poor. Total dissolved solids ("TDS") values have ranged from 2,880 to 6,650 mg/L (WCS data) and 2,500 to 6,400 mg/L (MW-2 data). The New Mexico Standards for Domestic Water Supply provide a TDS limit of 1,000 mg/L. EPA Secondary Maximum Contaminant Levels provide a TDS limit of 500 mg/L. TDS values from MW-2 are above both the New Mexico and EPA limits.

A recent investigation performed for the WCS site indicates that there also is a 100-foot thick water-bearing layer approximately 600 ft below ground surface. The first well-defined "aquifer" beneath the site, however, occurs in the Triassic-aged Santa Rosa Formation, approximately 1,115 feet below the NEF site. LES has not conducted local investigations of these water-bearing units due to their great depths and the thickness and low permeability of the overlying Chinle Formation red beds.

Q23. You stated earlier that the potential for adverse impacts on water resources at the NEF site is very low due, in part, to highly favorable site hydrological and hydrogeological conditions. Please explain the basis for this statement.

A23. (GAH, RLP) As set forth in Section 3.4 of the NEF Environmental Report, there are no surface water bodies or drainage features at the NEF site. In fact, LES requested and received a site inspection from the U.S. Army Corps of Engineers ("USCOE") to solicit the

USCOE's independent assessment of the existence of surface water bodies or drainage features at the site. I (GAH) accompanied the USCOE inspector. By letter dated March 17, 2004, the USCOE notified LES that there are no jurisdictional waters at the NEF site. (*see* Attachment 4 of LES Exhibit 3).

With respect to ground water, the few saturated, water-bearing units present beneath the NEF site occur at distinct depths – approximately 220, 600, and 1,115 feet below ground surface. As a result, these saturated strata are separated from one another by hundreds of feet of low-permeability sediments (*i.e.*, the Chinle Formation red beds). Indeed, WCS investigators have concluded that the very large hydraulic head differences associated with these units indicates a lack of hydraulic communication in the Triassic Dockum Group in the site area. (*see* LES Exhibit 3). In short, the thick, low-permeable red beds act as a natural barrier to the downward migration of groundwater, and hence, preclude natural recharge of the water-bearing units by waters originating on the surface of the NEF site, as well as hydraulic connection among those units.

Additionally, because the NEF site is located within a semi-arid climate, annual precipitation rates are lower than annual evaporation/evapotranspiration rates. In other words, water available for infiltration into the subsurface is limited in amount and is most likely to be lost through the evapotranspiration process, *i.e.*, there is generally a net deficit of water. As set forth in NEF Environmental Report, one recent study using field investigation techniques (e.g., geochemical and soil-physics techniques) and computer modeling has shown that no precipitation recharge occurs in thick, desert vadose (unsaturated) zones with desert vegetation. Under such conditions, which exist at the NEF site, precipitation that does infiltrate into the subsurface is efficiently transpired by the native vegetation (*see* LES Exhibits 1, 5). Specifically,

natural thermal gradients that exist within the deeper portions of such vadose zones induces water vapor to diffuse upward toward the base of the root zone. This water vapor, in effect, creates a negative pressure potential at the base of the root zone that acts like a sink, from which water is taken up by the plants and transpired.

The dry nature of the soils observed by LES in the various boreholes installed at the NEF site support the conclusion that hydrological conditions at the site are dominated by this process. Of the nine borings installed by LES in September 2003, only one of the borings produced drill cuttings that were *slightly moist* at 6 to 14 feet below ground surface. The other cuttings were very dry. Moreover, no water was observed in these borings after they were left open for at least a day. Likewise, of the five geotechnical borings completed by LES, only one boring, B-2, exhibited slight moisture from a depth of 35 to 41.4 feet below ground surface; the cuttings generated by these borings, on the whole, also were very dry. I (RLP) will discuss the observed lack of saturated conditions in these borings in greater detail in connection with specific NIRS/PC claims.

Q24. You have stated that the Chinle Formation red beds, which exceed 1,000 feet in thickness below the NEF site, are low-permeability sediments. Please provide the basis for this conclusion.

A24. (GAH, RLP) As set forth in Table 3.3-2 of the NEF Environmental Report (*see* LES Exhibit 1), measured vertical permeabilities at the WCS site ranged from 1.00×10^{-9} cm/sec (clays) to 1.93×10^{-6} cm/sec (siltstones and sandstones), and measured horizontal permeabilities ranged from 1.63×10^{-9} cm/sec (clays) to 6.53×10^{-7} cm/sec (average value for siltstones and sandstones). Based on these data, LES estimated the hydraulic conductivity of the red bed clay to be on the order of 2×10^{-8} cm/sec. To provide some context, the permeability of the red bed

clay is comparable to that associated with engineered landfill liner materials. Notably, a slug test performed by LES in MW-2 at the NEF site yielded a hydraulic conductivity value of 3.7×10^{-6} cm/sec for the siltstone/silty sandstone water-bearing unit located approximately 220 feet below ground surface. This low value, 3.7×10^{-6} cm/sec, is consistent with the laboratory-measured siltstone/sandstone permeability values cited above.

Laboratory results for 5 horizontal permeability tests of the Dockum Group (Chinle Formation) sediments at depths ranging from 68 to 90 ft ranged from 7.18×10^{-7} to 1.63×10^{-9} cm/sec at the WCS site. Results of 54 laboratory vertical permeability tests of the Dockum Group sediments at depths ranging from 34 to 208 ft ranged from 1.53×10^{-5} to $<1.00 \times 10^{-9}$ cm/sec at the WCS site, with an average of 6.2×10^{-7} cm/sec, and a median value of 5.7×10^{-9} cm/sec.

With respect to the water-bearing unit at approximately 220 to 225 feet below ground surface, WCS site data similarly indicate that the hydraulic conductivity of this unit is very low. Specifically, five laboratory permeability tests of samples from this unit yielded a geometric mean of 2.15×10^{-8} cm/sec, and two field slug tests yielded hydraulic conductivities of 6.0×10^{-8} cm/sec and 6.16×10^{-8} cm/sec, respectively. In conclusion, both NEF and WCS field data indicate that the shallowest saturated unit underlying both sites (at a depth of approximately 220 feet) is a low-permeability unit (*see* Cook-Joyce Inc., 2004a, *Section VI, Geology Report*, February 2004, prepared for Waste Control Specialists LLC, Andrews Texas, as contained in Attachment 6 to LES Exhibit 3).

Additionally, a significant amount of subsurface data are available from the nearby Lea County Landfill site, which is within the same geologic setting as the LES site. A total of 11 borings were drilled on the site to depths ranging from about 50 to 600 feet. Ten samples were

collected in the Dockum Group sediments at depths ranging from 60 to 485 and the vertical laboratory permeability ranged from 2.73 x 10^{-9} cm/sec to 7.25 x 10^{-8} cm/sec (*see* Attachment 6 to LES Exhibit 3).

The robust hydrogeologic characterizations performed at and near the LES site indicate that the Chinle Formation sediments have low permeability. Sediment samples collected for laboratory permeability in consolidated sediments, such as the Chinle Formation, would tend to be biased towards higher permeability values, rather than lower, due to the fact that the sampling device would generally have to be pounded into the sediments, potentially increasing the permeability of the sediments as a result of breaking or fracturing. Conversely, samples collected for laboratory permeability values in unconsolidated sediments, which are not present at the NEF site at the depths of interest, would tend to bias the samples towards lower permeability values as a result of the sediments being compacted as the sampling device is driven through them.

VI. NEF SITE MANAGEMENT OF PROCESS EFFLUENTS, SANITARY WASTEWATER, AND SITE STORMWATER RUNOFF AND RELATED ENVIRONMENTAL MONITORING

Q25. You mentioned LES's commitment to discharge process effluents and sanitary wastewater only to engineered basins and septic leach fields, respectively, and to collect site runoff in retention/detention basins. Please explain.

A25. (GAH) As set forth in the NEF Environmental Report, facility liquid effluents will discharged to the Treated Effluent Evaporative Basin; site stormwater runoff will be collected in the Uranium Byproduct Cylinder ("UBC") Storage Pad Stormwater Retention Basin and Site Stormwater Detention Basin; and sanitary wastewater will be discharged to the septic tanks and leach fields. NEF site liquid effluent rates will be relatively low, with the effluent flow

rate from all facility sources estimated to be about 28,900 cubic meters (7.6 million gallons) annually. This includes approximately 2,540 cubic meters (670,000 gallons) annually of liquid effluent from the NEF Liquid Effluent Collection and Treatment System, with cooling tower and heating boiler blowdown waters and sanitary sewage accounting for the remaining volume of effluent discharges.

Q26. Please describe the design and specific function of each of the engineered basins and the septic system.

A26. (GAH) The TEEB will be utilized to collect and contain liquid effluent from the Liquid Effluent Collection and Treatment System, as well as shower, hand wash, and laundry effluents. The TEEB will include two membrane liners (synthetic material with soil covering the uppermost liner) and a leak detection system between the two liners, with no outfall to preclude any infiltration into the ground. The ultimate fate of liquid effluents discharged to the basin will be through evaporation of water and impoundment of the residual dry solids byproduct of evaporation.

The UBC Storage Pad Stormwater Retention Basin will serve to collect and contain (1) cooling tower blowdown discharges, (2) heating boiler blowdown discharges, and (3) stormwater runoff from the UBC Storage Pad. Disposal of this water discharged to this basin also will be through evaporation of water and impoundment of the residual dry solids after evaporation. The basin will feature a membrane lining (synthetic material with soil cover), with no outfall, to preclude any infiltration into the ground.

The Site Stormwater Detention Basin will be used to collect runoff from developed parts of the site other than the UBC Storage Pad, such as runoff from the parking areas and building roofs. This basin will be unlined, and will have an outfall to control overflow and drainage.

Although there is some limited potential for its infiltration into the ground, water discharged to this basin will be disposed of principally through evaporation and evapotranspiration. No liquid discharges from facility operational systems will be discharged into this stormwater basin.

Finally, sanitary wastes will be discharged to six onsite septic systems, each with one or more leachfields. The six systems will be capable of handling approximately 40,125 liters (10,600 gallons) per day, though the system is expected to receive only half that amount given the actual number of employees. Similarly, while total annual design discharge will be approximately 14.6 million liters (3.87 million gallons) per year, actual flows will be approximately 50 percent of the design flows.

Q27. Do you believe that any of the facility discharges or runoff sources described above have the potential to adversely impact water resources at the NEF site?

A27. (GAH) No.

Q28. Please state the basis for your conclusion that discharges to the TEEB will not adversely impact water resources at the NEF site.

A28. (GAH) Contamination of groundwater as a result of discharges to the TEEB is unlikely for a number of reasons. First and foremost, only liquids (*i.e.*, process effluents and shower/hand wash/laundry effluents) meeting site administrative limits based on prescribed regulatory requirements would be discharged into the TEEB. To ensure that this is the case, post-treatment liquid effluent will be sampled and subjected to isotopic analysis *prior* to discharge to the TEEB, so as to confirm that release concentrations are below the concentration limits established in Table 3 of Appendix B to 10 C.F.R. Part 20. Any effluents unsuitable for release to the basin could be recycled through the liquid effluent treatment system or processed into a solid and sent to an offsite disposal facility. As a result of the liquid effluent treatment

process, it is expected that only 390 microcuries per year of uranium will be discharged to the TEEB. To put this in perspective, the TEEB will receive approximately 670,000 gallons of effluent discharge per year, but only about 1.3 pounds of uranium per year. Indeed, LES has determined that, if the total amount of uranium to be discharged to the TEEB over 30 years ~~uranium~~ were assumed to infiltrate into the soil to a depth of 20 feet below ground surface (well above any of the groundwater horizons described earlier), and over an area equal to that of the TEEB, that uranium would be equivalent to the uranium naturally occurring in the NEF site soil (*see* LES Exhibit 10).

As stated above, the TEEB will feature a double membrane liner, an active liquid-sensor leak detection system between the liners and will be segregated into two cells. The use of two cells will thus allow LES to isolate any leaks, assuming such leaks actually were to occur. The liner system will meet and surpass applicable New Mexico Environment Department guidelines (*see* Attachment 1 to LES Exhibit 3, LES Exhibit 4).

Moreover, the treated effluent would be disposed of via evaporation of all the water and impoundment of the remaining solids. On this point, it warrants mention that LES performed a water balance analysis of the basin. This analysis, which included consideration of effluent and precipitation inflows and evaporation outflows, indicates that the TEEB would be *dry* for 1 to 8 months of the year, depending on the rate of precipitation. (*see* Attachment 1 to LES Exhibit 3, LES Exhibit 9). Furthermore, in the event that heavy rainfalls were to occur, the TEEB is designed to retain treated effluent under conservatively-estimated precipitation conditions, *i.e.*, it includes a safety factor of 200% times the maximum storm water from a single rainfall event.

Finally, as part of its Radiological Environmental Monitoring Program, LES will install monitoring wells at five locations, two of which will be located downgradient of the TEEB.

These wells, which will be sampled quarterly for radiological and non-radiological analysis, will monitor ground water in the shallowest saturated unit approximately 220 feet below ground surface.

In sum, the foregoing measures provide for defense in depth by allowing LES to manage facility effluents and to monitor for any postulated releases to the ground.

Q29. Please state the basis for your conclusion that discharges/runoff directed to the UBC Storage Pad Stormwater Retention Basin will not adversely impact water resources at the NEF site.

A29. (GAH) First, it is highly unlikely that water discharges to this basin will include contamination in any appreciable amounts. The cooling tower and heating boiler blowdown discharges to the basin will not have constituents or characteristics that would adversely impact water resources at the site. With respect to UBC Storage Pad runoff, LES will implement numerous measures to preclude uranium contamination of such runoff. For example, LES will use only certified cylinders to ensure cylinder integrity, and will implement a cylinder maintenance and inspection program, based, in large part, on Urenco's extensive experience in managing such cylinders in Europe. UBCs containing depleted uranium hexafluoride ("DUF_6") will be surveyed for external contamination *before* being placed on the UBC Storage Pad and also will be monitored during their storage on the pad. If any external contamination were to be detected, it would be removed prior to cylinder placement on the pad. Notwithstanding these planned measures, LES performed an assessment of potential runoff contamination levels, in which it assumed a conservative level of radioactive contamination on cylinder surfaces and 100% washoff to the UBC Storage Pad Stormwater Retention Basin from a single rainfall event. The results of this assessment demonstrate that the radioactivity level in such a discharge would

be well within NRC regulatory limits for release. As with the TEEB, disposal of waters collected in this basin will be via evaporation of the liquid and impoundment of the residual dry solids after evaporation. Indeed, a ~~conservative~~ water balance of this basin indicates that the basin would be *dry* for ~~11~~ 2 to 12 months of the year, depending on precipitation rates (see LES Exhibit 9). In addition, the basin will be designed with a synthetic membrane liner, and without an outlet, to preclude any infiltration of water into the ground. This basin also will be designed to contain runoff under conservatively-estimated precipitation conditions, *i.e.*, to retain a volume of water slightly more than twice that for the 24-hour duration, 100-year frequency storm, plus an allowance for cooling tower blowdown (77,700 m^3 or 63 acre-ft) for the area served.

Finally, water and sediment samples will be collected quarterly from the UBC Storage Pad Stormwater Retention Basin to ensure that uranic material is not being deposited in the basin. Physiochemical analysis also will be performed on samples taken. Monitor wells located downgradient of the basin also will be sampled quarterly for radiological analysis.

In sum, as with the TEEB, the foregoing measures provide for defense in depth by allowing LES to manage inputs to the UBC Storage Pad Stormwater Retention Basin facility effluents and site stormwater runoff and to monitor for any postulated releases to ground water.

Q30. Please state the basis for your conclusion that runoff collected in the Site Stormwater Detention Basin will not adversely impact water resources at the NEF site.

A30. (GAH) This basin would receive runoff principally from building roofs and paved surfaces on the NEF site. Such runoff is not expected to contain contaminants in levels that would exceed applicable regulatory limits. Specifically, any chemical constituents potentially discharged to the subsurface via the Site Stormwater Detention Basin would be below concentrations that have been established by State and Federal regulatory agencies as protective

of the public health and the natural environment. LES will comply with applicable regulatory limits during the facility construction and operation phases, and confirm compliance through monitoring and collection/analysis of environmental data (*i.e.*, samples will be collected from the Site Stormwater Detention Basin to demonstrate that runoff would not contain any contaminants above regulatory limits).

Additionally, although there is some limited potential for runoff collected in this unlined basin to infiltrate into the underlying soil, it is expected that much of this water would be lost through evapotranspiration. Indeed, the water balance for this basin shows that it would be dry except during rainfall events, *i.e.*, disposal of water discharged to this basin will be principally via evaporation. In the event of a particularly heavy rainfall, the basin will be sized to contain runoff for a volume of water equal to the 24-hour, 100-year return period storm.. In any event, any infiltrating water is expected to have limited downgradient transport due to the storage capacity of the soils underlying the basin and the upward flux to the root zone characteristic of the shallow vadose zone at the NEF site. This issue is discussed in greater detail herein in connection with the NRC Staff's "plume analysis."

Q31. Please state the basis for your conclusion that sanitary wastewaters discharged to the site septic systems and leach fields will not adversely impact water resources at the NEF site.

A31. (GAH) Sanitary discharges and associated leachates will be typical of that associated with sanitary waste, *i.e.*, no plant process effluents will be introduced into the septic tanks. These discharges will meet required levels for all contaminants stipulated in any permit required for the systems, including applicable NRC regulatory limits set forth in 10 C.F.R. Part 20 and LES's New Mexico Groundwater Discharge Permit. To ensure that there is no uranic contamination within the septic tanks, each tank will be periodically sampled – prior to any

pumping out of the tanks contents – and analyzed for isotopic uranium. Any radioactive contamination from individuals, assuming it were to exist, would be in very low concentrations and likely be absorbed onto sludge in tanks. As with the Site Stormwater Detention Basin, any infiltrating water is expected to have limited downgradient transport due to the storage capacity of the soils underlying the basin and the upward flux to the root zone characteristic of the shallow vadose zone at the NEF site.

VII. LES RESPONSE TO SPECIFIC CLAIMS MADE IN CONTENTION NIRS/PC EC-2

A. Response to Contention as Originally Admitted by the Licensing Board (Original Bases)

Q32. Are you familiar with Contention NIRS/PC EC-1 ("Impacts Upon Ground and Surface Water")?

A32. (GAH, RLP) Yes. As originally admitted by the Licensing Board on July 19, 2004, Contention NIRS/PC EC-1 challenged the adequacy of the NEF Environmental Report, alleging that:

> [T]he ER does not contain a complete or adequate assessment of the potential environmental impacts of the proposed project on ground and surface water, contrary to the requirements of 10 C.F.R. § 51.45.

The original basis proffered by NIRS/PC in support of this contention, "Basis A," is set forth in their April 6, 2004 intervention petition. *See* "Petition to Intervene by Nuclear Information and Resource Service and Public Citizen," dated April 6, 2004, at 19-23. Basis A of the original contention raises 12 issues (labeled paragraphs a. through l.), purportedly relating to "the fate of waste waters and runoff that enter the subsurface at the NEF." The Licensing Board, however, admitted an amended version of this Contention NIRS/PC EC-1 on November 22, 2004 that

contains five additional bases that seek to contest the adequacy of the NRC Staff's Draft Environmental Impact Statement ("DEIS").

Q33. In Basis A of the original contention, NIRS/PC assert that LES has not adequately addressed how much water would infiltrate into the alluvium from: the TEEB, the UBC Storage Pad Stormwater Retention Basin, the Site Stormwater Detention Basin, and the septic leach field. *See* NIRS/PC Petition at 20, ¶ a. Do you agree with this assertion? If not, please state the basis for your conclusion.

A33. (GAH) No. As discussed above, with the exception of some limited potential for infiltration of water from the Site Stormwater Detention Basin and the septic leach fields, disposal of discharges and/or runoff to the various site basins and septic system will be principally by evaporation and evapotranspiration. The water balance analyses performed by LES and referred to above support this conclusion. The liners associated with the TEEB and UBC Storage Pad Stormwater Retention Basin will greatly minimize, if not entirely preclude, the potential for subsurface infiltration of water collected in these basins. Given the low precipitation and high evapotranspiration rates in the site vicinity, the low-permeability of the near-surface soils (primarily silts and silty sands), and the tendency of these soils to hold non-evapotranspired moisture in storage, infiltration of water from the Stormwater Detention Basin and septic leach fields is expected to be negligible.

Q34. In Basis A of the original contention, NIRS/PC assert that LES has not adequately identified where would water flowing along the alluvial/Chinle contact would be discharged? *See* NIRS/PC Petition at 20, ¶ b. Do you agree with this assertion? If not, please state the basis for your conclusion.

A34. (RLP) No. The likelihood that water from the Site Stormwater Detention Basin and septic leach fields would reach and flow along the alluvial/Chinle contact is low. As stated in response to the prior question, infiltration of water from the Stormwater Detention Basin and septic leach fields is expected to be negligible given site hydrological conditions. LES in not aware of any points in the site vicinity at which water purportedly flowing along the "alluvial/Chinle contact" is discharged. Moreover, NIRS/PC appear to assume that the contact between the alluvium and Chinle red beds beneath the site is uniform with respect to depth below ground surface. Boring logs for both the NEF and WCS sites, however, indicate that the depth to this contact can vary considerably. Where the depth to the contact is particularly shallow, water movement is likely to be dominated by evapotranspiration and unsaturated flow conditions, *i.e.*, flow conditions of the type found in a saturated zone or aquifer would be unlikely. Indeed, the numerous borings completed by LES at the NEF site clearly indicate that "saturated zone" conditions do not exist at the depths of interest.

In the DEIS, the NRC Staff analyzed the potential migration of hypothetical plumes that it posited to form along the alluvium/Chinle contact as a result of infiltration of water from the Site Stormwater Detention Basin and the septic leach fields (*see* DEIS at 4-13 to 4-13). The Staff concluded that the water would have limited downgradient transport due to storage capacity of the soils and the upward flux to the root zone. The Staff's analyses suggest that the portions of the plumes not evapotranspired and traveling downgradient could, in theory, result in a minor seep at Custer Mountain, or in the excavation a few miles southeast of the Monument Draw where the Chinle Formation is exposed. It warrants emphasis that these analyses are <u>highly conservative</u>, insofar as the Staff appears to have assumed that 100% of all annual stormwater runoff/discharge and discharges from the septic systems eventually reach the hypothetical

plumes. In any event, as the Staff correctly concluded in the DEIS, any potential impacts on water resources would be de minimis.

Q35. In Basis A of the original contention, NIRS/PC assert that LES has not determined how long it would take water from the NEF site to reach the discharge area. *See* NIRS/PC Petition at 21, ¶ c. Do you agree with this assertion? If not, please state the basis for your conclusion.

A35. (RLP) No. As stated above, LES does not believe that infiltration of water from the Site Stormwater Detention Basin and septic leach fields will result in any significant discharges – if any discharges at all – of water, via flow along the alluvial/Chinle contact. Even if one accepts that NRC Staff's highly conservative estimate of pore velocity of 252 m/yr (0.16 mile/yr) for a hypothetical plume, the time required for discharge at the postulated locations identified by the Staff (approximately 25 miles and 3 miles from the NEF site) would be on the order of 156 and 19 years, respectively.

Q36. In Basis A of the original contention, NIRS/PC claim that LES has not determined whether there are "fractures or other fast pathways that would allow water to flow rapidly from the alluvium to the Chinle, or from the Chinle to the Santa Rosa." On this point, NIRS/PC further assert that "the detection of a pesticide in MW-2 may indicate a connection to the surface, such as a fast flow path from the alluvium to the Chinle." *See* NIRS/PC Petition at 21, ¶ d. Do you agree with these assertions? If not, please state the basis for your conclusion.

A36. (GAH, RLP) In view of the various investigations performed and data available for the NEF and WCS sites, there do not appear to be any subsurface fractures or other fast pathways that would allow water to flow rapidly from the alluvium to the Chinle, or from the Chinle to the Santa Rosa. It is clear that the Chinle red beds underlying the site are low-

permeability materials. If these subsurface units were highly fractured, then we would expect to see much higher hydraulic conductivities than those previously determined in connection with the NEF and WCS sites. The confined nature of the water-bearing unit at approximately 220 feet below ground surface also indicates that there are no highly fractured zones that serve as fast flow paths. Even if fractures exist, they are not necessarily continuous or interconnected to a degree which would be conducive to enhanced fluid flow. It is unlikely that fractures/fracture zones would extend the entire depth of the alluvium or the Chinle clays. Further, such fractures may be "self-healing" in nature due to the presence of clay within the fractures, which swells as it becomes hydrated.

The one-time detection of a pesticide (4,4'-DDD) in MW-2 is not indicative of "a connection to the surface, such as a fast flow path from the alluvium to the Chinle." As set forth in the NEF Environmental Report, LES believes that the detection of a pesticide was likely due to contamination of field or laboratory equipment. This reflects a judgment by LES that the groundwater zone at issue (*i.e.*, the 220-foot zone) is well isolated from potential sources of surface contamination. The sample at issue was taken shortly after installation of MW-2. Additional sampling of MW-2 (three quarterly sampling events) supports this conclusion, insofar as no pesticides or other contaminants have been detected in subsequent samples taken from MW-2 (*see* analytical results contained in Attachment 6 to LES Exhibit 3, LES Exhibit 13).

Q37. In Basis A of the original contention, NIRS/PC claim that LES "should have determined the ages of water in the Chinle and Santa Rosa," and reason that "relatively young water would indicate that water reaches these units along fast flow paths." *See* NIRS/PC Petition at 21, ¶ e. Do you agree with this assertion? If not, please state the basis for your conclusion.

A37. (RLP) No. For the reasons set forth above, there do not appear to be any subsurface fractures or other fast pathways that would allow water to flow rapidly from the alluvium to the Chinle, or from the Chinle to the Santa Rosa. Available permeability and hydraulic conductivity data – and the sheer depths to water-bearing units in the Chinle and Santa Rosa Formations alone – indicate that "young" water is not reaching these units via "fast flow paths." Furthermore, published data obtained from geochemical analyses of groundwater samples taken from the Dockum Group in the region indicate that recharge to the Santa Rosa essentially ended more than 15,000 years ago. *See* A. Dutton and W. Simpkins, "Hydrogeochemistry and Water Resources of the Triassic Lower Dockum Group in the Texas Panhandle and Eastern New Mexico," Report of Investigations No. 161, Bureau of Economic Geology, University of Texas at Austin (1986) (*see* LES Exhibit 6).

Q38. In Basis A of the original contention, NIRS/PC allege that LES has not "adequately address[ed] whether groundwater exists in the alluvium at the proposed NEF site. *See* NIRS/PC Petition at 21, ¶ f. Do you agree with this assertion? If not, please state the basis for your conclusion.

A38. (GAH, RLP) LES has adequately addressed this issue based on its review of prior site investigations at the WCS site and its own hydrogeologic field investigations. From these data, it is clear that saturated horizons or pockets of groundwater are unlikely to exist in the alluvium beneath the site. LES has installed 14 borings (9 groundwater exploration and 5 geotechnical borings). Logs for all of these borings have been made available. As reflected in those logs, the cuttings associated with these borings were almost invariably very dry. The only moisture present was "slightly moist" in CJI boring B-9 at a depth between 6 and 14 feet below ground and "moist" in MACTEC boring B-2 at a depth between 35 and 41.4 feet below ground.

To better understand these observations, recent discussions were held between CJI and LES. According to the individual who logged boring B-9, the "slightly moist" descriptor was applied because the cuttings were not saturated, but coagulated a bit when held, indicating very little moisture was present. They indicated that this descriptor is not indicative of saturated groundwater conditions. This moisture is likely infiltrated precipitation that had yet to evapotranspire (since CJI locates drilling locations in low spots rather than high spots, *i.e.*, at top of a dune, rainfall may preferentially collect and infiltrate into the ground and then become available for evapotranspiiration). Recent discussions also were held between LES and MACTEC, with the individual who logged boring B-2. The "moist" descriptor was applied to indicate that some residual water content was present, and was not meant to be indicative of saturated groundwater conditions. If a significant quantity of water had been present in the cuttings at issue, then the boring log description of those cuttings likely would have indicated they were "very moist" or "wet" or "saturated." Significantly, with respect to the nine borings installed in September 2003, the investigators allowed at least 24 hours for water to enter the borings. No water was observed in the boreholes. The observed lack of any significant moisture content in the alluvial sediments beneath the site is consistent with site hydrological conditions discussed previously, *i.e.*, low precipitation rates and high evapotranspiration rates.

Q39. In regard to this same issue, NIRS/PC also maintain that the known existence of groundwater in the alluvium at three places *near* the NEF site further reflects LES's alleged failure to adequately address whether groundwater exists in the alluvium at the proposed NEF site. Do you agree with this assertion? If not, please state the basis for your conclusion.

A39. (RLP) No. The zones of saturation observed in the alluvium at three places to the north and east of the NEF site (*i.e.*, Wallach Quarry, Baker Spring, and the WCS site) are limited

and intermittent. These zones are due to very localized infiltration mechanisms, such as infiltration from "buffalo wallow" depressions that pond surface water and man-made features. These localized conditions, however, do not exist at the NEF site. Moreover, none of these shallow saturated unit occurrences is laterally continuous nor extends to the NEF site.

The unique conditions giving rise to the occurrence at offsite locations identified above are described in detail in Section 3.4.1.1 of the NEF Environmental Report. At Wallach Quarry, minor quantities of perched groundwater occur at the base of the sand and gravel unit in the quarry, atop the low-permeability Chinle red bed clay, which serves as a confining unit that arrests downward percolation of localized recharge.

Baker Spring, located just northeast of the NEF site, represents a second instance of saturation above the Chinle clay. Through a pedestrian survey, personal interviews, and a search of historical aerial photograph, LES investigated the origin of the area identified as Baker Spring on USGS topographic maps. Baker Spring is a manmade feature that resulted from the historical excavation of gravel and caprock materials that are present above the red bed clay. As a result of the excavation, Baker Spring is topographically lower than the surrounding area. Following rainfall events, ponding on the excavation floor occurs. Because the excavation floor consists of very low permeability clay, small quantities of water are able to pond above the red beds. Shading from the high wall and trees that have flourished in the excavated area retard the natural evaporation rates and water stands in the pond for sometime. It is also suspected that during periods of ponding, surface water infiltrates horizontally into the sands at the base of the excavated wall and is retained as bank storage. As the surface water level declines, the bank storage is discharged back to the excavation floor.

The third example of localized shallow groundwater occurrence near the NEF site is to the east on the WCS property, where several abandoned windmills are located. The windmills were once used to supply water for stock tanks by tapping small saturated lenses above the Chinle Formation red beds. The amount of groundwater in these zones is limited. The source of recharge for these localized perched zones is likely to be "buffalo wallows" (playas), *i.e.*, substantial surface depressions located near the windmills that collect surface water runoff. However, WCS has drilled monitoring wells in these areas to characterize the nature and extent of the saturated conditions. Some of these wells are dry, reflecting the localized nature of any perched water conditions that might exist. When water is present, it is slow to recover following sampling events. These findings reflect the low permeability and discontinuous nature of these localized occurrences of saturated conditions.

In sum, the conditions giving rise to localized occurrences of saturation in the alluvium *near* the NEF site are not present at the NEF site. The surface soils at the NEF site, as well as at the WCS and Lea County landfill sites, are finer-grained (*i.e.*, they consist mainly of fine sand and silt) than the sand and gravel at the Wallach site. While LES observed minimal amounts of gravel in certain zones, gravel does not appear to be consistently present beneath the site. Further, there are no excavations of the type observed at Baker Spring at the NEF site. Excavations into, and naturally occurring surface depressions ("buffalo wallows") in, the alluvium can act as "bowls" where water can more readily accumulate on top of the red-beds, which may allow localized perched zones to develop. Finally, relative to the WCS site, there are no "buffalo wallows" or related groundwater conditions at the NEF site. In any event, the localized occurrences of alluvial groundwater observed near the NEF site do not constitute

aquifers, nor do they appear to be hydrologically connected to any deeper water-bearing units (e.g., the thin saturated zone present at approximately 220 feet below ground surface).

Q40. In connection with LES's purported failure to "adequately address whether groundwater exists in the alluvium at the NEF site," NIRS/PC also aver that LES should also have addressed "the sources (recharge points) of groundwater in the Chinle and Santa Rosa" Formations. Do you agree with this assertion? If not, please state the basis for your conclusion.

A40. (RLP) No. As explained above, LES has not observed any saturated conditions in the alluvium at the NEF site and has no reason to believe that such conditions – even were they to exist beneath the site – would contribute to the natural recharge of water-beating units located at depths of 220 feet and greater below ground surface. The thick, low-permeable red beds clearly act as a natural barrier to the downward migration of groundwater, and thus preclude any natural recharge of the water-bearing units located at depth. In fact, water in the Santa Rosa aquifer is quite old, and published data indicate that recharge to the aquifer occurred during the Pleistocene, more than 15,000 years ago. Erosion of the Pecos and Canadian River valleys during the Pleistocene created groundwater basin divides along the western and northern limits of the Southern High Plains, thereby preventing modern recharge in the Dockum Group outcrops from reaching confined parts of the Dockum Group aquifer. *See* Dutton and W. Simpkins, "Hydrogeochemistry and Water Resources of the Triassic Lower Dockum Group in the Texas Panhandle and Eastern New Mexico," Report of Investigations No. 161, Bureau of Economic Geology, University of Texas at Austin (1986) (*see* LES Exhibit 6).

Earlier hydrogeologic work in the area by Nicholson and Clebsch (1961) indicated that the Santa Rosa received recharge as a result of precipitation on sand dunes overlying outcrop

areas. The more recent work on recharge to the Dockum Group sediments by Dutton and Simpkins has shown this not to be the case.

Q41. Also in connection with LES's alleged failure to adequately address whether groundwater exists in the alluvium at the NEF site, NIRS/PC suggest that LES has not adequately considered how to distinguish between groundwater contamination potentially caused by the NEF and contamination potentially caused by other nearby facilities (e.g., the Wallach quarry, WCS site, and the Lea County Municipal Landfill). Do you agree with this assertion? If not, please state the basis for your conclusion.

A41. (GAH, RLP) No. LES will install a background monitoring well, located in the north sector of the NEF site, up-gradient of the NEF, down-gradient of Wallach Quarry, and cross-gradient from the WCS facility. Monitoring at this location will occur both in the vicinity of the alluvium/Chinle contact (even though no water was present in this zone when LES conducted its NEF site investigations, nor is any expected to be present) and in the 220-foot groundwater zone. This well will be used to distinguish between postulated releases from the NEF, Wallach Quarry, and WCS sites. The Lea County landfill is located downgradient of the NEF site.

As a general matter, in ascertaining the source of any potential contaminants, LES would consider the types of contaminants involved and the location of their potential sources relative to the direction of any discernible site groundwater flow. For example, releases from the Wallach Quarry and the Sundance Services "produced water" lagoons north of the NEF site would be readily differentiated from potential releases from the NEF site.

Q42. You refer to the other facilities near the NEF site as being up-gradient, cross-gradient, and down-gradient of the NEF site. Please explain.

A42. (GAH, RLP) As set forth in the NEF Environmental Report, LES has installed three monitor wells in the 220 to 230-foot siltstone/silty sandstone unit beneath the site. To date, only MW-2 has produced any water. Monitoring wells also have been installed in this unit at the WCS site (referred to by WCS as the 230-foot zone). Groundwater levels in MW-2 are consistent with those observed in the WCS monitoring wells. Based on the groundwater levels in MW-2 and the data from the adjacent WCS site wells, LES has determined the groundwater gradient in the siltstone/silty sandstone unit to range from about 0.011 to 0.017 foot/foot, with a slope or flow direction generally to the south. Thus, locations north of the NEF would be considered up-gradient, locations south of the NEF would be considered downgradient, and locations to the west and east would be considered cross-gradient.

Q43. In Basis A of the original contention, NIRS/PC, citing the original version of the NEF license application, state that "there is a mystery as to the depth of the Santa Rosa Aquifer at the NEF site." *See* NIRS/PC Petition at 22, ¶ g. Do you agree with this assertion? If not, please state the basis for your conclusion.

A43. (GAH) No. LES has revised the NEF Environmental Report to provide clarification on this issue. Specifically, Table 3.3-1 of Revision 2 (July 2004) of the NEF Environmental Report, indicates that the depth to the Santa Rosa Formation ranges from approximately 1,115 to 1,425 feet in the vicinity of the NEF site.

Q44. On a related note, in Basis A of their original contention, NIRS/PC suggest that LES's groundwater monitoring plans are inadequate in view of "at least four potential sources of groundwater contamination at the site (three evaporation basins and the septic leach field)." In support of this assertion, they claim that: (1) LES does not intend to investigate the Santa Rosa Aquifer; (2) LES plans to install only two monitoring wells, presumably in the alluvium; and (3)

LES should install at least one background monitoring well up-gradient of the NEF site. *See* NIRS/PC Petition at 22, ¶ h. Do you agree with this assertion? If not, please state the basis for your conclusion.

A44. (GAH) No. As set forth above, facility effluents and site runoff are not expected to contain contaminants in levels that exceed any applicable regulatory limits. Moreover, the site basins and septic system will provide for appropriate containment and disposal of facility effluents and site runoff (largely by evaporation). NIRS/PC are correct in asserting that LES does not intend to investigate the Santa Rosa Aquifer. Given the substantial depth to this aquifer (*i.e.*, over 1,000 feet below ground surface) and the thickness and low permeability of the overlying Chinle Formation – which serves to inhibit potential groundwater migration to the Santa Rosa Aquifer – there is no need to investigate this aquifer. Indeed, even assuming that water were to travel from the surface of the Chinle Formation clay to the top of the Santa Rosa, the travel time would be on the order of thousands of years in view of the hydraulic properties of the Chinle materials.

The statements of NIRS/PC regarding LES's proposed monitoring are incorrect and do not reflect current information. Specifically, LES plans to install monitoring wells at five locations at the site. These wells *will* include one background monitoring well located on the northern boundary of the site, between the NEF site and the Wallach quarry; two monitoring wells located on the southern edge of the UBC Storage Pad; one monitoring well located on the south side of the UBC Storage Pad Stormwater Retention Basin; and one monitoring well located on the southeastern corner of the Site Stormwater Detention Basin. These monitoring wells will be used to monitor the siltstone/silty sandstone unit at approximately 220 feet below ground surface, *i.e.*, the shallowest occurrence of saturated conditions beneath the NEF site. ~~As stated~~

~~previously,~~ At the up-gradient background monitoring well location, a well ~~also~~ will be screened to monitor any water that might occur in vicinity of the alluvium/Chinle contact, though no water was present in this zone when LES conducted its NEF site investigations. These wells will be sampled quarterly in accordance with LES's New Mexico Groundwater Discharge Permit.

Q45. In Basis A of their original contention, NIRS/PC state that, according to Table 6.2-1 of the NEF Environmental Report, "the detection limit for most metals in groundwater will be 5 ppm." They assert that this is "much higher" than the health-based standards that the Environmental Protection Agency ("EPA") has established for many metals, and that the detection limits for each metal should be no higher than the health-based standard. *See* NIRS/PC Petition at 22-23, ¶ i. Please state your conclusion relative to this claim.

A45. (GAH) Since the time NIRS/PC submitted its original contention, LES has revised Table 6.2-1 of the NEF Environmental Report to reflect that the lower limits of detection ("LLD") for all analyses listed in that table will meet applicable EPA LLDs. Therefore, the concern stated by NIRS/PC has been fully addressed.

Q46. In Basis A of their original contention, NIRS/PC assert that "the full composition of the UF_6 feedstock has not been specified," and that "LES should identify the other hazardous materials that may be contained in the feedstock." *See* NIRS/PC Petition at 23, ¶ j. Please state your conclusion relative to this claim.

A46. (GAH) LES will use only natural uranium hexafluoride ("UF_6"), containing approximately 0.71 w/o uranium-235 (^{235}U), as feed material. The NEF Safety Analysis Report, at Table 1.2-1, indicates that LES will require UF_6 suppliers to provide Commercial Natural UF_6 in accordance with ASTM C 787-96, "Standard Specification for Uranium Hexafluoride for Enrichment." ASTM C 787-96 specifies the composition of the UF_6 feed material. LES has

further indicated that it will require cylinder suppliers to preclude use of cylinders that, in the past, have contained reprocessed UF_6, unless such cylinders have been decontaminated. *See* SAR Table 1.2-1, note (1). Accordingly, LES does not expect the feedstock to contain "other hazardous materials."

Q47. In Basis A of their original contention, NIRS/PC assert that the permeabilities presented in Table 3.3-2 of the NEF Environmental Report "may be derived from laboratory measurements," and that such measurements "often underestimate the bulk permeability of a rock body because they do not account for fractures and other features that may act as fast flow paths." *See* NIRS/PC Petition at 23, ¶ k. Do you agree with this assertion? If not, please state the basis for your conclusion.

A47. (RLP) No. The permeabilities presented in Table 3.3-2 of the NEF Environmental Report are, in fact, derived from laboratory measurements performed on field samples from near the NEF site. However, contrary to the assertion of NIRS/PC, laboratory-measured permeabilities are likely to be higher than actual *in situ* values due to deformation/fracturing caused by the sampling process. In any event, the permeability data presented in ER Table 3.3-2 represent ranges of measured permeabilities for reddish brown silty clays, sandstones and siltstones near the NEF site. The values for the clay indicate that it is highly impervious. While the siltstones/sandstones may be slightly more permeable than the clays, they still have relatively low permeabilities. Comparison of boring logs from the 14 NEF borings with boring logs from the nearby WCS site demonstrate similar stratigraphy at the locations. The CJI report also supports this conclusion by its heavy reliance on WCS data to supplement the NEF data. CJI performed both studies and must have concluded that the stratigraphy information at WCS is transferable to the NEF site with adjustments as provided by

the NEF borings. As discussed above, extensive permeability data from WCS site confirm the appropriateness of the characterization of NEF site permeability values as indicative of highly impervious material. The low permeability and low hydraulic conductivity values obtained from the NEF, Lea County Landfill, and WCS site investigations do not suggest the presence of "fast flow paths" in the NEF site vicinity.

Q48. In Basis A of their original contention, NIRS/PC LES claim that LES's statement on page 4.12-9 of the NEF Environmental Report that water in the Santa Rosa Aquifer is "considered not potable" lacks basis, and state that "the Santa Rosa Aquifer is used as a source of domestic and livestock water in Lea County." *See* NIRS/PC Petition at 23, ¶ l. Please state your conclusions regarding this assertion.

A48. (GAH, RLP) As an initial matter, this issue is not relevant to the adequacy of LES's evaluation of the proposed NEF on water resources, *i.e.*, the subject of Contention NIRS/PC EC-1. The statement on page 4.12-9 of the NEF Environmental Report was made in the context of that portion of LES's conservative radiological pathway dose assessment involving potential exposure of humans to liquid effluents. It was not made in the context of LES's assessment of potential water resources impacts. Moreover, by virtue of its great depth below ground surface (over 1,000 feet) and confinement by thick beds of low-permeable Chinle red bed clay, the Santa Rosa will not be impacted by NEF operations. Finally, data from a well installed in the Santa Rosa aquifer at the WCS site indicates that the total dissolved solids (TDS) concentration of water produced from the Santa Rosa aquifer in this area exceeds New Mexico Drinking Water Bureau standards. The WCS analysis of the Santa Rosa aquifer water resulted in a TDS value of 1,370 mg/L ~~(see LES Exhibit 11)~~ (see LES Exhibit 11). The New Mexico Standards for Domestic Water Supply provide a TDS limit of 1,000 mg/L. EPA Secondary Maximum Contaminant

Levels provide a TDS limit of 500 mg/L. The TDS value from the Santa Rosa aquifer is above both the New Mexico and EPA limits. LES acknowledges that the Santa Rosa aquifer may be used as a source of water for livestock in the region surrounding the site. However, as described above, the NEF will not impact the Santa Rosa aquifer. Therefore, use of the Santa Rosa aquifer as a source of water for livestock in the region surrounding the NEF has no bearing on this issue.

B. **Response to Contention as Amended by the Licensing Board (Additional Bases)**

Q49. You stated earlier that Licensing Board amended Contention NIRS/PC EC-1 on November 22, 2004 to include five additional bases that contest the adequacy of the NRC Staff's DEIS. Are you familiar with each of these five additional bases?

A49. (GAH, RLP) Yes.

Q50. In Basis A of the amended contention, NIRS/PC note that the DEIS contains estimates of the dimensions, flow rates, and discharge areas associated with "perched" bodies of groundwater that might form at the alluvium/Chinle interface due to the potential seepage of water from the Site Stormwater Detention Basin and the septic leach fields. NIRS/PC assert, however, that the "NRC provides no explanation of such calculations, and it is not possible to determine whether they are reasonable." Do you agree with this assertion?

A50. (RLP) No.

Q51. Please state the basis for you conclusion.

A51. (RLP) The NRC Staff has since provided its calculations to NIRS/PC. *See* NRC Staff's Response to Interrogatories and Document Request by Petitioners Nuclear Information and Resource Service and Public Citizen to Commission Staff, dated November 10, 2004, at 7-11 (NIRS/PC Exhibit 42) ~~(LES Exhibit 19)~~. The NRC Staff's explanation of the assumptions underlying these calculations leaves no doubt that the Staff's estimates are extremely conservative in nature. First

and foremost, the Staff has assumed that 100% of all annual stormwater runoff (*i.e.*, all precipitation) and discharge to the septic systems would be available to form plumes along the alluvium/Chinle contact. With respect to stormwater, the Staff noted that "[t]he plume rate is estimated as the precipitation, at a rate of 46.1 cm/yr, falling on the basin's drainage area of 39 hectares; runoff infiltration, evaporation of runoff water and basin water, and evapotranspiration have been conservatively neglected." With respect to the septic system, the Staff stated that "[t]he plume flow rate is taken as the actual system discharge, 7.3 million liters/yr; evapotranspiration has been conservatively neglected." These assumptions are highly conservative, insofar as significant quantities of precipitation runoff will be lost through the aforementioned processes, before such runoff has an opportunity to reach the Site Stormwater Detention Basin. Likewise, leachates from the septic systems will be subject to evapotranspiration.

Indeed, the annual evaporation rate in the site vicinity, 204 cm (80 inches) per year, exceeds the precipitation rate. According to a water balance analysis performed by LES, basin outflow due to evaporation and infiltration will exceed all inflows on a monthly basis. Of the amount that would infiltrate into the ground, most would be expected to eventually return to the atmosphere via evapotranspiration by vegetation growing in the vicinity of the basin, *i.e.*, it would not contribute to the formation of a plume. The Staff specifically acknowledged this fact in the DEIS, stating that "[t]he water would be expected to have limited downgradient transport due to the storage capacity of the soils and upward flux to the root zone." *See* DEIS at 4-13.

In sum, the Staff's estimates assume that water movement through the vadose zone is occurring at rates equivalent to those of saturated sediments, and that all water discharged to the basin and leach fields migrates from the site. However, these assumptions purposely ignore the

fact that there is a monthly net soil moisture deficit in the site vicinity, where evapotranspiration losses exceed precipitation. Thus, it its very conservative to assume that perched water bodies will form along the alluvium/Chinle contact as result of seepage from the Site Stormwater Detention Basin or septic leach fields. It is even more conservative to assume that all water potentially discharged to the Stormwater Detention Basin and leach fields will move "downgradient" as a plume and ultimately discharge at the land surface.

Q52. With respect to the Staff's "plume" estimates, NIRS/PC witness George Rice asserts that "[a]lthough the hydraulic conductivity used by NRC may result in a reasonable estimate of average groundwater flow rates, it underestimates the rate at which groundwater is likely to flow through the more permeable materials underlying the site (e.g., gravels)." *See* November 24, 2004 Expert Report of George Rice. In support of this assertion, Mr. Rice states that (1) gravels exist beneath the site at various depths, (2) the hydraulic conductivity of gravels ranges from 0.1 cm/sec to 100 cm/sec, and (3) the porosity of gravel ranges from 0.25 to 0.40. Do you agree with Mr. Rice's assertion that the NRC Staff has underestimated the rate at which groundwater is likely to flow through the more permeable materials underlying the site?

A52. (RLP) No. I would also like to point out that the staff analysis is overly conservative.

Q53. Please state the basis for your conclusion.

A53. (RLP) As stated previously, given site hydrological conditions, it is highly conservative to posit that any water that infiltrates from the Site Stormwater Detention Basin or leach fields will result in the formation of perched water bodies or plumes. Notwithstanding, the Staff's assumed conservative hydraulic conductivity value, as the Staff itself recognized in stating that: "The chosen k_h = 0.01 cm/sec is on the conservative side (*i.e.*, results in greater

Darcy Velocity) of the range of site surface soils hydraulic conductivity as given on page 3-35 of the DEIS [and page 3.4-14 of the ER]." A hydraulic conductivity value of 0.01cm/sec is consistent with published values for *clean* sand (0.005 to 1.0 cm/sec, Freeze and Cherry, 1979) (*see* LES Exhibit 7). Logs from the various boreholes drilled at the NEF site indicated that the alluvial soils below the site consist mainly of fine sand and silt. While minimal amounts of gravel were observed in certain zones, gravel is not consistently present throughout the site. Mr. Rice's choice of hydraulic conductivity is an attempt to demonstrate a potential maximum flow rate for ground water traveling along the surface of the red beds, when, in fact, a continuous gravel layer has not been documented to occur immediately above the red beds. Moreover, boring logs indicate that the depth to the alluvium/Chinle red bed contact may vary considerably across the site. Where the depth to the contact is particularly shallow, water movement is likely to be dominated by evapotranspiration and unsaturated flow conditions, *i.e.*, flow conditions of the type found in a saturated zone or aquifer would be unlikely. Finally, the use of a higher effective porosity value (*i.e.*, greater than the 0.25 value used by the Staff) would actually result in a lower estimated velocity, not a higher velocity.

Q54. Assuming that seepage of water from the Site Stormwater Detention Basin and/or septic leach fields could result in the formation of perched bodies of water or plumes that move down-gradient and eventually discharge at the surface, do you believe that adverse impacts on water resources would result?

A54. (GAH, RLP) No.

Q55. Please state the basis for this conclusion.

A55. (GAH, RLP) Runoff collected in the Site Stormwater Detention Basin, and sanitary wastewaters discharged to the site septic systems, are not expected to contain

contaminants in levels that exceed applicable regulatory limits. The NEF may not commence facility construction, discharge stormwater runoff, or discharge septic wastewaters prior to obtaining the requisite federal and state authorizations. And again, even if one accepts that NRC Staff's highly conservative estimate of pore velocity of 252 m/yr (0.16 mile/yr), the time required for discharge at the postulated locations identified by the Staff (approximately 25 miles and 3 miles from the NEF site) would be on the order of 156 and 19 years, respectively.

Q56. In Basis B of the amended contention, NIRS/PC assert that the DEIS should contain an estimate of "the probability and frequency of leakage through the liners of the treated effluent basin or the stormwater detention basin," and "show the fate of water and contaminants that leak from the basins." Do you agree with this assertion?

A56. (GAH) No.

Q57. Please state the basis for this conclusion.

A57. (GAH) LES has committed to construct the TEEB and install the liner system in a manner that will ensure optimum performance. The materials and construction methods used for the TEEB will be consistent with current New Mexico Environment Department ("NMED") guidelines for liner material and site preparation of synthetically-lined lagoons. Specifically, the TEEB will have two geosynthetic liners fabricated from material that is chemically compatible with potential liquid effluents to be discharged to the TEEB, resistant to sunlight deterioration, and of sufficient thickness to have adequate tensile strength and puncture resistance. The specific liner material will be selected during the final design and will have a projected service life in excess of the projected service life of the NEF. LES will take necessary actions to ensure that the liner stays within manufacturer's specifications throughout the required performance period. As required by the NMED guidelines, the liner material will be pre-approved by a

professional engineer and the NMED. The liner will be installed and tested by certified installers according to project specifications. LES will implement a monitoring plan that provides for periodic inspections and, if necessary, the implementation of corrective actions.

Additionally, the TEEB will include an active liquid-sensor leak detection system for determining whether the primary (upper) liner has been breached. This system will have a drain/sump system consisting of collection pipes that will be routed to a monitored sump. If the sump is collecting liquid, then a level monitor will alert NEF site personnel. In the event that a failure of the primary or upper liner is detected by the leak detection system, site personnel will take appropriate mitigation measures, *i.e.*, assess any damage to the liner and restore liner integrity. Because the TEEB will be designed with two cells, the cell with the breached liner can be isolated, drained, and repaired, while discharges can continue to the intact cell. The secondary (lower) liner further serves to preclude discharge of TEEB liquids to subsurface in the event of a breach of the primary liner. In view of LES's commitment to carefully select liner materials and properly install in accordance with the manufacturer's recommendations and project specifications, test, and monitor the liner system, catastrophic failure of the liner system is not considered a credible event (*see* Attachment 1 to LES Exhibit 3, LES Exhibits 4 and 8).

The TEEB will contain only very low concentrations of uranic materials that are well within applicable regulatory limits. As I explained previously, if all of the uranium that would be discharged to the TEEB over 30 years were <u>assumed</u> to infiltrate into the soil to a depth of 20 feet below ground surface over an area equal to that of the TEEB, it would be equivalent to the uranium naturally occurring in NEF site soil (*see* LES Exhibit 10). Moreover, as Mr. Peery has explained, site hydrogeological conditions are such that that subsurface migration of any leakage from the TEEB – assuming such leakage were to occur – would be unlikely. Finally, LES will

implement a monitoring program designed to detect to any postulated releases to the environment. For these reasons, I do not believe that it is necessary to estimate of the probability and frequency of leakage through the liners of the TEEB, or to provide any additional analysis of the fate of any assumed leakage beyond that already provided by LES in the NEF Environmental Report and in this testimony.

The appropriate considerations described above that are applicable to the single-lined UBC Storage Pad Stormwater Retention Basin lead to the same conclusion that it is not necessary to estimate of the probability and frequency of leakage through the liner of the UBC Storage Pad Stormwater Retention Basin, or to provide any additional analysis of the fate of any assumed leakage beyond that already provided by LES in the NEF Environmental Report and in this testimony.

Q58. NIRS/PC have identified several documents in support of Basis B of the amended contention. Are you familiar with these documents?

A58. (GAH) Yes. The documents include the following: (1) EPA, 1994a, *The Hydrologic Evaluation of Landfill Performance (HELP) Model, User's Guide for Version 3,* EPA/600/R-94/168a (Sept. 1994); (2) Laine, D.L., and M.P. Miklas, Jr., 1989, *Detection and Location of Leaks in Geomembrane Liners Using an Electrical Method: Case Histories,* Southwest Research Institute, San Antonio, Texas, Proceedings of the 10th National Conference, Superfund '89, Washington, D.C., U.S.A. (Nov. 27-29, 1989); and (3) EPA, 2004a, *Survey of Technologies for monitoring Containment Liners and Covers,* EPA 542-R-04-013, June 2004.

Q59. Do these documents alter your conclusion regarding Basis B of the amended contention?

A59. (GAH) No. The first document is a user's guide intended to explain how to use Version 3 of the Hydrologic Evaluation of Landfill Performance (HELP) computer program, "a quasi-two-dimensional hydrologic model of water movement across, into, through and out of landfills." It is "a tool for both designers and permit writers," the "primary purpose [of which] is to assist in the comparison of design alternatives as judged by water balances." The user's guide discusses "data requirements, nomenclature, important assumptions and limitations, other fundamental information needed to run the program." It also describes the procedures and options available to input data, execute the model, and obtain results. In other words, it is not a definitive study specific to the issue of leakage of geosynthetic liners.

The EPA user's guide speaks in terms of "pinhole defects" generally resulting from manufacturing flaws such as polymerization deficiencies," and notes that "[t]he density of pinholes and installation defects is a subject of speculation." To the extent it provides "representative installation defect densities" for input purposes, it states that they are intended to be "reasonably conservative" so as to allow determination of "maximum probable leakage quantities." The document also indicates that the density of installation defects is "a function of the quality of installation, testing, materials, surface preparation, equipment, and QA/QC program," and that typical geomembranes may have about 0.5 to 1 pinholes per acre. The surface area of TEEB is approximately 0.75 acres at bottom of the basin and 1.75 acres at high water level. The area of the UBC basin is approximately 19 acres at high water level.

Notably, a companion report to user's guide, the Engineering Documentation for Version 3, defines a composite liner as a low permeability soil liner covered with a geomembrane (The TEEB and UBC basins both meet this definition). The geomembrane component of a composite liner virtually eliminates leakage except in the area of defects, punctures, tears, cracks and bad

seams. In contrast, "pinhole" flaws are more commonly associated with the original, less sophisticated, geomembrane manufacturing techniques. Current manufacturing and polymerization techniques have made pinhole flaws less common. Indeed, this document recommends use of a flaw density of 1 flaw per acre for intensively monitored projects. Based on above, and given LES's commitments to install per NMED guidelines, potential leaks in the liners will be as low as is physically possible to achieve.

The second document cited by NIRS/PC, Laine and Miklas (1989), does not appear to contain data that are germane to the lined basins to be installed at the NEF. The authors of this report reportedly reviewed data for 61 geomembrane-lined facilities and concluded that leaks were detected at 58 of the 61 facilities. These facilities included: primary and secondary liners at landfills; concrete vaults for solid waste storage; wastewater storage ponds for sewage treatment facilities; above-ground steel tanks for storage of hazardous materials; brine storage impoundments; descaling ponds for natural gas transmission companies; and cooling water ponds. It is not clear from the report which data apply to a particular type of installation, or how much of data are even relevant to the proposed NEF lined basins. Moreover, the data provided in Laine and Miklas (1989) appear to be skewed, *i.e.*, they are heavily influenced by a few installations at which there were a very high number of detected leaks. For instance, two of the 61 installations accounted for 27% of all detected leaks in the data set. Seven of the 61 installations accounted for approximately 50% of all detected leaks (*see* LES Exhibit 72).

The third document referenced by NIRS/PC simply describes various methods for detecting leaks beneath lined landfills and impoundments. According to this document, the accepted practice or "industry standard" for monitoring the performance of liner systems is to install groundwater monitoring wells at the down-gradient edge of the unit and periodically test

the groundwater for changes in its quality that might indicate that a release is occurring. LES's proposed monitoring approach for the NEF is consistent with the accepted industry practice. Thus, this document in no way suggests that the liners to be installed at the NEF will not perform their intended function.

Q60. In Basis C of the amended contention, NIRS/PC assert that the DEIS should explain the presence of this moisture in two of the soil borings installed by LES at the NEF site. According to NIRS/PC, the presence of such moisture conflicts with the Staff's statement in the DEIS that "... no precipitation recharge (*i.e.*, rainfall seeping deeply into the ground) occurs in thick, desert vadose zones with desert vegetation." What is conclusion relative Basis C?

A60. (RLP) I strongly disagree with the conclusion reached by NIRS/PC is Basis C. Indeed, this is the same issue raised by NIRS/PC in their original contention relative to LES's alleged failure to adequately evaluate whether groundwater exists in the alluvium at the NEF site. I fully addressed this issue earlier. In short, the moisture observed in two soil samples likely represented some "residual" moisture attributable to the moisture storage capacity of the soil in the vadose zone. It did <u>not</u> reflect the existence of saturated conditions. This opinion is consistent with those of the individuals who logged the two borings at issue. Extensive boring data from both the NEF and WCS sites confirm that continuous saturated conditions do not exist in the alluvium beneath those sites, and that the first continuous saturated unit beneath the NEF site occurs at a depth of approximately 220 feet. Indeed, the "slightly moist" cuttings and "moist" clay descriptions were used only twice in the descriptions from the nine hydrogeologic and five geotechnical borings performed at the NEF site. All other determinations, 66 in number, were either "dry" or "very dry." Finally, the Staff's statement regarding the lack of

recharge correctly reflects site conditions, namely, the low rate of precipitation and high rate of evapotranspiration.

Q61. In Basis D of the amended contention, NIRS/PC states that two types of permeability measurements have been made on the Chinle Formation at or near the site: laboratory measurement of core samples and a slug test performed in MW-2. According to NIRS/PC, "[s]uch extremely limited measurements, where faults are present, cannot describe the permeability of the entire site, and NRC should explain its reliance on such restricted data." Please state your conclusion regarding this assertion.

A61. (RLP) Neither LES nor the NRC Staff relied on "restricted data" in assessing the potential for "fractures or other fast flow pathways" to exist below the NEF site. This issue was assessed through review of NEF site boring logs (nine hydrogeologic and five geotechnical) and three monitor wells, the extensive information in WCS reports, the existence of the dense Chinle (red bed) clay under the site and familiarity of this structure in the vicinity of the site, hydraulic conductivity and permeability data obtained from both NEF and WCS sites; and the confined siltstone layer, at approximately 220 to 230 feet below ground surface, with measured high piezometric levels (reflecting confined conditions). This information, particularly when viewed in the aggregate, does not indicate that fractures and fast flow paths exist under the National Enrichment Facility site.

Q62. In Basis E of the amended contention, NIRS/PC allege that the Site Stormwater Detention Basin will discharge runoff containing numerous contaminants, and that the DEIS neither adequately identifies these contaminants nor explains how they will be monitored. According to NIRS/PC, the presence of these contaminants should be disclosed and the

stormwater should be monitored for such contaminants. Please state your views regarding this basis.

A62. (GAH) LES will conduct monitoring of site stormwater runoff in accordance with applicable Federal/State requirements. The ER specifically states that the "monitoring program will be refined to reflect applicable regulatory requirements," and that "the Site Stormwater Detention Basin will adhere to the requirements of the Groundwater Discharge Permit/Plan from the [New Mexico Water Quality Board]."

Section 6.2 of the NEF Environmental Report sets forth LES's proposed physiochemical monitoring program, which encompasses the Site Stormwater Detention Basin. In particular, Table 6.2-2, "Stormwater Monitoring Program for Detention and Retention Basins," sets forth the various parameters to be monitored by LES (as well as the monitoring frequency, sample type, and lower limit of detection) with respect to stormwater detention basin discharges. These parameters include oil and grease, total suspended solids, 5-day biological oxygen demand, chemical oxygen demand, total phosphorus, total Kjeldahl nitrogen, pH, nitrate plus nitrite nitrogen, and metals. The proposed monitoring program meets or exceeds NPDES Multi-Sector General Permit stormwater monitoring requirements. It also exceeds monitoring requirements at two nuclear power plants with which I am familiar. LES believes this proposed plan to be adequate in view of applicable regulatory requirements and site conditions, and the fact that the applicable permitting processes are still in progress.

Q63. In support of Basis E, NIRS/PC cite two references: (1) Barrett, M.E, et al., "Review and Evaluation of Literature Pertaining to the Quality and Control of Pollution from Highway Runoff and Construction," Technical Report CRWR 239 (April 1993); and (2) Mahler, B.J. et al., "Concentrations of Polycyclic Aromatic Hydrocarbons (PAHs) and Major and Trace

Elements in Simulated Rainfall Runoff from Parking Lots, Austin, Texas, 2003" United States Geological Survey, Open File Report 2004-1208 (2004). Have you reviewed these documents?

A63. (GAH) I have reviewed an updated (second edition) of document (1) published in 1995 as well as document (2).

Q64. Does your review of these documents alter your conclusion regarding the adequacy of LES's proposed plan for monitoring Site Stormwater Detention Basin Discharges?

A64. (GAH) No. The first report (second edition) provides a review and evaluation of the literature associated with the quantity and control of pollution from highway runoff and construction. The report notes that studies "which have shown minimal effects on groundwater quality have been located in areas with fairly thick soils, which immobilize many of the pollutants in runoff." The report notes that even thin soils can result in significant attenuation and that no obvious impact of highway runoff on groundwater was found. The report provides information that shows that potential groundwater contamination would be more likely to occur where the runoff is immediately available to shallow groundwater systems, which is not the case at the NEF site (*see* LES Exhibit 71). The soils at the NEF site will provide similar attenuation of any runoff constituents from the paved vehicle roadways or parking lots at the NEF site and no impacts on groundwater are expected. This conclusion would apply to the conveyance systems, basin and outfall areas. The second report looked at polycyclic aromatic hydrocarbons ("PAHs") that might wash off of seal-coated parking lots that might be transported to surface bodies of water. Given the depth of soil to groundwater and the conclusions of the first study described above, no impacts to groundwater from PAHs – even assuming they were present – are expected at the NEF site. Likewise, this conclusion would apply to the conveyance systems, basin and outfall areas.

Q65. Please state your overall conclusions relative to Contention NIRS/PC EC-1 (including all bases admitted in support of the contention).

A65. (GAH/RLP) The potential for NEF operations to have adverse impacts on water resources is very low in view of the lack of any surface waters, LES's proposed treatment of effluents prior to discharge and use of other preventive measures designed to preclude contamination of effluents and site runoff, LES's proposed use of engineered basins/systems to collect facility discharges and runoff, favorable site hydrogeological conditions, and LES's proposed environmental monitoring program.

Contention NIRS/PC EC-1, in effect, represents a "parade of horribles" scenario that rests on the postulated occurrence of a series of events, each of which, in its own right, is unlikely to occur. This unlikely series of events would include contamination of facility discharges and runoff at levels that would exceed applicable regulatory limits; faulty performance of facility engineered basins and systems; substantial infiltration of facility discharges and/or site runoff, despite high evaporation/evapotranspiration rates and the presence of low-permeability soils; and the transport of contaminants either along the alluvium/Chinle contact or to water-bearing units no less than 200 feet below ground surface through postulated, but unobserved, "fast flow paths."

Q66. Does this conclude your testimony?

A66. Yes.

FRAMATOME ANP

GEORGE A. HARPER, P.E.
FRAMATOME ANP

Title/Position: Manager
Regulatory Compliance Programs

Years of Experience: 25

SUMMARY

Mr. Harper has over 25 years of nuclear industry experience in analyzing environmental, hydrologic, hydraulic, seismic, geotechnical, groundwater, tornado and tornado missile, and probabilistic risk assessment (PRA) issues relating to nuclear power plants. He currently manages over 60 scientists, engineers and technicians in the Regulatory Compliance Programs Department. This department provides services in areas including; environmental, health and safety, environmental engineering, health physics, radiation protection, quality assurance, environmental laboratory and emergency planning.

Mr. Harper has recently participated in development of a license application for a uranium enrichment facility. Responsibilities included overall management of the environmental report, development of portions of the environmental report, integrated safety analysis (ISA) and the portions of the security threat assessment. He was also responsible for the external events portion of the ISA. Mr. Harper has participated in siting evaluations for dry independent spent fuel storage installations (ISFSI) at the Vermont Yankee and Yankee Rowe nuclear plants, which included participating in environmental and geotechnical assessments at both locations. He has recently completed a similar effort for Seabrook Station. These assessments involved addressing environmental, seismic, soil amplification, liquefaction and slope stability issues. He also provided geotechnical and environmental field support during ISFSI construction at Yankee Rowe and also supported preparation of the 10CFR72.212 evaluation. Mr. Harper is experienced at performing TNT blast equivalent evaluations for determining safe separation distances between design basis threats and critical facilities.

Mr. Harper has also performed many environmental studies including; environmental effects of plant power level uprates, heat dissipation in receiving waters, storm water runoff, dilution of plant effluents in receiving waters and NPDES supporting studies. Performs and manages various analyses and safety evaluations in support of nuclear plant engineering, environmental, licensing, design and operations. Mr. Harper participated on a task force at Seabrook Station to determine the root cause and identify corrective actions after tritium was discovered in the groundwater near the spent fuel pool. His areas of responsibility included identifying the extent of groundwater contamination and the likely groundwater travel paths. He developed a recommended groundwater remedial plan which is presently being implemented.

Mr. Harper completed a Federal Energy Regulatory Commission (FERC) research project on flood studies associated with dam safety. Recently, Mr. Harper served on a FERC-approved Board of Consultants overseeing dam safety evaluations for some regulated dams in the State of New York. He previously served on a similar FERC-approved Board of Consultants for two dams in the State of Maine. He was responsible for updating the equipment inventory for

FRAMATOME ANP

Seabrook Station's decommissioning cost estimate study. In addition, he has managed several design changes at Millstone and Seabrook Station. He also provides routine engineering support to Seabrook on various operational, design and system issues.

Mr. Harper has completed external event design basis reviews on flooding, tornado, seismic and potential effects from nearby facilities at Seabrook Station in support of their response to the Nuclear Regulatory Commission's (NRC) 10CFR50.54(f) request concerning licensee licensing basis compliance. He also completed similar reviews at Millstone Unit 3, and served as the Lead Engineer for Millstone Unit 3's Chapter 2 Updated Final Safety Analysis Report (UFSAR) verification. In addition, he developed and presented a three-day training course to Ukrainian nuclear engineers on methodologies for evaluating nuclear power plant external flooding.

Mr. Harper has completed various tornado venting analyses to support design changes at several plants. He has also performed individual plant examinations of external events (IPEEE) for probable maximum flooding (PMF) at eight nuclear power plants. He has also participated in numerous PMF studies for hydro power dams. Mr. Harper has also been extensively involved in decommissioning activities and waste siting issues. He planned and performed media sampling efforts in support of decommissioning site characterization. He performed various geotechnical and slope stability assessments associated with hauling heavy equipment and components during decommissioning. He also provided engineering support for decommissioning studies and for radiological evaluations, including ingestion pathway, liquid pathway, and on-site and off-site disposal. In addition, Mr. Harper has provided engineering and environmental support for low level radioactive waste (LLRW) siting issues in Vermont and Maine.

EDUCATION/TRAINING

MS, Civil Engineering, University of Massachusetts, 1978
BS, Civil Engineering, University of Massachusetts, 1975
Integrated Safety Analysis Leader Training, Process Safety Institute, 2002
Managing Projects with Microsoft Project2000, 2001
Computer-Aided Hydrology and Hydraulics, American Society of Civil Engineers (ASCE), 1994
MODFLOW for Simulation of Groundwater Flow and Advective Transport, National Groundwater Association, 1992
Calculating Explosion Hazards, American Institute of Chemical Engineers (AIChE), 1990
Soil Dynamics and Foundation Engineering, University of Missouri, 1987
Wind Loads on Buildings and Structures, Texas Tech University, 1984
Seismic Design and Analysis of Earth and Rockfill Dams, University of Missouri, 1982
Analytical Techniques for HEC-1 and DAMBRK, Pennsylvania State University, 1982
Flood Predictions, Estimations and Forecasting, Colorado State University, 1981
Statistical Computer Techniques in Hydrology and Water Resources, Colorado State University, 1980
Flood Plain Hydrology HEC-1, Pennsylvania State University, 1979
Embankment Dams, Design and Construction, Massachusetts Institute of Technology (MIT), 1979
HEC-2 Advanced, Pennsylvania State University, 1978
Flood Flow Frequency Analysis, Pennsylvania State University, 1978

FRAMATOME ANP

PROFESSIONAL AFFILIATIONS/CERTIFICATIONS

Registered Professional Engineer: Massachusetts, New Hampshire, Maine
American Society of Civil Engineers (ASCE), Member

EXPERIENCE

Manager, Regulatory Compliance Programs	1/03-present
General Manager, Environmental Health & Safety Department	10/01-12/02
Manager, Environmental Services Group	10/00-10/01
Consulting Engineer	12/97-10/00

Framatome ANP Inc. / Duke Engineering & Services

Performs and manages various analyses and safety evaluations in support of nuclear plant engineering, environmental, licensing, design and operations. Led the design team performing marine mammal barrier system design work for the submerged offshore intakes of Seabrook Station's circulating water system. This system was successfully installed in 1999 and has successfully eliminated the entrapment of seals.

Provided support to Seabrook Station on thermal impact on ocean cooling water temperature rise for two-pump versus three-pump circulating water system operation. Also, addressed state and Environmental Protection Agency (EPA) issues associated with adequacy of plankton entrainment sampling system for Seabrook's circulating water system. He also participated in a siting study to select a dry fuel storage location at Seabrook Station.

Participated in the siting process for a dry storage ISFSI at the Vermont Yankee Nuclear Power Station, which resulted in the selection of a preferred site. Subsequently, managed the geotechnical assessments that included seismic evaluations of underlying soils at the selected location for amplification and liquefaction potential. Participated in the overall siting process for a dry storage ISFSI at the Yankee Rowe Nuclear Power Plant, which is presently being decommissioned. This process resulted in the selection of a preferred site. Completed soil amplification, liquefaction, slope stability, geotechnical assessments and site flooding evaluations in support of the detailed design. Provided field support during construction of the ISFSI facility.

Recently served on a FERC-approved Board of Consultants overseeing dam safety evaluations on two dams located in New York. Previously completed a similar project in Maine. Performed probable maximum flood (PMF) studies for a New Hampshire dam owned by the State of New Hampshire and a New York dam owned by the New York Power Authority (NYPA). Recently assisted in developing an updated PMF study at a Duke Power dam in South Carolina. Held responsibility for a design change that designed and installed roof scuppers on all safety-related structures at Millstone Unit 2. Also, provides technical support for Seabrook Station's decommissioning cost estimate. In addition, performs safety evaluations in support of design changes and external event issues that could impact plant operations.

FRAMATOME ANP

Principal Engineer 04/79-11/97
Yankee Atomic Electric Company

Performed configuration management reviews at Millstone and Seabrook for external event design bases. Managed and assisted in Millstone Unit 3's Chapter 2 UFSAR verification. Provided ongoing geotechnical and sampling support for decommissioning activities. Performed external flooding evaluations for the individual plant examination of external events (IPEEE) at eight nuclear power plants. Completed a major research program under contract to the Electric Power Research Institute (EPRI) to develop an extreme rainfall probability methodology. Compiled and evaluated site-specific severe weather data in support of blackout evaluations at the Seabrook, Vermont Yankee and Yankee Rowe nuclear power stations. Redesigned and licensed a major modification to Seabrook's flood protection system. Formulated groundwater radiological travel time estimates to surface water bodies at the Yankee Rowe, Vermont Yankee, Maine Yankee and Seabrook nuclear power stations to support licensing requirements and evaluate unplanned liquid radiological releases to the environment. Performed groundwater modeling at the Yankee site using MODFLOW to support decommissioning activities.

Lectured at the Harvard School of Public Health on "Radionuclide Transport Evaluations: Terrestrial and Aquatic." Provided training to Ukrainian nuclear engineers on nuclear plant flooding evaluations. Developed testimony and testified before the Vermont Public Service Board on licensing requirements for siting a low level radioactive waste (LLRW) disposal site. Supported Vermont Yankee and Maine Yankee on site characterization issues for siting a LLRW disposal facility in Vermont and Maine, respectively. Provided engineering support for Vermont Yankee's LLRW storage facility safety evaluation. Projected LLRW disposal costs for New Hampshire in support of a decommissioning study.

Performed explosion hazard evaluations for the on-site storage of various gases, and probabilistic evaluations of tornado missile impacts on safety-related equipment. Developed technical input for plant decommissioning cost estimates and storm drainage system hydraulic modeling. Developed site-specific tornado wind and pressure drop probabilistic hazard curves, and building venting calculations for tornado induced pressure drop evaluations. Produced a major update to Seabrook's decommissioning study.

Supported the Yankee Rowe Nuclear Power Station Systematic Evaluation Program (SEP). Successfully resolved all external flooding and tornado missile issues. Developed tornado and wind hazard descriptions, and determined structure and system wind fragilities as part of the tornado and wind cost/benefit analysis.

Engineer 09/77-03/79
DuBois & King, Inc.

Performed data collection, engineering analysis, computer modeling of rivers, flood forecasting, design of hydraulic structures, and report preparation work. Also, negotiated contracts with local, state and federal agencies.

JOHN SHOMAKER & ASSOCIATES, INC.
WATER-RESOURCE AND ENVIRONMENTAL CONSULTANTS
2703 BROADBENT PARKWAY NE, SUITE B
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-3407, FAX (505) 345-9920

RESUME

ROGER L. PEERY

EDUCATION

1989-92 Master of Science in Water Resources (1992)
University of New Mexico, Albuquerque, NM

1984-87 Bachelor of Science in Geology (1987)
University of New Mexico, Albuquerque, NM

EXPERIENCE

1988- CEO/Senior Hydrogeologist, John Shomaker & Associates, Inc.

Water-resource evaluations, water-resource development, and water-well siting.

Project manager for regional and local water planning, including two regional water plans accepted by the New Mexico Interstate Streams Commission.

Project management and field supervision of water-well and monitor drilling and construction for wells completed at depths exceeding 3,000 feet, deep-aquifer discrete-interval zone sampling, well development/sampling, infiltration testing, injection wells completed at depths exceeding 3,500 feet, and injection testing.

Related well experience also includes development of drilling specifications for wells drilled up to 3,000 ft below ground level, wells completed using casing path design method, and artesian wells.

Ground-water flow modeling, aquifer test pumping and interpretation of test data, and evaluation of ground water in storage.

Project manager for site investigations and remediation of contamination associated with leaking underground-storage tanks.

Evaluation of hydrogeology for aquifer storage and recovery projects.

PROFESSIONAL DEVELOPMENT

1992	Hydrologic Evaluation for Landfill Performance Modeling (HELP), University of Milwaukee, Wisconsin
1993	Applying Ground Water Flow Modeling Techniques to Field Problems, Environmental Education Enterprises Institute and the Association of Engineering Geologists
1993	Borehole Geophysical Techniques for Water Wells, Hughbert A. Collier, Ph.D.
1994	A Design Workshop for Soil and Groundwater Remediation, University of New Mexico, College of Engineering
1997	Risk Based Corrective Action Applied at Petroleum Release sites, ASTM
1998	Fractured Rock Hydrogeology, University of Arizona, Shlomo Neuman, Ph.D.
1999	Applied Transport and Fate Modeling for Risk-Based Soil Screening and Cleanup Levels Using SESOIL and AT123D, National Ground Water Association
2000	Visual MODFLOW, National Ground Water Association
2002	Applications in Risk Assessment, Remediation, Modeling, and GIS, National Ground Water Association
2002	Estimating Times of Remediation Associated with Monitored Natural Attenuation and Contaminated Source Removal, National Ground Water Association
2004	Artificial Recharge of Ground Water, National Ground Water Association

PROFESSIONAL REGISTRATION

- American Institute of Professional Geologists, CPG-9808
- State of Wyoming Professional Geologist, PG 2363 (New Mexico does not register geologists)
- New Mexico Environment Department Underground Storage Tank Bureau Certified Scientist, No. 002
- State of New Mexico Regulation and Licensing Department Construction Industries Division, GS29 No. CQ064612
- State of Texas Licensed Professional Geologist, No. 2222

MEMBERSHIPS

- Association of Ground Water Scientists and Engineers
- American Water Resource Association, New Mexico Section, President 1998

EXPERT TESTIMONY

Provided sworn testimony before Santa Fe County Development Review Committee, Santa Fe County Commissioners, Sandoval County Planning and Zoning Committee, Sandoval County Commissioners, Socorro County Commissioners, San Miguel County Commissioners, and New Mexico Office of the State Engineer hearing examiners.

PUBLICATIONS

Finch, S. T., Jr., and Peery, R. L., 1995, Soil investigations and installation of shallow ground-water monitoring wells using a hand-held auger: National Ground Water Association, Preceding for the Ninth National Outdoor Action Conference/Expo, May 2-4, 1995.

Peery, R. L., 1995, The importance of hydrogeologic evaluation and water resource assessment in subdivision planning, Santa Fe County, New Mexico, AWRA 1995 Annual Meeting and Field Trip.

Author and Co-Author of numerous ground-water studies available in the public record as consultant's reports.

1 CHAIR BOLLWERK: And let me then see what
2 exhibits we have that accompany this testimony.
3 MR. REPKA: I was planning to do all the
4 exhibits after both pieces of testimony. I have not
5 correlated them by document.
6 CHAIR BOLLWERK: Okay.
7 MR. REPKA: The rebuttal testimony --
8 CHAIR BOLLWERK: Okay, that would be a
9 good point. Why don't you go ahead and do that. I'm
10 sorry, I'm -- rebuttal. I apologize.
11 MR. REPKA: Okay. I'll turn back to the
12 panel and I'll ask, do you have in front of you a
13 document entitled the revised pre-filed rebuttal
14 testimony of George A. Harper and Roger L. Peery on
15 behalf of Louisiana Energy Services LP on Contention
16 NIRS/PC EC-1, impacts upon ground and surface water,
17 dated February 3rd, 2005?
18 WITNESS PEERY: Could I ask for some
19 clarification? Did you say revised?
20 MR. REPKA: Yes, that's the title,
21 revised. It's the February 3rd, 2005 version of the
22 rebuttal testimony.
23 WITNESS HARPER: Well, we have the January
24 28th one.
25 MR. REPKA: Well, let me ask you then, do

1 you have any corrections you need to make to this
2 document?
3 WITNESS HARPER: No, I do not.
4 WITNESS PEERY: No.
5 MR. REPKA: Okay. So we'll get you a copy
6 later if you need it. But, for now, let's --
7 JUDGE ABRAMSON: Which one are you
8 referring to Counsel?
9 CHAIR BOLLWERK: Can I make one
10 suggestion? Maybe you just might give them the copy
11 that you've got and let them see it just to make sure
12 we're all on the same page here.
13 MR. REPKA: Okay. Do you recognize that
14 document?
15 WITNESS HARPER: Yes.
16 WITNESS PEERY: Yes, I do.
17 MR. REPKA: Was it prepared by you or
18 under your supervision?
19 WITNESS HARPER: Yes, it was.
20 WITNESS PEERY: Yes, it was.
21 MR. REPKA: And does that represent your
22 rebuttal testimony in this proceeding on this
23 contention?
24 WITNESS HARPER: Yes.
25 WITNESS PEERY: Yes.

1 MR. REPKA: Is it true and correct to the
2 best of your knowledge and belief?
3 WITNESS HARPER: Yes, it is.
4 WITNESS PEERY: Yes, it is.
5 MR. REPKA: And, with that, I'll ask that
6 the Board accept this as the rebuttal testimony and
7 that it be admitted into the record as if read.
8 CHAIR BOLLWERK: Let me turn to the
9 parties then. Any objections from the Staff or from
10 NIRS/PC? I hear none. Then the revised pre-filed
11 rebuttal testimony of George Harper and Roger L. Peery
12 on behalf of LES on Contention NIRS/PC EC-1, the
13 impacts upon ground and surface water, should be
14 admitted or entered into the record as if read.
15 Pre-filed rebuttal admitted.
16 (Whereupon, the pre-filed rebuttal
17 testimony of Mr. George A. Harper and Mr. Roger L.
18 Peery were inserted into the record as if having been
19 read.)

February 3, 2005

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:	)	
	)	Docket No. 70-3103-ML
Louisiana Energy Services, L.P.	)	
	)	ASLBP No. 04-826-01-ML
(National Enrichment Facility)	)	

REVISED PREFILED REBUTTAL TESTIMONY OF GEORGE A. HARPER AND ROGER L. PEERY ON BEHALF OF LOUISIANA ENERGY SERVICES, L.P. ON CONTENTION NIRS/PC EC-1 ("IMPACTS UPON GROUND AND SURFACE WATER")

I. WITNESS BACKGROUND

Q1. Please state your name, occupation, employer, and responsibilities relative to the licensing of Louisiana Energy Services, L.P.'s ("LES") proposed National Enrichment Facility ("NEF").

A1. I, George H. Harper ("GAH"), am the Manager of Regulatory Compliance Programs at Framatome ANP in Marlborough, Massachusetts, where I managed a team of scientists and engineers involved in preparing the NEF Environmental Report. I also contributed to the preparation of specific portions of the NEF license application and related state permit applications, including LES's New Mexico Groundwater Discharge Permit application. A full statement of my professional qualifications was included with LES's initial prefiled testimony in this proceeding, submitted on January 7, 2005. *See* "Prefiled Testimony of George A. Harper and Roger L. Peery on Behalf of Louisiana Services, L.P. Concerning Contention NIRS/PC EC-1 ("Impacts Upon Ground and Surface Water")" (hereinafter "Harper-Peery Direct Testimony").

I, Roger L. Peery ("RLP"), am employed as Chief Executive Officer and Senior Hydrogeologist at John Shomaker & Associates, Inc. in Albuquerque, New Mexico, where I am responsible for managing a variety of hydrogeological and water resources evaluations. I was hired by LES to serve as an expert witness on hydrogeological and water resources issues in this proceeding. A full statement of my professional qualifications was included with LES's initial prefiled testimony in this proceeding, submitted on January 7, 2005 and revised on February 3, 2005. *See* Harper-Peery Direct Testimony.

Q2. What is the purpose of this rebuttal testimony?

A2. (GAH, RLP) The purpose of this rebuttal testimony is to specifically address the written direct testimony of George Rice regarding Contention NIRS/PC EC-1 in this proceeding. We have reviewed Mr. Rice's testimony, which was submitted on behalf of Nuclear Information and Resource Service and Public Citizen ("NIRS/PC") on January 28, 2005, in its entirety. We show how the issues raised by Mr. Rice were previously addressed in our initial direct testimony in this proceeding. *See* "Direct Testimony of George Rice on Behalf of Nuclear Information and Resource Service and Public Citizen" (January 28, 2005) ("Rice Direct Testimony"). We also provide some additional responses to those issues in view of certain additional claims made by Mr. Rice. In general, as we concluded previously, LES and the NRC Staff have performed a complete and adequate assessment of the potential environmental impacts of the proposed NEF on site surface and ground water.

II. RESPONSE TO SPECIFIC CLAIMS MADE IN THE PREFILED DIRECT TESTIMONY OF NIRS/PC WITNESS GEORGE RICE

Q3. Please summarize the major opinions and conclusions stated by NIRS/PC witness George Rice in his prefiled direct testimony relative to Contention NIRS/PC EC-1.

A3. (GAH, RLP) In the final answer of his testimony, Mr. Rice summarizes his "major points" relative to Contention NIRS/PC EC-1. Mr. Rice concludes that "[t]he work performed by LES and the NRC Staff is deficient," insofar as they have neither "performed investigations necessary properly to characterize existing groundwater conditions," nor "performed investigations necessary to determine how the proposed facility will affect groundwater in the future." Rice Direct Testimony, at 22. He suggests that LES and the NRC Staff should be required to:

1. Measure the hydraulic properties of the shallow materials.

2. Investigate the possibility that fractures capable of acting as preferred flow paths may exist at the proposed site.

3. Estimate the amount of water that would leak from:

    a. The Treated Effluent Evaporative Basin ("TEEB")
    b. The Uranium Byproduct Cylinder ("UBC") Storage Pad Stormwater Retention Basin
    c. The Site Stormwater Detention Basin.
    d. The septic leach fields.

4. Determine where water that leaked from the facility would go, *i.e.*, identify discharge areas.

5. Estimate the time it would take for water from the NEF to reach discharge areas.

6. Develop a groundwater monitoring plan that clearly identifies all units to be monitored.

7. Monitor stormwater runoff for all contaminants that the proposed plant is expected to generate.

Q4. Do you agree with any of Mr. Rice's conclusions or opinions, as summarized above?

A4. (GAH, RLP) No. We strongly disagree with the conclusions and opinions expressed by Mr. Rice. In fact, we believe that each of the "major points" identified by Mr. Rice

in his direct testimony already has been adequately addressed by LES and the NRC Staff in those parties': (1) respective environmental review documents [*i.e.*, the NEF Environmental Report ("ER") and the NRC Draft Environmental Impact Statement ("DEIS")], and (2) prefiled direct testimony. Notwithstanding, we believe that a number of the assertions made by Mr. Rice in his direct testimony warrant clarification or additional explanation because they are inaccurate, irrelevant, and/or unsubstantiated.

A. <u>Claims Regarding the Hydraulic Properties of the "Shallow Materials"</u>

Q5. In his prefiled direct testimony, George Rice concedes that "[g]roundwater has not been found in the alluvium at the proposed site." Rice Direct Testimony, at 4. He states, however, that "groundwater is known to exist in the alluvium at three places near the site: 1) about ½ mile north at the Wallach sand and gravel quarry, 2) about ½ mile northeast at Baker Spring and 3) about 2/3 mile east at the WCS site." Rice Direct Testimony, at 4. Do you believe that this observation supports Mr. Rice's view that LES has not adequately evaluated the alluvium beneath the proposed NEF site for the presence of groundwater?

A5. (GAH, RLP) No. We fully addressed this issue in our prefiled direct testimony. *See* Harper-Peery Testimony (Answers 38, 39, and 60), at 30-34, 50-51. As stated therein, the zones of saturation observed in the alluvium at three places to the north and east of the NEF site (*i.e.*, Wallach Quarry, Baker Spring, and the WCS site) are limited and intermittent, and are attributable to very localized infiltration mechanisms, such as infiltration from "buffalo wallow" depressions that pond surface water and man-made features (*e.g.*, excavations). These localized conditions, however, do not exist at the NEF site. Moreover, based on review of the data collected at the NEF site and that obtained from the nearby sites, none of these shallow saturated unit occurrences appears to be: (1) laterally continuous (*i.e.*, they do not extend to the NEF site),

or (2) hydrologically connected to any deeper water-bearing units (*e.g.*, the thin saturated zone present at approximately 220 feet below ground surface).

Q6. Mr. Rice also states that "groundwater in the alluvium and the Dockum Group (Chinle Formation or the Santa Rosa Aquifer) has been used in the vicinity of the site." Rice Direct Testimony, at 5. Does this statement support his view that LES has not adequately characterized site groundwater conditions in general, or evaluated the "shallow" alluvium beneath the proposed NEF site in particular?

A6. (RLP) No. Citing a reference that is over 40 years old, Mr. Rice states that "[a]lluvial wells approximately three miles west of the proposed site have been used for domestic purposes," and that "[t]he City of Eunice had an old public supply well in the Dockum . . . about six miles west of the [NEF] site." Rice Direct Testimony, at 5. As I explained previously, the extensive hydrogeological data (including numerous boring logs) collected at and near the NEF site do not suggest that saturated conditions exist in the alluvium beneath the NEF site. The existence of small, discontinuous zones of saturation in the alluvium (including "alluvial wells" that tap such zones) within several miles of the NEF site does not alter this conclusion, especially given the typically localized and intermittent nature of such occurrences. Furthermore, as Mr. Rice himself acknowledges, there are no downgradient groundwater users within two miles of the proposed NEF site. *See* Rice Direct Testimony, at 5. The particular wells identified by Mr. Rice, to the extent they even still exist, are located upgradient of, and substantially far from, the NEF site. Therefore, any <u>postulated</u> releases from the proposed NEF would not affect these facilities.

Citing a more recent reference, Mr. Rice states that "[t]he Town of Oil Center, about 12 miles northwest of the site, obtains water from the Dockum Group," and that "deeper

aquifers such as the Dockum Group may be developed for future water supplies." Rice Direct Testimony, at 5. He adds that the *Lea County Regional Water Plan* "recommends investigating areas where faulting may have fractured those aquifers." *See* Rice Direct Testimony, at 5 n.18. LES has concluded that NEF operations will not adversely impact any saturated zones beneath the site, the shallowest of which occurs at approximately 220 feet below ground surface. Specifically, the thick, low-permeable red beds, with vertical permeabilities on the order of 2 x 10^{-8} cm/sec, act as a natural barrier to the downward migration of groundwater, and hence, preclude natural recharge of the water-bearing units by waters originating on the surface of the NEF site, as well as hydraulic connection among those units. *See* Harper-Perry Direct Testimony (Answer 24), at 16-18.

Notably, the *Lea County Regional Water Plan* specifically states that development of Dockum Group groundwater is "limited specifically to the Santa Rosa sandstone unit" in large part due to "high cost of producing the deep Dockum waters" (*see* LES Exhibit 26, at 6-12). The plan further states that "[t]he Dockum Group, Rustler, Capitan Reef, and other deeper aquifers in Lea County will need to be characterized in more detail, before the feasibility of using these deposits can be known and before large-scale water production can begin" (*see* LES Exhibit 26, at 6-12). In short, the existence of these deeper aquifers (or postulated fractures within those aquifers) – which are located below the Santa Rosa Aquifer – has no bearing on whether LES has adequately characterized site groundwater conditions in general.

Q7. In his direct testimony, Mr. Rice maintains that "LES and NRC have not performed any tests to determine the hydraulic properties of the alluvium or other shallow materials underlying the site," and that "at a minimum, the range of hydraulic conductivities should be determined." In particular, he suggests that they be measured by "infiltrometer tests"

and/or the "reverse auger method." Rice Direct Testimony, at 5-6. Do you agree with these assertions?

A7. (RLP) No. LES does not believe that there is a need to measure specifically the hydraulic properties of the "alluvium or other shallow materials underlying the site," whether by field methods or laboratory measurements. As set forth in my direct testimony, no groundwater was encountered in these soils beneath the NEF site when Cook-Joyce, Inc. ("CJI") and MACTEC Engineering and Consulting, Inc. ("MACTEC") installed a total of 14 borings. *See* Harper-Peery Direct Testimony (Answer 38), at 30-31; *Hydrogeologic Investigation, Section 32; Township 21 Range 38, Eunice, New Mexico,* prepared by Cook-Joyce, Inc. (Nov. 19, 2003) (LES Exhibit 3, Tab L); *Report of Preliminary Subsurface Exploration, Proposed National Enrichment Facility, Lea County, New Mexico,* prepared by MACTEC Engineering and Consulting, Inc. (Oct. 17, 2003) (LES Exhibit 3, Tab N). Additionally, given its considerable thickness and low permeability, the Chinle Formation sediments (*i.e.*, red beds) that lie beneath the alluvium are more important from a hydrogeologic standpoint insofar as they inhibit potential downward migration of groundwater, as well as hydraulic connection among the known water-bearing units below the NEF site. Furthermore, as indicated in the Walvoord et al. (*see* LES Exhibit 5) analysis of thick desert vadose zones, and discussed further below, the net moisture fluxes (flow or movement) below desert root zones are generally upward.

Based on the hydrogeologic and geotechnical investigation borings installed by CJI and MACTEC at the NEF site, it is clear that the alluvium or shallow soils overlying the Chinle Formation red beds consist mainly of fine sand and silt, with some gravel in certain areas. Further, based on these characterization efforts, LES has reasonably estimated the porosity of these soils to be about 25 to 50 percent, and the saturated hydraulic conductivity of these soils to

range from 10^{-5} to 10^{-1} centimeters per second. *See* LES Exhibit 1, at 3.4-14; Freeze, R. and Cherry, J., *Groundwater* (1979), at 29, 37.

Q8. Citing the observation of "moisture" in cuttings from two borings drilled at the NEF site, Mr. Rice asserts that "LES does not explain how the water came to be trapped, how long it has been trapped, or whether the moisture will dissipate (*i.e.*, will it flow in response to hydraulic gradients?)." Rice Direct Testimony, at 7. Do you agree with this assertion?

A8. (GAH, RLP) No. We fully addressed this issue in our direct testimony. *See* Harper-Peery Testimony (Answers 38, 60), at 30-31, 50-51. As discussed therein, CJI and MACTEC installed a total of 14 borings (nine groundwater exploration and five geotechnical borings, respectively) at the NEF site. The associated boring logs confirm that the soils encountered by CJI and MACTEC were almost invariably very dry. The "slightly moist" and "moist" soil descriptions cited by Mr. Rice were used only twice (*i.e.*, in CJI boring B-9 at a depth between 6 and 14 feet below ground and in MACTEC boring B-2 at a depth between 35 and 41.4 feet below ground, respectively). *See* Appendix A ("Lithologic Logs") to *Hydrogeologic Investigation, Section 32; Township 21 Range 38, Eunice, New Mexico*, prepared by Cook-Joyce, Inc. (Nov. 19, 2003) (LES Exhibit 3, Tab L) The limited moisture observed in these two soil samples likely represented some "residual" moisture, possibly infiltrated precipitation that had yet to evapotranspire, attributable to the moisture storage capacity of the soil in the vadose or unsaturated zone (*i.e.*, the space in soil voids or pores are only partially filled with water). It did <u>not</u> reflect the existence of saturated conditions, as specifically confirmed by the CJI and MACTEC employees who logged the two borings at issue.

Any moisture present in the vadose zone is held in the soil pores under surface-tension forces. As explained in Section 3.4.1.1 of the NEF Environmental Report (*see* LES

Exhibit 1, at 3.4-4) and the Walvoord study cited therein (*see* LES Exhibit 5), the movement of soil water within thick (greater than 25 meters) semi-arid to arid vadose zones (such as is present at the NEF site) is dominated largely by an upward hydraulic potential gradient. To the extent such moisture is able to make its way downward to the alluvium/Chinle contact, any further downward movement of that would be further inhibited by the low-permeability Chinle clay. Thus, the limited moisture observed in the two soil samples described above is in no way indicative of saturated conditions.

Q9. So you do not agree with Mr. Rice's assertion that "[t]he most straightforward explanation for the presence of this moisture is that it represents residual water from episodic recharge events"? Rice Direct Testimony, at 7.

A9. (RLP) I do not agree with Mr. Rice's assertion. He misapplies the term "recharge." Contrary to Mr. Rice's suggestion, the NEF Environmental Report does not define "recharge" as mere "infiltration of water beneath the base of the root zone." Recharge is traditionally defined as the "the entry into the saturated zone of water made available at the water-table surface, together with the associated flow away from the water table within the saturated zone." Freeze, R. and Cherry, J., *Groundwater*, at 211 (1979). The saturated zone refers to permeable geologic materials in which the pore spaces are completely filled with water, such as the saturated sediments below the water table. The root zone is the depth to which plant roots extend below the ground surface

It is conceivable that some infiltrating water may make its way past the base of the root zone; however, this does not mean that it will enter underlying saturated zones located at great depths, as at the NEF site. The first occurrence of a continuous saturated water-bearing unit beneath the NEF is within the low-permeable Chinle red bed clay at a depth of about 220

feet below ground surface. The presence of very limited moisture within the alluvium above or at the alluvium/Chinle interface is not tantamount to "recharge," as Mr. Rice wrongly suggests by describing such moisture as "residual water from episodic recharge events" and "recharge that ponded along interface between the alluvial materials and the relatively impermeable Chinle." Rice Direct Testimony, at 7. Indeed, the authors of the Walvoord study concluded that their modeling results "suggest that current net moisture fluxes below desert root zones are generally upward, groundwater recharge is extremely small, and the net moisture flux below the root zone is not equivalent in magnitude or direction to the flux across the water table." Michelle A. Walvoord, Mitchell A. Plummer, and Fred M. Phillips, "Deep Arid System Hydrodynamics Part 1: Equilibrium States and Response Times in Thick Desert Vadose Zones," Water Resources Research, Vol. 38 No. 12 (2002), at 44-13 (*see* LES Exhibit 5).

Q10. Mr. Rice appears to suggest that the conclusions reached in the Walvoord study are inapplicable because the authors "state that their method of assessing flow in the vadose zone assumes that preferential flow paths do not affect the system." Rice Direct Testimony, at 7 n.28. He adds that such flow paths "may also result from variations in the permeability of the shallow materials underlying the site." Rice Direct Testimony, at 8. Do you agree with these assertions?

A10. (RLP) No. The authors of the Walvoord study do state that they assumed that "fractures, macropores, or other preferential flow paths do not affect the system." However, as we explained in our direct testimony, in view of the abundant data available for the NEF and nearby WCS site, there do not appear to be any subsurface fractures or "fast flow" pathways that would allow water to flow rapidly from the alluvium to the Chinle Formation, or from the Chinle Formation to the Santa Rosa Formation. Certainly, variations in permeability can occur laterally and with depth. Notably, as part of their work, the Walvoord team performed a sensitivity

analysis by systematically varying parameters and comparing results to their base case solution. Specifically, they accounted for significant variations in soil type (by considering sand, silt, and silty clay), saturated permeability, porosity, geothermal gradient, water table depth, fixed root zone matric potential, and vapor diffusion rate. They concluded that their model applies to a broad range of thick, unconsolidated vadose zones in semi-arid to arid regions (*see* LES Exhibit 5, at 44-11). In this regard, we believe that the model adequately accounts for potential anisotropies and heterogeneities (*i.e.*, directional and spatial variations in permeability/hydraulic conductivity) of the type that reasonably might be expected to occur at the NEF site.

Q11. Mr. Rice states that "[m]oist clay at the alluvial/Chinle contact also occurs at the WCS site." Specifically he claims that "in the early 1990s, moist clay was found in most of the borings that penetrated the contact." Rice Direct Testimony, at 7. Does the claimed presence of "moisture" in the WCS borings in any way alter your conclusions regarding the adequacy of LES's groundwater characterization efforts or the potential for recharge by waters originating at the NEF site surface?

A11. (RLP) No, not at all. I have revisited the WCS boring logs referred to by Mr. Rice (*see* LES Exhibit 3, Tab G). It is correct that many of the boring logs describe certain soil samples, including clay samples taken near the Chinle contact, as containing "moisture." However, with only one exception, the moisture content descriptions are "slightly moist," "moist," or "damp." Moreover, several of the "moist" samples occurred at depths approaching or exceeding 200 feet below ground surface, where one might expect to find groundwater associated with the so-called "220-foot" groundwater zone. Indeed, the monitoring wells installed in these borings were screened from 185 to 215 feet and 211 to 221 feet, respectively (*see* LES Exhibit 3, Tab G).

As with the two samples from the NEF site discussed earlier, the "slightly moist" and "moist" clay/silty clay samples taken at or near the Chinle contact beneath the NEF site are not indicative of saturated conditions or active recharge of underlying saturated zones. Rather, the moisture in these samples is likely "residual" moisture that did not yet fully evapotranspire (*see* Borings B-9 and B-2) and that, in the case of Boring B-2, may have worked its way down, over long periods of time, to the low-permeable Chinle clays, which have a higher moisture storage capacity than the overlying "alluvial" soils. Notably, the vast majority of the boring log descriptions reflect very dry conditions – indeed, many of the samples were described as being hard, brittle, and crumbly, in addition to dry – both above and below those discrete intervals near the Chinle contact where "moisture" was observed. In fact, the very limited extent of this moisture further confirms that groundwater is not moving through "fast flow paths" and reaching the saturated zones that exist at great depths below the NEF and WCS sites. As such, I disagree with Mr. Rice's conclusion that the moisture found in the WCS borings "indicates that some recharge currently occurs at the site." Rice Direct Testimony, at 8. Again, Mr. Rice misapplies the term "recharge." Furthermore, Walvoord et al. (*see* LES Exhibit 5, at 44-1) indicate "that water transport in thick desert vadose zones at steady state is usually dominated by upward vapor flow and that long response times, of the order of $10^4 - 10^5$ years, are required to equilibrate to existing arid surface conditions."

Q12. Do you believe that it is necessary to use "radioisotopes to date the moisture found in the vadose zone" (Rice Direct Testimony, at 7), as Mr. Rice suggests in this direct testimony?

A12. (RLP) No. Mr. Rice suggests using this approach to answer "this question about recent recharge." As I just explained, I do not believe that "recent recharge" is occurring at the

NEF site. Published data obtained from geochemical analyses of groundwater samples taken from the Lower Dockum Group in the region indicate that recent recharge has not occurred. *See* Dutton, A. and Simpkins, W., "Hydrogeochemistry and Water Resources of the Triassic Lower Dockum Group in the Texas Panhandle and Eastern New Mexico," Report of Investigations No. 161, Bureau of Economic Geology, University of Texas at Austin (1986) (LES Exhibit 6). Therefore, radioisotopic dating is unnecessary.

In addition, the use of radioisotopes for hydrogeologic characterizations of the type at issue here is not standard or customary. To my knowledge, none of the numerous hydrogeologic investigations conducted to date in the site vicinity (at WCS in particular) involved or required the conduct of radioistopic analysis of site groundwater. In general, the specific age of the water in an aquifer beneath a site is not the concern, though the presence of groundwater that is tens of thousands of years old suggests that recent recharge has not occurred. Rather, the potential for the site-specific hydrogeologic setting to limit the downward migration of water (in this case, the low permeability red beds), and the site-specific plans to preclude subsurface contamination, are the primary concerns when assessing the potential for contamination of ground water.

Finally, the approach suggested by Mr. Rice himself would appear to yield potentially inconclusive results. Specifically, he states that even if "high concentrations" of tritium, chlorine-36, or carbon-14 were determined to be present in vadose zone moisture, their presence at such levels "would not necessarily indicate that moisture was recent . . . because water in the vadose zone may exchange water vapor and other gases in the atmosphere." Rice Direct Testimony, at 8.

B. Claims Regarding the Potential for Fractures to Act as Fast Flow Paths

Q13. Mr. Rice claims that LES has not adequately investigated the possibility that fractures may act as fast flow paths, and that "[s]uch fractures could allow water to rapidly flow from the alluvium to the saturated zones in the Chinle, or from the Chinle to the Santa Rosa Aquifer." Rice Direct Testimony, at 8. Do you agree with these assertions?

A13. (RLP) No. I fully addressed this issue in my prefiled direct testimony. *See* Harper-Peery Testimony (Answers 24, 36 and 61), at 16-18, 28-29, 51. NRC Staff witness Alan Toblin also has thoroughly addressed this issue in his direct testimony. *See* Toblin Testimony (Answers 40-52), at 19-23. In summary, extensive permeability and hydraulic conductivity data obtained from the WCS, Lea County Municipal Landfill, and NEF sites confirm that the Chinle Formation sediments underlying the site are not highly transmissive. *See, e.g., Waste Control Specialists, Section VI, Geology Report*, prepared by Cook-Joyce, Inc., and Intera, Inc. (Feb. 2004), at 5-16; Table 6.5-2 (*see* LES Exhibit 3, Tab O). The confined nature of the various water-bearing zones beneath the NEF site, and the very large hydraulic head differences (differences in water level elevations) between these zones (which indicate a lack of hydraulic communication), strongly suggest that there are no fracture zones that act as fast flow paths. Furthermore, it is unlikely that any fractures beneath the NEF site would form interconnected or continuous zones that extend hundreds of feet vertically downward. As Mr. Toblin correctly pointed out, the lack of interconnectivity, the lack of proper fracture orientation, and/or the filling in of fracture apertures by clay or mineralization tend to limit the existence of "fast" or "preferential" flow paths. *See* Toblin Direct Testimony (Answer 43), at 20. Mr. Rice's view that angled borings should have been drilled appears to be based on the premise that any fractures that might exist at or near the NEF site would be vertically oriented. In fact, such fractures are

more likely to be obliquely oriented, making the vertical borings drilled at the NEF site, and at the nearby WCS and Lea County Landfill sites, a better method for detecting the presence of fractures because they are generally present at oblique angles, as indicated in the investigation of faulting at the WCS site.

Q14. In his direct testimony, Staff witness Alan Toblin referred to an August 2004 geology report, in which CJI and Intera, Inc. evaluated faulting observed in the Chinle Formation red beds at the WCS site and its relationship to the overlying Antlers Formation. *See* Toblin Direct Testimony (Answer 51) at 22. Are you familiar with this report?

A14. (RLP) Yes, I have reviewed this report. *See Waste Control Specialists, Section VI, Geology Report*, prepared by Cook-Joyce, Inc., and Intera, Inc. (Aug. 2004) (LES Exhibit 73).

Q15. What was the purpose of this report?

A15. (RLP) In February 2004, investigators discovered ancient (approximately 135 million-year-old) faulting in the Triassic-aged Chinle red beds at the WCS site. To further investigate the faulting, WCS extended the southeast wall of the Resource Conservation Act and Recovery ("RCRA") landfill about 200 feet southwest, exposing the geology of the site over about 60 vertical feet and 400 horizontal feet. The excavation extended between 30 and 40 feet into the red beds. CJI and Intera then performed detailed geologic mapping of the excavation that "focused on geologic contacts and distinguishable geologic features, including faults, joints, slickensides, bedding planes, partings, channels, alteration and weathering zones" (*see* LES Exhibit 73, at 4-6.

Q16. Do you agree with Mr. Toblin that the WCS evaluation "found no evidence of a fast flow path resulting from the faulting at the WCS site?"

A16. (RLP) Yes. Faulting in the Triassic-aged Dockum Group sediments at the WCS site clearly did not create joints or fractures that increased the permeability of the sediments. CJI and Intera reached the following conclusions:

> . . . [T]here are no indications that the Cretaceous-aged Antlers Formation was affected by the faulting in the Triassic red beds. There are clearly no geologic Formations present in the excavation younger than Triassic that are affected by faulting and there are no regulatory issues related to faulting at the WCS site. Additionally, there are no issues with respect to potential migration pathways resulting from the faulting at the WCS site. The uppermost faulting occurred completely within the Triassic red beds; which have great capacity for healing and closing fault planes and joints to fluid migration as indicated by the limited penetration of the alteration front in the red beds. (*see* LES Exhibit 73, at 4-11).

Q17. Mr. Rice notes that "[f]ractures were found at various depths, from the alluvial/Chinle contact to more than 200 feet below ground surface," in core samples taken by Terra Dynamics at the WCS site from 1992 to 1993. Rice Direct Testimony, at 9. Does this observation alter your conclusion regarding the absence of fracture-related "fast flow paths" beneath the NEF site?

A17. (RLP) No. I have re-examined the boring logs identified by Mr. Rice in his direct testimony (*see* LES Exhibit 3, Tab G). The fractures described in these boring logs are by no means indicative of the presence of large-scale, continuous interconnected fracture systems that extend to great depths within the Chinle Formation. The presence of small fractures in desiccated or very dry clays is certainly not unusual. Most of the Chinle samples in which fractures were observed were described as dry, hard, crumbly, and/or brittle, and as exhibiting "conchoidal" or "blocky" fracture. In other words, the fractures may reflect the natural mineralogical composition/structure of the sediments, very low moisture content, and the effects of sampling itself. As confirmed by the August 2004 WCS fault investigation, to the extent that larger joints and fractures are present in the Chinle red beds, they have not increased the

permeability of those sediments, which have a capacity for "self-healing." Any fluid migration is matrix-dominated.

In fact, in a 1996 follow-up report to the 1993 Holt report cited by Mr. Rice, the author, Ken Rainwater, Ph.D., P.E., stated as follows:

> On October 4, 1993, Dr. Rainwater visited the office of Jack H. Holt, Ph.D. and Associates. Inc. (JHA) with Mr. Witteveld to visually examine core samples from selected borings. Cores 6-B and 9-G . . . represent locations in which almost all of the different lithological [units] were penetrated. Of particular concern in this examination was the condition of the red claystone. In the samples from both cores, the red claystone was typically continuous (few fracture planes not attributable to the sampling process), solid, and tight. As indicated by the results of the laboratory hydraulic conductivity tests, the claystone was probably naturally compacted by the weight of overburden during deposition.

See *Evaluation of Potential Groundwater Impacts by the WCS Facility in Andrews County, Texas,* prepared by Ken Rainwater (Dec. 1996), at 8-9 (LES Exhibit 3, Tab H). Essentially, Dr. Rainwater's observations were that Chinle red beds have few fractures, and that the sampling process contributed, to some degree, to the fracturing observed in the core samples. Also, he observed that the claystone was naturally compacted over time, making it more solid, which, in turn, would decrease its permeability. In fact, two of Dr. Rainwater's major conclusions were that: (1) the presence of a thick Triassic clay layer (i.e., the Chinle Formation) near the ground surface at the site makes it an excellent location for a properly designed and constructed landfill; and (2) if properly constructed and operated, the landfill should have no impact on usable groundwater in Andrews County (*see* Executive Summary of LES Exhibit 3, Tab H).

Q18. Mr. Rice further posits that "the generally dry conditions found in the Chinle do not mean that fracture flow does not occur." Rice Direct Testimony, at 9. Do agree with this assertion?

A18. (RLP) No. Mr. Rice states that moisture contents of materials like the Chinle red beds can be difficult to judge in the field, and that one cannot assume that an interval of the Chinle is dry merely because it was logged as dry in the field. He cites two examples in support of this proposition. Specifically, he states that, according to the boring logs and well construction diagrams for WCS boring/monitor wells B-20 (11-D) and B-21 (9-G(3)), no water was encountered within the screened intervals, yet these wells were later found to contain more than 100 feet and 6 feet of standing water, respectively. *See* Rice Direct Testimony, at 10 n.43.

Again, I must disagree with Mr. Rice's interpretation of the relevant data. As here, when a boring/well installed in a low-permeability unit, particularly using the air rotary drilling method (which generates heat and pressure that can inhibit groundwater flow from the formation into the boring), it is not unusual for there to be a delay in the entry of groundwater into the boring/well. In fact, in "developing" such wells, it is often necessary to add distilled water and to repeatedly bail or pump the well to induce formation flow into the well.

WCS boring/monitoring well B-20 (11-D) is screened in a clay to silty clay zone located approximately 232 to 257 feet below ground surface (*see* LES Exhibit 3, Tab G). This may be the same water-bearing unit as the 220-foot zone to which I have referred previously. Based on data from both the NEF site (the MW-2 slug test) and WCS site, this unit is known to have a very low hydraulic conductivity. WCS boring/monitoring well B-21 (9-G(3)) was screened in a very silty clay zone located between 263 to 273 feet below ground surface, which also is likely to have a very low hydraulic conductivity (*see* LES Exhibit 3, Tab G). This water bearing zone is present under confined conditions at each of these wells. If fast flow paths were present at these locations, then it would be expected that this saturated zone would not be present under confined conditions, and the hydraulic conductivity would be higher.

In the 1996 "Rainwater" report cited by Mr. Rice, Dr. Rainwater made several important observations with respect to the WCS wells (including 11-D and 9-G(3)) installed by Terra Dynamics in the 1992-1993 timeframe. *See Evaluation of Potential Groundwater Impacts by the WCS Facility in Andrews County, Texas*, prepared by Ken Rainwater (Dec. 1996), at 6 (*see* LES Exhibit 3, Tab H). First, he pointed out that, when bailed to dryness, the water levels in the wells typically took several weeks to return to static levels," indicating that "either low local permeability, little water volume in storage, or both controlled the return of water to the screened interval." Second, he stated that the equilibrated water surface elevations at most of the monitoring wells with similar depths of screen were not close enough to imply hydraulic continuity." Finally, Dr. Rainwater noted that in certain wells, including well 11-D, the height of the water columns above the top of the screens "indicate that the water in the siltstones at those locations was under pressurized confined conditions, yet the permeability or discontinuity still restricted the flow." To sum it up, the delayed or slow entry of groundwater into WCS boring/monitor wells B-20 (11-D) and B-21 (9-G(3)) is <u>not</u> indicative of "episodic" groundwater flow "along fractures." Rather, it reflects groundwater flow under low-permeable, confined conditions.

Q19. Mr. Rice also suggests that the presence of "mineral deposits" in some of the 1993 WCS core samples "indicate that the fractures have acted as groundwater flow paths." Rice Direct Testimony, at 9. What is your view with respect to this statement?

A19. (RLP) It is not uncommon for minerals (*e.g.*, quartz, calcite, and metal oxides) to precipitate from ions in solution within a fracture. However, it is misleading to suggest that the mere presence of such mineralized veins, particularly on a small or localized scale, is an indication that "the fractures have acted as groundwater flow paths." First, it is probable that the

mineral deposits observed by Jack H. Holt and Associates were deposited when climatic and geologic conditions were very different from those which exist at the site today (*i.e.*, on the order of thousands to perhaps millions of years ago). In should be understood that the red bed sediments were deposited millions of years ago as the sediments were transported by ancient rivers. Second, the mineral deposits may have precipitated from a very modest quantity of water that was trapped in the fracture, or as the sediments dried out after their initial deposition. In short, I do not believe that it is credible to infer the existence of "fast" flow paths from the presence of mineral veins in the low-permeability Chinle red beds.

Q20. With respect to the issue of permeability, Mr. Rice asserts that "limited permeability measurements that were performed at the proposed site and the nearby WCS site are not likely to reveal the presence of fractures that may be spaced at intervals of five feet, ten feet, or more." Rice Direct Testimony, at 10. Do you agree with this assertion?

A20. (RLP) No. First, as I have testified previously, the permeability and hydraulic conductivity values obtained from the NEF, Lea County Landfill, and WCS site investigations constitute a substantial and adequate body of data; these data are not "limited" or "restricted," as Mr. Rice suggests. These data are summarized in Answer 24 of my prefiled direct testimony. *See* Harper-Peery Direct Testimony, at 16-18. These data confirm that the Chinle Formation consists of very low-permeability materials at and near the NEF site. Again, absent the "right" orientation, degree of interconnectivity, and continuity with depth (over hundreds of feet at the NEF site), even limited numbers of open (unfilled) fractures will <u>not</u> act as "fast flow paths." It is not reasonable or customary to drill boreholes for site investigations at spacing of 5 to 10 feet. In fact, attempting to evaluate the subsurface conditions by drilling boreholes at this spacing would be likely to damage the formation and create fast flow paths. Based on my review of the

available and ample hydrogeologic data, I do not believe that such fast flow paths exist beneath the NEF site.

Q21. Mr. Rice questions the reliability of laboratory measurements of permeability, maintaining that they "often underestimate the bulk permeability of a unit, because they do not account for fractures and other features that may act as preferential flow paths." Rice Direct Testimony, at 10. Do you agree with this assertion?

A21. (RLP) No. I disagree with this assertion for the reasons set forth in detail in Answers 24, 47, and 61 of my prefiled direct testimony. *See* Harper-Peery Direct Testimony, at 16-18, 39-40, 51. Also, as indicated by Dr. Rainwater's observations of cores from 6-B and 9-G, the sampling process can create some degree of fracturing. The fractures associated with the sampling techniques would lead to laboratory permeability values which overestimate the in-situ permeability of the sediments.

Q22. In support of this assertion, Mr. Rice states that "[p]ermeabilities measured in the field may be more than a thousand times greater than the corresponding laboratory measurement." Rice Direct Testimony, at 10. What is your view relative to this statement?

A22. (RLP) This statement is unsubstantiated. Mr. Rice purports to base this conclusion on data extracted from a technical report and plotted in Figure 2 of his testimony. *See* Olson, R.E., D.E. Daniel, 1981, *Measurement of the Hydraulic Conductivity of Fine-Grained Soils*, in "Permeability and Groundwater Contaminant Transport", Zimmie and Riggs, editors, ASTM Special Technical Publication 746 (*see* NIRS/PC Exhibit 43). I have reviewed the Olson and Daniel report and reach a very different conclusion. First, the authors of the report specifically acknowledge that there are uncertainties associated with the data upon which they based their comparison of field and laboratory-measured hydraulic conductivities "*k*"):

> In many cases it was necessary to simplify the data by reporting average values when there was significant scatter or by reporting data at only one effective stress. It was often unclear how certain measurements were made, and inferences were drawn from general discussions in some cases. NIRS/PC Exhibit 43, at 54.

Second, notwithstanding this fact, the authors state that "[t]he range in the ratio of field *k*/laboratory *k* is from 0.3 to 46,000, but nearly 90 percent of the observations lie in the range from 0.38 to 64." NIRS/PC Exhibit 43, at 54. In other words, laboratory-measured hydraulic conductivity values were, in fact, in numerous cases greater than the field-measured values. In any case, field values that exceeded laboratory values by more than a ratio of 10 to 1 were rare (*i.e.*, outliers), and appear to reflect the use of laboratory values back-calculated from consolidation (*i.e.*, Terzagh's) theory, as opposed to the use of directly measured values. Indeed, the authors cited this fact as one of the major causes of higher values of field hydraulic conductivity. NIRS/PC Exhibit 43, at 54 & Table 4. It warrants mention that the WCS and Lea County Municipal Landfill permeability values discussed in my testimony involved direct laboratory measurements of permeability using ASTM-prescribed methods, not back-calculations.

Q23. The authors of the report also note that higher field conductivity values could result from "the presence of sand seams, fissures, and other macrostructures in the field which are not represented properly in the laboratory." NIRS/PC Exhibit 43, at 54. In your view, is this cause for concern?

A23. (RLP) No. The permeability measurements taken on samples in the site vicinity, over 50 in number, consistently indicate that Chinle Formation consists of low-permeability sediments. Moreover, to the extent that "sand seams, fissures, and other macrostructures" might exist within the Chinle and cause slightly larger permeabilities, such structures should not

confused with vast, transmissive, interconnected fracture zones that would have the potential to act fast flow paths. I do not believe the latter exist beneath the NEF site in view of the substantial hydrogeologic data available to me.

Additionally, while Mr. Rice recommends using field techniques to measure hydraulic conductivities, he neglects to mention their limitations, as acknowledged by Olson and Daniel. Specifically, the report authors note that field tests are preferred for saturated soils, which, at the NEF site, are not present until 220 feet below ground surface. In this regard, the infiltrometer and reverse auger tests mentioned by Mr. Rice appear to be impractical. Indeed, Olson and Daniel state that field testing for measurement of conductivity in unsaturated soils is at a "rudimentary stage of development." NIRS/PC Exhibit 43, at 55.

Q24. In his direct testimony, Mr. Rice states that groundwater can flow between the Dockum Group and overlying units, as "this is the conclusion of investigators who have studied this issue." Rice Direct Testimony, at 11. Do you agree with Mr. Rice on this point?

A24. (RLP) I disagree with Mr. Rice to the extent he suggests that such cross-formational flow is occurring in the vicinity of the NEF site. As Mr. Rice himself concedes, the potential for groundwater flow between the water-bearing strata of concern depends on local conditions. *See* Rice Direct Testimony, at 11. Based on my review of the pertinent hydrogeologic data, I conclude that conditions conducive to cross-formational flow are not present at the NEF site at rates greater than the documented permeabilities for the red beds in the area. Two of the three references cited by Mr. Rice involve different hydrogeologic settings and are unsuitable for that reason (*see* NIRS/PC Exhibits 23 and 33). The third reference, which I have previously cited in my own testimony (*see* LES Exhibit 6), actually undermines Mr. Rice's position relative to the potential for cross-formational flow at the NEF site.

The first two references identified by Mr. Rice indicate that there may be some hydraulic communication between the Ogallala Formation and the Dockum Group (which includes the Chinle and Santa Rosa Formations). However, as I testified previously, the Ogallala Formation has not been found at the NEF site. According to a recent WCS report prepared in large part by CJI, the southern limit of the Ogallala Aquifer is north of the red bed ridge at approximately the northern and eastern boundaries of the WCS permitted area (and hence, to the north and east of the NEF site). *See Waste Control Specialists, Section VI, Geology Report,* prepared by Cook-Joyce, Inc., and Intera, Inc. (Feb. 2004), at 3-1 (*see* LES Exhibit 3, Tab O). The hydrogeologic environments discussed in Langman *et al.* and Mehta *et al.* are located substantially far north and northeast of the NEF site, about 110 miles and 270 miles respectively, in areas where the Ogallala Formation overlies the Dockum Group. The conclusions reached in those reports relative to cross-formational flow thus are not applicable to the NEF site vicinity.

Mr. Rice relies on a third reference, Dutton and Simpkins (1986) (*see* LES Exhibit 6) for the proposition that "in some portions of the Southern High Plains, the Dockum Formation receives recharge from overlying aquifers." Rice Direct Testimony, at 11. This is not the case, however, in the vicinity of the NEF site. As I explained in my direct testimony, based on their analysis of hydrogeochemical data, the authors reached a different conclusion. Specifically, they concluded that erosion of the Pecos and Canadian River valleys during the Pleistocene created groundwater basin divides along the western and northern limits of the Southern High Plains, thereby preventing modern recharge in the Dockum Group outcrops from reaching confined parts of the Dockum Group aquifers. *See* Harper-Peery Direct Testimony (Answer 40), at 34; LES Exhibit 6, at 32.

CJI agrees with this conclusion. *See Waste Control Specialists, Section VI, Geology Report,* prepared by Cook-Joyce, Inc., and Intera, Inc (Feb. 2004), at 3-3 to 3-4 (LES Exhibit 3, Tab O). CJI has stated that the relative difference in hydraulic head between the lower Dockum aquifer and the overlying Ogallala aquifer throughout much of the region (though the Ogallala aquifer is not present at the NEF site) suggests that the lower Dockum aquifer is receiving essentially no recharge from cross-formational flow (*see* LES Exhibit 3, Tab O, at 3-4). Notably, CJI has concluded that "the primary limiting factors on recharge to the Dockum Group aquifer include the low-permeability aquitard characteristics of the upper Dockum Group and the cut-off by the Pecos River Valley of historical recharge areas in eastern New Mexico" (*see* LES Exhibit 3, Tab O, at 3-4). In other words, the areas in which historical recharge to the Dockum Group aquifer occurred no longer exist, and, therefore, modern recharge to the confined portions of the Dockum Group is not occurring.

Q25. In view of the above, do you believe that it is necessary to collect additional information of the type suggested by Mr. Rice (*i.e.*, to perform fracture studies and to measure the stable isotope ratios and ages of the groundwaters beneath the site)?

A25. (RLP) No. I would add that Mr. Rice has provided no compelling basis for his opinion that "fractures could allow water to rapidly flow from the alluvium to the saturated zones in the Chinle, or from the Chinle to the Santa Rosa Aquifer." Rice Direct Testimony, at 8. In this regard, I would emphasize that Figures 1 and 3 of his direct testimony, which depict continuous fractures extending from the alluvium/Chinle contact downward through the Dockum Formation – for hundreds to over 1,000 feet – are purely hypothetical, lack any scientific basis, and ignore all data available from the NEF, WCS, and Lea County Landfill sites.

C. Claims Regarding "Leakage" from the NEF Site Engineered Basins and Septic Leach Fields

Q26. NIRS/PC claim that LES and the NRC Staff have not adequately evaluated how "discharges" from the proposed NEF will affect groundwater in the future. Do you agree with this assertion?

A26. (GAH, RLP) No. In raising this issue, NIRS/PC witness George Rice again merely poses a series of questions that LES and the NRC Staff "should answer." Specifically, Mr. Rice asserts that LES and the Staff should determine how much water would infiltrate into the alluvium from the three proposed engineered basins and septic leach fields; where water flowing along the alluvial/Chinle contact would be discharged; how long it would take this water to reach any discharge areas; and whether this water could reach underlying saturated zones via fractures. *See* Rice Direct Testimony, at 13. We have, in fact, fully addressed each of these issues in our direct testimony. *See* Harper-Peery Direct Testimony (Answers 33-36, 51-53), at 26-29, 41-44. In short, given the low precipitation and high evapotranspiration rates in the site vicinity, the low-permeability of the near-surface soils (primarily silts and silty sands), and the tendency of these soils to hold non-evapotranspired moisture in storage, infiltration and migration of water from the Stormwater Detention Basin and septic leach fields is expected to be negligible.

Q27. Do you agree with Mr. Rice's assertion that LES and the NRC "seem to disagree" on the fate of water that would "leak" from the Site Stormwater Detention Basin and septic leach fields? *See* Rice Direct Testimony, at 14.

A27. (GAH, RLP) No. Like LES, the NRC Staff recognizes that any potential infiltration of water from the Site Stormwater Detention Basin and septic leach fields is likely to be limited by high evapotranspiration rates and the moisture storage capacity of the soils. *See*

Toblin Direct Testimony (Answers 19, 39), at 10, 18. To the extent that such water does infiltrate into the alluvium and form perched water bodies along the alluvium/Chinle contact, any downgradient movement of that water would be limited due to these same factors. Mr. Rice criticizes LES and the NRC Staff for having "not quantified either of these limiting factors." Rice Direct Testimony, at 15. As set forth in our direct testimony, and in the direct testimony of NRC Staff witness Alan Toblin, the Staff has, in fact, performed a highly conservative analysis of the potential movement of "perched water bodies" along the alluvium/Chinle interface. *See* Harper-Peery Direct Testimony (Answer 51), at 41-43. This analysis includes calculations – based on very conservative assumptions – of the dimensions of these perched water bodies, their flow rates, and their potential discharge locations. *See* Toblin Testimony (Answers 11 through 21), at 6-11.

Q28. Mr. Rice asserts that the NRC Staff's estimate of the flow rate is too low, and that the Staff has not adequately investigated potential discharge areas. *See* Rice Direct Testimony, at 15. Do you agree with these claims?

A28. (GAH, RLP) No. These are essentially the same unfounded criticisms levied by Mr. Rice in his expert report of November 24, 2004. We have addressed the issues raised by Mr. Rice in Answers 50 through 55 of my direct testimony. *See* Harper-Peery Direct Testimony, at 41-45. Furthermore, Mr. Toblin has addressed these issues in explaining the Staff's analysis of "perched water body" dimensions, flow rates, and potential discharge locations. *See* Toblin Testimony (Answers 11 through 21), at 6-11.

Q29. Mr. Rice also states that, in its comments on the Staff's DEIS, "the New Mexico Environment Department ("NMED") has expressed concern regarding the possibility that leakage from the NEF may transport contaminants offsite and pose a threat of contamination to

ephemeral drainages or aquifers." Rice Direct Testimony, at 17. Have you reviewed the NMED's comments?

A29. (GAH, RLP) Yes. We would note that the NMED appears to have taken the Staff's "perched water body" or "plume" analysis at face value, without acknowledging that the assumptions and calculations underlying that analysis are highly conservative. In any event, we believe that the Staff's conservative analysis is more than sufficient for purposes of its NEPA evaluation, and note that the NEF will not be able to commence construction and operation of the NEF until it receives a New Mexico Groundwater Discharge Permit from the NMED. That permit will require LES to conduct appropriate groundwater monitoring in accordance with a plan specifically approved by the NMED. Given the NEF design, the characteristics of the liquid discharges, the hydrogeologic characteristics of the site and the proposed monitoring system, we believe the possibility that leakage from the NEF may transport contaminants offsite and pose a treat of contamination to ephemeral drainages or aquifers is negligible.

Q30. In his direct testimony, Mr. Rice claims that LES and the NRC have not adequately addressed the possibility of leakage from the lined basins, *i.e.*, the Treated Effluent Evaporative Basin ("TEEB") and the Uranium Byproduct Cylinder ("UBC") Storage Pad Stormwater Retention Basin. Rice Direct Testimony, at 17-19. Do you agree with this assertion?

A30. (GAH) No. This claim coincides with Basis B of Contention NIRS/PC EC-1, as amended. The majority of the concerns raised by Mr. Rice in direct testimony relative to this issue were previously raised in his expert report of November 24, 2004. *See* "Expert Reports on Behalf of Nuclear Information and Resource Service and Public Citizen Pursuant to Order Dated October 20, 2004," dated November 24, 2004. Accordingly, both LES and the NRC Staff have

thoroughly addressed those concerns in their direct testimony. *See* Harper-Peery Direct Testimony (Answers 26-29, 57-59), at 19-22, 45-50; Toblin Direct Testimony (Answers 22-31), at 11-16. For the reasons set forth in my direct testimony, I do not believe that it is necessary – or even useful for that matter – to attempt to estimate the probability and frequency of leakage through the liners of the TEEB and the UBC Storage Pad Stormwater Retention Basin. Nor do I believe that it is necessary to provide any additional analysis of the fate of postulated leakage beyond that already provided by LES and the NRC Staff in their respective environmental review documents and prefiled direct testimony.

Q31. So you do not believe that it is necessary for LES to design additional monitoring systems "to detect leakage from both lined basins" and "to detect leakage in the vadose zone, and along the alluvial/Chinle contact," as Mr. Rice proposes?

A31. (GAH) No, I do not believe that additional monitoring devices over those already described in the ER and in the Groundwater Discharge Permit are necessary to adequately monitor the NEF basins and septic systems.

Q32. With regard to the issue of potential "leakage" from the NEF site engineered basins and septic leach fields, Mr. Rice claims that LES has made "contradictory statements" regarding the "fate" of water discharged to the septic leach fields and engineered basins? Specifically, he cites apparent inconsistencies between statements made by LES during discovery and in its New Mexico Groundwater Discharge Permit application. *See* Rice Direct Testimony, at 18-19. Do you agree with this assertion?

A32. (GAH) No, I disagree. I was directly involved in the preparation of the New Mexico Groundwater Discharge Permit application, and I am familiar the discovery-related

statements cited by Mr. Rice. The statements of concern are not contradictory when viewed in the proper context.

Q33. What did LES state in the context of discovery?

A33. (GAH) Mr. Rice cites several interrogatory responses and a portion of my deposition testimony. With respect to the septic leach fields, the relevant interrogatory response states: "The treated liquid will be discharged to the leach fields. The ultimate disposal of liquid discharged to the leach fields is expected to be via evapotranspiration, based on geologic and meteorological conditions at the site." *See* "Applicant's Objections and Responses to Interrogatories of Nuclear Information and Resource Service and Public Citizen," dated September 23, 2004, at 3 ("LES Response to Interrogatories"). With respect to the Site Stormwater Detention Basin, the relevant interrogatory states: "As described in ER RAI 4-2A response, dated May 20, 2004, infiltrating water is expected to eventually return to the atmosphere via evapotranspiration." LES Response to Interrogatories, at 5. RAI Response 4-2A, in turn, states: "Of the amount that infiltrates into the ground, most is expected to eventually return to the atmosphere via evapotranspiration by vegetation growing within and in the vicinity of the basin" (*see* LES Exhibit 3, Tab B). Similarly, during my deposition, I stated that "of the amount [of basin water] infiltrated, it essentially would all go back up through evapotranspiration." Harper-Peery September 17, 2004 Dep., Tr. at 35. Finally, in regard to the two lined basins, the pertinent interrogatory response states: "The basins will be designed to preclude water from infiltrating into the subsurface." LES Response to Interrogatories, at 6.

Q34. What did LES state in the New Mexico Groundwater Discharge Permit application for the NEF?

A34. (GAH) Mr. Rice cites three statements from LES's Ground Water Discharge Permit application to support his claim. These paragraphs pertain to the septic leach fields, the Site Stormwater Detention Basin, and the UBC Storage Pad Stormwater Retention Basin. As discussed below, Mr. Rice takes these statements out of context.

By way of background, the New Mexico Water Quality Board requires that facilities that discharge an aggregate wastewater of more than 7.6 m^3 (2,000 gal) per day to surface impoundments or septic systems apply for and submit a groundwater discharge permit and plan, respectively. This requirement is based on the assumption that the discharges have the potential to affect groundwater. *See* NEF Environmental Report at 4.4-1 (citing Section 20.6.2.3104 of New Mexico Water Quality Control Commission Regulations) (*see* LES Exhibit 1). The section of the Ground Water Permit Application containing the text cited by Mr. Rice is entitled "20.6.2.3109.C Approval Demonstration." *See* New Mexico Groundwater Discharge Permit Application for the National Enrichment Facility (April 26, 2004, as revised on October 14, 2004) (*see* LES Exhibit 4). The purpose of this section is to demonstrate that, under any conditions, the NEF would be in compliance with applicable New Mexico ground water standards. Therefore, LES structured its demonstration to be highly conservative by considering the possibility – however unlikely – that infiltrating water would reach the first groundwater zone at roughly 220 feet below ground surface.

Relative to the septic leach fields and the Site Stormwater Detention Basin, the permit application thus states: "The infiltrated waters are expected to potentially recharge the limited ground water system at the 214 to 222 foot depth or return to the atmosphere via evapotranspiration." (*see* LES Exhibit 4, at 17). Mr. Rice focuses on this statement, ignoring the underlying conclusion in both cases, as stated several sentences later: "Therefore, based on the

above, even if any of the infiltrated waters reach the ground water, the applicable ground water standards in 20.6.2.3103 NMAC will be met" (*see* LES Exhibit 4, at 17). Likewise, with respect to the UBC Storage Pad Stormwater Retention Basin, LES conservatively posited that: "Any minor leakage past the liner will infiltrate into the ground under the basin. The infiltrated waters are potentially expected to recharge the limited ground water system at the 214 to 222 foot depth or return to atmosphere via evapotranspiration." (*see* LES Exhibit 4, at 18). Several sentences later, the permit application states: "Therefore, based on the above, it is concluded that even if any of the basin waters infiltrated into the ground, the applicable ground water standards in 20.6.2.3103 NMAC will be met." (*see* LES Exhibit 4, at 18). Again, Mr. Rice chooses to ignore this fact.

These sentences clearly convey the fact that migration of infiltrating water to a depth of approximately 220 feet below ground surface is not the expected outcome. This possibility was included as a conservatism for purposes of LES's approval demonstration. As reflected in the NEF Environmental Report, LES's discovery responses, and LES's prefiled testimony, I expect the evapotranspiration process to inhibit any potential for "recharge" of the 220-foot saturated zone by infiltrating surface waters. In summary, there are no "apparent inconsistencies" between statements made by LES in this proceeding and statements made in the Ground Water Discharge Permit Application.

D. Claims Regarding the Adequacy of LES's Groundwater Monitoring Plan

Q35. Mr. Rice alleges that LES has not presented a "clear groundwater monitoring plan." In particular, he claims that "[a]ll groundwater zones beneath the site, from the Santa Rosa Aquifer to the surface, should be monitored," and that LES has "not explained how [it] will distinguish between groundwater contamination caused by the NEF and contamination caused by

other potential sources." Rice Direct Testimony, at 20. What is your view with regard to these assertions?

A35. (GAH) These concerns are addressed in our direct testimony. *See* Harper-Peery Direct Testimony (Answers 41-42, 44), at 35-38. I would like to make one additional point. Mr. Rice notes that "the NMED has stated that it will probably require LES to install additional wells to monitor any leakage from the basins or septic systems that perches on the alluvial/Chinle contact." Rice Direct Testimony, at 20 n.97. Importantly, this statement was contained in the NMED's comments on the Staff's DEIS. As I stated above, it appears that the NMED has taken the Staff's "perched water body" or "plume" analysis at face value, without acknowledging that the assumptions and calculations underlying that analysis are highly conservative. In any event, if the NMED chooses to impose such a requirement in LES's groundwater discharge permit, then LES will be required to comply with it. This possibility does not change my conclusions relative to the adequacy of LES's and the Staff's environmental evaluations.

E. <u>Claims Regarding the Adequacy of LES's Stormwater Monitoring Program</u>

Q36. On a related note, Mr. Rice also asserts that LES's proposed Stormwater Monitoring Program for Detention and Retention Basins is inadequate. *See* Rice Direct Testimony, at 20-21. What is your response to this claim?

A36. (GAH) With one exception, I have already responded to the claims made by Mr. Rice in his direct testimony relative to stormwater monitoring at the NEF site, which relate to Basis E of Contention NIRS/PC EC-1, as amended. *See* Harper-Peery Testimony (Answers 62-64), at 52-53. I would note that Staff witness Alan Toblin also has addressed these claims at length in his direct testimony. *See* Toblin Direct Testimony (Answers 53-61), at 23-27.

Q37. What is the exception to which you alluded in your previous answer?

A37. (GAH) In his direct testimony, Mr. Rice states that the Regional Environmental Officer of the United States Department of the Interior has expressed a concern that wastewater in the UBC Storage Pad Stormwater Retention Basin may contain nutrients, heavy metals, organic chemicals, petroleum, solvents, or pesticides, and that these contaminants may pose a risk to migratory birds and other wildlife. *See* Rice Direct Testimony, at 21.

Q38. What is your view relative to this statement?

A38. (GAH) For the reasons set forth in Answer 29 of my prefiled direct testimony, I do not believe that the UBC Storage Pad Stormwater Retention Basin poses such a risk. In particular, LES's environmental monitoring program will allow LES to adequately monitor the basin waters and ensure the risk to migratory birds and other wildlife is minimized.

Q39. Does this conclude your testimony?

A39. (GAH) Yes.

1 MR. REPKA: Okay. I'm going to turn to
2 the exhibits that correspond now to these two pieces
3 of testimony. And, what I'll do is I'll introduce
4 them briefly by exhibit number and a description of
5 their title.
6 CHAIR BOLLWERK: And we're marking these
7 for identification.
8 MR. REPKA: And they'll be marked for
9 identification. And my expectation is to move them
10 into evidence at the end of this discussion. First,
11 LES Exhibit number 1 is an NEF environmental report
12 excerpts from sections 3.3, 3.4, and 4.4.
13 (Whereupon, the above-
14 referenced to document was
15 marked as LES Exhibit No. 1 for
16 identification.)
17 M R . R E P K A :
18 LES Exhibit number 2 is from the NEF
19 environmental report excerpts section 6.1 and 6.2.
20 (Whereupon, the above-
21 referenced to document was
22 marked as LES Exhibit No. 2 for
23 identification.)
24 MR. REPKA: LES Exhibit number three is
25 excerpts from the LES response to an NRC request for

1 additional information regarding the NEF environmental
2 report, a document dated May 20th, 2004, which
3 includes a number of attachments and appendixes that
4 are labeled as tabs A through O.
5 (Whereupon, the above-
6 referenced to document was
7 marked as LES Exhibit No. 3 for
8 identification.)
9 M R . R E P K A :
10 LES Exhibit number four is the New Mexico
11 groundwater discharge permit application for the NEF
12 dated April 26th, 2004 as revised on October 14th,
13 2004.
14 (Whereupon, the above-
15 referenced to document was
16 marked as LES Exhibit No. 4 for
17 identification.)
18 M R . R E P K A :
19 LES Exhibit number five is a technical
20 report from Walvoord, Plummer & Phillips published in
21 Water Resources Research in 2002. It relates to deep
22 arid system hydrodynamics.
23 (Whereupon, the above-
24 referenced to document was
25 marked as LES Exhibit No. 5 for

1 identification.)

2 M R . R E P K A :

3 LES Exhibit number six is another

4 technical report from Dutton & Simpkins published by

5 the University of Texas at Austin in 1986.

6 (Whereupon, the above-

7 referenced to document was

8 marked as LES Exhibit No. 6 for

9 identification.)

10 MR. REPKA: LES Exhibit number seven is

11 from a textbook on groundwater by Freeze & Cherry.

12 It's page 29, table 2-2, published in 1979.

13 (Whereupon, the above-

14 referenced to document was

15 marked as LES Exhibit No. 7 for

16 identification.)

17 MR. REPKA: Exhibit number eight is a

18 document from the New Mexico Environment Department

19 titled Guidelines for Liner Material and Site

20 Preparation for Synthetically Lined Lagoons, dated

21 December 11th, 1995.

22 (Whereupon, the above-

23 referenced to document was

24 marked as LES Exhibit No. 8 for

25 identification.)

1 M R . R E P K A :

2 LES Exhibit nine is a calculation summary

3 sheet prepared by LES titled Water Balance Tables for

4 National Enrichment Facility Basins. It has a

5 document identifier which reads 32-5047375-00.

6 (Whereupon, the above-

7 referenced to document was

8 marked as LES Exhibit No. 9 for

9 identification.)

10 MR. REPKA: LES Exhibit ten is another

11 calculation summary sheet entitled -- prepared by LES

12 -- entitled TEEB soil concentration and integrative

13 liner dose. It has a document identifier 32-2400589-

14 00.

15 (Whereupon, the above-

16 referenced to document was

17 marked as LES Exhibit No. 10

18 for identification.)

19 MR. REPKA: LES Exhibit eleven, which is

20 the one we just discussed earlier, it is an excerpt

21 from a 2002 analytical report prepared by Severn Trent

22 for waste controls specialists.

23 And that's one that we'll be getting

24 documents shortly, copies of that.

25 (Whereupon, the above-

1 referenced to document was
2 marked as LES Exhibit No. 11
3 for identification.)
4 M R . R E P K A :
5 The next would be LES Exhibit 13, which is
6 an analytical report prepared, dated September 17th,
7 2004. It has a lot number identifier D4H190128. It
8 represents a lab analytical report with certain non-
9 radiological data on well MW-2.
10 (Whereupon, the above-
11 referenced to document was
12 marked as LES Exhibit No. 13
13 for identification.)
14 M R . R E P K A :
15 The next would be LES Exhibit 71, which is
16 a technical document from Barrett, Zuber, Collins et
17 al. And it relates to highway runoff. It's CRWR
18 online report 95-2, published April 1995.
19 (Whereupon, the above-
20 referenced to document was
21 marked as LES Exhibit No. 71
22 for identification.)
23 M R . R E P K A :
24 LES Exhibit 72 is another technical report
25 from the Southwest Research Institute in San Antonio,

1 Texas from Laine & Miklas on detection and location of
2 leaks in geo-membrane liners using electrical methods.
3 And that was published November 1989.
4 (Whereupon, the above-
5 referenced to document was
6 marked as LES Exhibit No. 72
7 for identification.)
8 M R . R E P K A :
9 And the last one is LES Exhibit number 73.
10 It's an excerpt. It's pages 4-1 to 4-11 only from a
11 geology report prepared by Cook-Joyce Inc. & Intera
12 Inc. in August 2004.
13 It relates to a fault investigation at the
14 CWCS site. All of these exhibits with the exception
15 of Exhibit 11 are identified further in the pre-filed
16 exhibit list filed by LES on February 2nd, 2005.
17 (Whereupon, the above-
18 referenced to document was
19 marked as LES Exhibit No. 73
20 for identification.)
21 CHAIR BOLLWERK: All right. Then let the
22 record reflect that the exhibits identified as LES
23 Exhibits 1 through 11, 13, 71 and 71 through 73 have
24 been marked for identification.
25 MR. REPKA: Okay. And I would like to

1 move that these exhibits be accepted into evidence as
2 supporting exhibits to go with the LES direct and
3 rebuttal testimony.
4 CHAIR BOLLWERK: Any objections from the
5 parties?
6 MR. LOVEJOY: No.
7 MS. CLARK: No objection.
8 CHAIR BOLLWERK: All right. Then the LES
9 exhibits identified as 1 through 11, 13, 71, 72, and
10 73 are admitted into evidence.
11 (The documents referred to,
12 having been previously marked
13 for identification as LES
14 exhibit Nos. 1-11, 13, 71-73
15 were admitted into evidence.)
16 CHAIR BOLLWERK: And, again, you would
17 need to give us original and two copies of number 11,
18 I think is what we lack. Have you provided copies of
19 those to our --
20 MR. REPKA: I have an original and two
21 copies of all of the exhibits. We'll add 11 to that.
22 And we'll certainly add another copy of 11 if anybody
23 else needs a copy.
24 CHAIR BOLLWERK: Okay.
25 MR. LOVEJOY: I request a copy.

1 MR. REPKA: Okay.

2 MR. LOVEJOY: It was, I think, withdrawn,

3 so we didn't bring it.

4 MR. REPKA: Okay. We'll provide that for

5 the Board and both parties, all parties.

6 CHAIR BOLLWERK: Right. Whenever you can

7 actually physically give them to the clerk, that would

8 be -- she will start processing them.

9 MR. REPKA: I can do that right now.

10 CHAIR BOLLWERK: That would be fine.

11 MR. REPKA: With the exception of 11.

12 CHAIR BOLLWERK: All right.

13 (Pause.)

14 MR. REPKA: With that I have nothing more

15 for the panel and they're prepared for cross

16 examination.

17 CHAIR BOLLWERK: All right. Thank you.

18 Let me also mention one thing briefly. You all had

19 given us a summary of your arguments this morning. And

20 I just want to mention, the Board found very useful

21 the written summaries you gave us.

22 And, I know those took some time to

23 prepare, but we did really find them useful in terms

24 of presenting your cases. So, we really appreciate

25 your efforts in doing that. Thank you.

1 All right, at this point the panel then is
2 available for cross examination. Let me turn to the
3 Staff and see if they have any cross examination for
4 this panel.
5 MS. CLARK: I have no cross examination of
6 this panel.
7 CHAIR BOLLWERK: All right. Mr. Lovejoy
8 then?
9 MR. LOVEJOY: Thank you, Your Honor. I
10 have a question of mechanics.
11 CHAIR BOLLWERK: All right.
12 MR. LOVEJOY: First of all, I think that
13 the witnesses aught to have a set of the exhibits that
14 they have with them for reference --
15 CHAIR BOLLWERK: All right.
16 MR. LOVEJOY: -- during this examination.
17 CHAIR BOLLWERK: In theory we need to use
18 the originals. Or, if LES has any other copy they can
19 provide, however you would like to do it. You're
20 going to be asking about some of the exhibits,
21 obviously.
22 MR. LOVEJOY: Yes.
23 MR. REPKA: We have another set. And I'm
24 happy to take that as well.
25 MR. LOVEJOY: And the question also

1 involves some exhibits which we have marked and plan
2 to introduce and would be asking the witnesses to take
3 a look at those as well.
4 CHAIR BOLLWERK: All right.
5 MR. LOVEJOY: Can I just take one of the
6 sets we propose to offer?
7 CHAIR BOLLWERK: Yes, if you want to take
8 it up there. I do not know if you want to do it
9 individually or if you want to do it now. That's
10 fine, however you want to --
11 MR. LOVEJOY: I think it's probably better
12 if we just given them the books and they can flip to
13 it.
14 CHAIR BOLLWERK: All right.
15 MR. LOVEJOY: I want to keep the paper
16 shuffling to a minimum.
17 CHAIR BOLLWERK: All right. I take it,
18 with respect to each one of those, when you actually
19 wish to ask about them, we're going to identify them
20 and get them admitted into evidence, is that correct?
21 MR. LOVEJOY: I suppose we should.
22 CHAIR BOLLWERK: That would be the best
23 approach, yes.
24 JUDGE KELBER: Mr. Lovejoy, could you
25 please bring the mike a little closer?

1 MR. LOVEJOY: I will.

2 JUDGE KELBER: Thank you.

3 MR. LOVEJOY: Sorry.

4 EXAMINATION BY MR. LOVEJOY OF

5 ROGER L. PEERY

6 GEORGE A. HARPER

7 MR. LOVEJOY: Mr. Harper and Mr. Peery, do

8 you have the LES exhibits on EC-1 with you?

9 WITNESS PEERY: Yes.

10 WITNESS HARPER: Yes.

11 MR. LOVEJOY: And, do you have the NIRS/PC

12 exhibits in volume 1 and volume 2 also?

13 WITNESS HARPER: Yes, we do.

14 WITNESS PEERY: Yes, we do.

15 MR. LOVEJOY: Thank you. Now, I'm going

16 to be asking various questions. And I understand that

17 either one of you can reply. And I just want to say,

18 those are the rules as far as I understand it for a

19 panel cross.

20 JUDGE ABRAMSON: Let me just mention that,

21 as you reply, state your name so that the clerk knows

22 who is replying when you begin your reply.

23 MR. LOVEJOY: Okay. You were just

24 referring to part of your testimony concerning -- I

25 think you told about dissolved solids in the Santa

1 Rosa water.

2 And, in your testimony, I believe you say

3 something like that you concede that Santa Rosa might

4 be used for livestock water. Isn't it true that the

5 Santa Rosa has been used for domestic water supplies

6 as well?

7 WITNESS PEERY: Yes.

8 MR. LOVEJOY: Okay. And, it's the Lee

9 County water plan, the regional water plan -- is that

10 among the exhibits that we've marked just now?

11 WITNESS PEERY: The Lee County water plan?

12 MR. LOVEJOY: Yes.

13 WITNESS PEERY: No, it is not included.

14 MR. LOVEJOY: Okay. I'd like to use LES

15 Exhibit 26 for identification, if I may.

16 CHAIR BOLLWERK: Is that an exhibit that

17 was withdrawn or not going to be used by LES?

18 MR. LOVEJOY: I believe that it's still on

19 the list.

20 CHAIR BOLLWERK: All right.

21 MR. LOVEJOY: It's possibly identified as

22 an EC-2 exhibit.

23 CHAIR BOLLWERK: All right. I'm sorry,

24 what was the number again?

25 MR. LOVEJOY: It's LES Exhibit 26.

1 CHAIR BOLLWERK: Okay. All right, it is.
2 If that's the case, we can go ahead and identify it
3 now.
4 (Whereupon, the above-
5 referenced to document was
6 marked as LES Exhibit No. 26
7 for identification.)
8 MR. LOVEJOY: May I request that the
9 witness be shown Exhibit 26?
10 MR. LOVEJOY: Let me try to speed this up
11 if I may. My copy of Exhibit 26 says, and probably
12 yours will, that the Santa Rosa aquifer, I'm reading
13 from page 6-12 is the principle source of groundwater
14 for domestic and livestock uses in the southwestern
15 portion of the county, and was the principle aquifer
16 for the city of Jal before 1954.
17 Do you concur with that?
18 WITNESS PEERY: I assume that you are
19 reading the Exhibit 26 is the Lea County regional
20 water plan.
21 MR. LOVEJOY: The regional water plan.
22 WITNESS PEERY: Yes. I'd like to state
23 that the main reason it's the principal aquifer in
24 selected portions of the southern part of the county
25 is that there is very little shallow groundwater

1 present in the southern part of the county.

2 Therefore people needing domestic water

3 supplies have to drill relatively deep to get to the

4 Santa Rosa aquifer which is on the order of eleven

5 hundred feet below ground surface.

6 The city of Jal no longer -- did you say

7 the city of Jal? Eunice is pretty large, but --

8 MR. LOVEJOY: I mentioned the city of Jal.

9 WITNESS PEERY: The city of Jal quit using

10 their Dockum aquifer well, as I recall, several

11 decades ago primarily because it didn't provide much

12 water pumped out readily, and they moved their well to

13 another source within the Jal underground water basin.

14 CHAIR BOLLWERK: I see the exhibits have

15 come. Did you want him to have those in front of him?

16 MR. LOVEJOY: Yes. Perhaps the witness --

17 Exhibit 26 --

18 CHAIR BOLLWERK: Okay, why don't you go

19 ahead and identify it for the record if you would?

20 MR. LOVEJOY: I'm asking the witness be

21 shown LES Exhibit 26, which is the Lea County regional

22 water plan.

23 JUDGE ABRAMSON: What page are you

24 referring to?

25 MR. LOVEJOY: I'm referring to page 6-12.

1 JUDGE ABRAMSON: All right.

2 CHAIR BOLLWERK: Let the record reflect

3 that LES Exhibit 26 has been marked for

4 identification. Could you point to the particular

5 location?

6 MR. LOVEJOY: The text was under Dockum

7 aquifers, about two thirds of the way down the page.

8 WITNESS PEERY: So that refers to the city

9 of Jal using that water before 1954, so that was

10 incorrect. It was more than just a couple of decades.

11 It was a much longer time period ago that they had

12 used that water.

13 MR. LOVEJOY: Do you have any expectation

14 whether the Dockum group may be used for future water

15 supplies as necessity arises?

16 WITNESS PEERY: Certainly not for the city

17 of Jal. They are relying solely on the Jal

18 underground water basin at this time for water

19 supplies.

20 MR. LOVEJOY: But other than the city of

21 Jal?

22 WITNESS PEERY: As part of the regional

23 water plan there was a recommendation to try to

24 evaluate the potential for water development within

25 the Santa Rosa aquifer.

1 Well yields in the Santa Rosa are
2 generally fairly low by the standards which you would
3 find for instance in the Lea County underground water
4 basin which has yields exceeding many hundreds of
5 gallons per minute.
6 Thus the vast amount of irrigation that's
7 present in this area. One wouldn't expect to find
8 yields of particularly high quantities within the
9 Santa Rosa, but it is a potential water supply to
10 evaluate for the county as an alternative created in
11 this regional water plan.
12 MR. LOVEJOY: Okay. And there -- you
13 distinguished between the Dockum aquifer and alluvial
14 aquifers, don't you?
15 WITNESS PEERY: Yes.
16 MR. LOVEJOY: And in fact, there has been
17 use of the alluvial aquifers also for domestic
18 purposes, hasn't there?
19 WITNESS PEERY: Yes. There has been some
20 limited use of the alluvial aquifer for domestic
21 purposes. The primary reason that the use is quite
22 limited is that the alluvial aquifers are not
23 continuous throughout the southern part of the county.
24 They're only found in selected areas, and
25 therefore aren't readily used or readily available for

1 development on a wide scale use.

2 MR. LOVEJOY: The alluvium is the source

3 of water use of the quarry operated by Wallack isn't

4 it?

5 WITNESS PEERY: The Wallack quarry, which

6 is located north of the NEF site, as I recall, does

7 use alluvial water for part of the processing. What

8 they've done at the quarry is essentially -- well,

9 it's a quarry so therefore they mined out the

10 overburden, the overlying alluvial materials above the

11 red bed surface, and have essentially created a sump

12 within the red bed that collects water that

13 infiltrates through the cracked leaches at the

14 surface.

15 It infiltrates and then basically collects

16 in the sump which is developed within the red bed

17 surface itself.

18 MR. LOVEJOY: And the -- so the source of

19 that is the alluvium?

20 WITNESS PEERY: Yes. Yes, it's the

21 process -- it's used for processing the -- as part of

22 the processed water for the quarry.

23 MR. LOVEJOY: Okay. Going back to the

24 Dockum group again, was that used as a source of water

25 for town of Oil Center?

1 WITNESS PEERY: I believe it was
2 referenced as a source of water for the town of Oil
3 Center, which I believe is located ten or more miles
4 north of the -- and west of the NEF site as I recall.
5 MR. LOVEJOY: Okay. What do you call that
6 being referred to?
7 WITNESS PEERY: I think it's in the
8 Nicholson and Clebsch reference in 1961 if I recall
9 correctly.
10 MR. LOVEJOY: Okay. And have you -- are
11 you aware that the town of Jal, Texas mixes Dockum
12 water with other water as its supply source?
13 WITNESS PEERY: I don't recall that
14 specifically, but it seems to me if you have to mix
15 the water then obviously you have some kind of either
16 water quality issue that you're trying to get past, or
17 potentially your yields are low from whatever the
18 varying sources are.
19 MR. LOVEJOY: Would you look at LES
20 Exhibit 6, page 22 of that. That's the Dutton and
21 Simpkins report. Can you see the reference to the
22 town in Texas?
23 WITNESS PEERY: The 1986 Dutton and
24 Simpkins report?
25 MR. LOVEJOY: Exactly, page 22. I'm

1 looking at the text on the right column, last
2 paragraph. I'll just ask you, that doesn't confirm
3 that the town of the City of Harper circumstances like
4 you described, mixes Dockum group groundwater with
5 other water?
6 WITNESS PEERY: Yes. It does appear that
7 that is the case. And I guess my memory did serve
8 correctly because this references the fact that they
9 have to, in order to meet demands they use the Dockum
10 group aquifer, mix it with Ogallala formation water
11 because of an objectional taste related to the Dockum
12 group water. So I guess that was the issue.
13 MR. LOVEJOY: Now I think it was stated in
14 your direct testimony that you're not aware of any
15 place where water that flows along the contact between
16 the alluvium and the Chinle formation is discharged.
17 Is that your understanding now?
18 WITNESS PEERY: I'm not aware of any place
19 it's discharged with the exception of the Wallack
20 quarry and Baker spring.
21 MR. LOVEJOY: Oh, I see. What is Baker
22 spring?
23 WITNESS PEERY: Baker spring is the
24 similar situation to what I described at the Wallack
25 quarry in that the red beds are exposed at the surface

1 and water is able to drain from the alluvial material
2 which seems to be collected primarily as a result of
3 some man made berms, but again the red beds act as a
4 sump to collect this water and that's why it
5 discharges at that location.
6 MR. LOVEJOY: Now the Staff had an
7 analysis of potential plumes under the NEF site, if
8 there were leakage, and probably plumes from the storm
9 water basin. And the believed that any water that was
10 not evaporotranspired could seep out near, I think,
11 monument draw.
12 I think they analyzed the outlet point and
13 reanalyzed it, and they concluded monument draw would
14 be the place. Do you agree with that?
15 WITNESS PEERY: Well, as I remember, the
16 analysis performed by Mr. Toblin of the NRC Staff --
17 he took a very conservative analysis -- approach to
18 his analysis.
19 And he assumed complete conservation of
20 mass of any water that might enter into the storm
21 water retention pond. And that water would completely
22 infiltrate into the alluvial system, form a perched
23 water body along the alluvial contact, and move out
24 from the NEF location towards monument draw.
25 And the calculation was very conservative

1 in that it didn't assume any evaporotranspiration
2 losses whatsoever. So he identified a location
3 approximately three miles southwest of the site at
4 monument draw where that water could potentially
5 discharge.
6 MR. LOVEJOY: And how long do you think it
7 would take to get there?
8 WITNESS PEERY: According to the
9 calculation by NRC Staff, the rate of movement would
10 be approximately .16 miles per year with the
11 assumptions that I just mentioned in terms of the
12 conservation of mass for the plume.
13 That would put the travel time at
14 approximately 19 years. I would like to again
15 emphasize that the assumption is total conservation of
16 mass, and the lack of a shallow groundwater system at
17 the NEF site indicated that evaporotranspiration rates
18 are quite high.
19 And in fact this plume would start to
20 move, should one actually develop. It would be
21 subject to losses of water from evaporotranspiration,
22 both at the pond itself, and the alluvial sediments
23 below a retention basin, and as it's migrating toward
24 the discharge point.
25 Now if we continue with the theory that

1 this plume might actually get as far -- or is enough
2 size to head towards monument draw, as the alluvial
3 sediments thin out toward the discharge point, what
4 happens is your water is then subject to much greater
5 rates of evaporotranspiration as opposed to when a
6 plume is theoretically below a greater thickness of
7 alluvial sediments.
8 Now also at this time I'd like to point
9 out that the -- in addition to the lack of groundwater
10 beneath the NEF site, the Walvoord study, which is the
11 study related to evaporotranspiration from arid
12 environment soils seems to apply quite well.
13 And we would expect the vast amount of
14 water to be lost through the upward migration in
15 evaporotranspiration process in this type of
16 environment.
17 JUDGE ABRAMSON: Can I follow this up for
18 a second, Counsel? So you described this initially as
19 a very conservative analysis, and then told us about
20 other physical processes that would be expected to
21 occur.
22 WITNESS PEERY: Yes, sir.
23 JUDGE ABRAMSON: So would you say that
24 it's so conservative as to be unrealistic?
25 WITNESS PEERY: Yes, sir, I would say

1 that.

2 JUDGE ABRAMSON: And --

3 WITNESS PEERY: It's so conservative that

4 it certainly presents a worst case look at what could

5 possible happen at the site.

6 JUDGE ABRAMSON: Well, let's pursue that,

7 because characterizing as a worst case at least leads

8 me to believe that it's a possibility. You're telling

9 me there are other -- I thought I heard you say there

10 were other physical processes that would go on here

11 that would -- at least you lead me to believe that the

12 .16 miles per year migration is an extreme estimate,

13 that -- well, I don't want to put words in your mouth.

14 Tell me how these processes would affect

15 the migration rate, and what you think would be a

16 realistic migration rate if there would be -- or would

17 there be migration at all?

18 WITNESS PEERY: Well, I'd like to say that

19 I don't think it's an extreme calculation, but it's

20 certainly a very conservative calculation, because as

21 I stated it, assume total conservation of mass of any

22 water that would fall on the land surface, and

23 ultimately it would infiltrate.

24 JUDGE ABRAMSON: Right. Is that or is

25 that not possible?

1 WITNESS PEERY: It is not possible.

2 JUDGE ABRAMSON: Then it's more than

3 extreme, isn't it? I'm sorry, but --

4 WITNESS PEERY: It's very conservative.

5 If I might use that term. The evaporotranspiration

6 rates in this area range -- estimates range from 65 to

7 80 inches per year for evaporotranspiration, where as

8 the average rainfall is on the order of about 12

9 inches per year.

10 So the net effect in this area is that

11 water doesn't readily form perched water bodies in

12 this alluvial environment. There are some areas where

13 this does occur but there hasn't been any

14 documentation of alluvial water at the NEF site.

15 My opinion would be that if some perched

16 water bodies were formed, that before they traveled

17 very far they would be subject to evaporotranspiration

18 and would likely be lost to the atmosphere.

19 MR. LOVEJOY: Thank you. Sorry to

20 digress, Counsel, but I want to get this one clear.

21 You said that as water traveled, as Staff

22 hypothesized, from a plume at the NEF, that as it came

23 closer to the surface evaporotranspiration would have

24 a greater effect.

25 Is that correct? Is that what you were

1 saying?

2 WITNESS PEERY: That's correct.

3 MR. LOVEJOY: Have you done any

4 calculations to reflect that hypothesis?

5 WITNESS PEERY: No, I haven't done any

6 calculations, but as water is closer to the ground

7 surface it is subject to more processes that effect

8 evaporotranspiration, mainly movement or diffusion

9 through the soil grains.

10 Also vegetation has a greater effect on

11 evaporotranspiration rates. Temperature of the soils

12 driving thermal gradients, that sort of thing. So

13 it's just the fact that as water is closer to the

14 ground surface and the sediments, it is subject to a

15 greater number of processes.

16 MR. LOVEJOY: Do you remember the

17 conductivity value assumed by the Staff in that

18 analysis?

19 WITNESS PEERY: As I recall, is was .01

20 centimeters per second, which is a value that

21 corresponds to a well sorted sand material, when In

22 fact, the sediments below the site consist of lenses

23 of gravel and silky sand material.

24 And I should point out that the gravel

25 lenses present at the site are not continuous, either

1 in a north-south or east-west direction. There is no
2 channel of gravels that can transport water off of the
3 site.
4 So using the conservative value for
5 assuming the well sorted sand does provide a
6 conservative value of the rate at which water could
7 theoretically move from the site.
8 JUDGE ABRAMSON: Which means that it
9 predicts movement rates on the high end, and you say
10 conservative?
11 WITNESS PEERY: Yes. Movement rates on
12 the high end, yes, sir.
13 MR. LOVEJOY: Well you say that gravel
14 doesn't occur in channels or continuous deposits. In
15 order to know that, you really have to do some
16 drilling that hasn't been done, wouldn't you?
17 WITNESS PEERY: Gravel does occur at the
18 site, but the theory that there is a continuous
19 channel of gravel, the day that the site did not
20 support that there were 15 bore holes at the site that
21 went through the alluvial material.
22 And if you look at the elevations of which
23 those gravel lenses or gravel occurrences were
24 reported in each bore hole, they are not continuous in
25 a way that they can migrate water just through a

1 channel lens or channel of some long duration from the
2 site.
3 They are not continuous in that fashion.
4 They're more of a lens type material.
5 MR. LOVEJOY: And where do you see that
6 data?
7 WITNESS PEERY: From the Mactec borings at
8 the NEF site, borings B-1 through B-6, and the borings
9 advance by Cook-Joyce borings one through nine.
10 MR. LOVEJOY: Okay.
11 WITNESS PEERY: I'm sorry, B1 through B-5
12 on the Mactec.
13 MR. LOVEJOY: Have you done any
14 calculations of the type that NRC Staff did by
15 assuming presence of gravel?
16 WITNESS PEERY: No, I didn't do any
17 calculations of that type. And again, because the
18 gravels aren't continuous, that wouldn't be an
19 appropriate thing to do at this site.
20 MR. LOVEJOY: There is reference in your
21 testimony to the investigations done at the WCS site,
22 the Lea County landfill, and the investigations done
23 in connection with the -- is it Avlis proposal the
24 Holt report, immediately to the east of the NEF site.
25 Actually, in those efforts, haven't those

1 properties been far better characterized than the NEF
2 site has been?
3 WITNESS PEERY: Well, I would like to
4 point out that the NEF site relied on the
5 hydrogeologic setting of this area. Before NEF did
6 any drilling at this site WCS had done a significant
7 amount of work at their location and identified
8 permeabilities of the Chinle sandy siltstones at the
9 Chinle red bed, which are primarily shales or clay
10 stones, had performed quite a detailed analysis with
11 over 50 permeability measurements, vertical
12 permeability measurements within the Chinle red beds,
13 five or six horizontal permeability measurements
14 within those same sediments.
15 And additionally, the Lea County landfill
16 had already done a significant amount of drilling to
17 characterize the hydrogeologic setting there, which
18 ties in quite readily with the geology at the WCS
19 site.
20 So ultimately NEF hired the same
21 contractor, Cook-Joyce, who had performed the majority
22 of work at the WCS site to perform their
23 investigation.
24 And essentially, the drilling and
25 investigation methods indicated that the geology at

1 the NEF site is essentially what is found at the WCS
2 site.
3 It's a very continuous hydrogeologic
4 setting in this area. And so I think that the --
5 based on the vast amount of data that's available from
6 the Lea County landfill and the WCS site, I would say
7 that the area is quite well characterized.
8 MR. LOVEJOY: Let me ask you -- I have
9 some notes here about the work done at those other
10 sites, and you can certainly check the documents. But
11 let me just ask you whether you agree, first of all,
12 as to the investigation by Holt, I think in 1993, the
13 Avlis data.
14 Was that -- do you recall if that was
15 based on 55 borings, soil borings, and 200 to 300
16 feet, and then 12 soil borings to 45 feet to get
17 cores? Do you remember that?
18 MR. REPKA: Do you have an exhibit number?
19 MR. LOVEJOY: That is LES Exhibit 3, tab
20 E, page 2.
21 WITNESS PEERY: I'm sorry, could you
22 repeat that exhibit please?
23 MR. LOVEJOY: Exhibit 3. It's the
24 response to the RAI that has a series of geologic
25 reports attached to it. You'll see items four and

1 five on the list.

2 WITNESS PEERY: Yes, I see what you're

3 saying, and yes that is correct.

4 MR. LOVEJOY: Okay. And by my notes, the

5 Lehman and Rainwater report is tab I, and that was at

6 the WCS site. And by my notes, that was based on 35

7 air rotary bore holes.

8 WITNESS PEERY: Yes. That's what it says

9 on page one of the report.

10 MR. LOVEJOY: Okay. And the Cook-Joyce

11 report for WCS on Section 6, which I think is 04.

12 That should be tab O, based collectively on 220 bore

13 holes. Reference is page 5-2. I see 5-1 actually.

14 WITNESS PEERY: Yes, I see that reference.

15 MR. LOVEJOY: And there were 109 monitor

16 wells with piezometers?

17 WITNESS PEERY: Correct.

18 MR. LOVEJOY: Do you see that reference?

19 Okay. And they say in that same report over on page

20 2 that Weaver-Boos at the municipal landfill site did

21 26 bore holes.

22 WITNESS PEERY: On page what?

23 MR. LOVEJOY: That's the next page, 5-2 of

24 Exhibit 3, tab O.

25 WITNESS PEERY: Okay. Correct.

1 MR. LOVEJOY: And further down they refer
2 to the 1998 11E-2 sighting investigation which I
3 believe was at WCS. And that involved 65 bore holes
4 and five monitor wells with piezometers, right?
5 WITNESS PEERY: Yes.
6 MR. LOVEJOY: And at the NEF site, there
7 was an investigation report found in the Separate '03
8 report by Cook-Joyce addressing the uppermost aquifer.
9 And how many bore holes did they install,
10 Cook-Joyce?
11 WITNESS PEERY: At the NEF site?
12 MR. LOVEJOY: Yes.
13 WITNESS PEERY: As I stated earlier, nine
14 geotechnical -- I'm sorry, nine groundwater
15 investigation, shallow water investigation borings,
16 and five geotechnical borings for Cook.
17 And as I previously stated before you
18 pointed to these exhibits, this is an extensive amount
19 of drilling for this are within about a two mile
20 radius of the NEF site.
21 I would consider this a really exhaustive
22 evaluation of the hydrogeologic setting of this area.
23 And again, as I previously mentioned, the Cook-Joyce
24 firm that did the work at WCS, as you pointed out in
25 these documents, with over 220 borings and 109

1 monitoring wells, as you referenced on page 5-1.

2 And in the Holt report and the Lea County

3 landfill report, which are all in these immediate

4 area, within a mile or so of the NEF site really build

5 upon the foundation for the hydrogeologic setting at

6 this site.

7 And NEF was able to use this documentation

8 to essentially confirm that the hydrogeologic setting

9 where they're at is similar to the other sites around

10 it.

11 MR. LOVEJOY: But the drilling at the

12 other sites was at other sites?

13 WITNESS PEERY: Yes.

14 MR. LOVEJOY: And the drilling that

15 Lockwood, Green, and Mactec did, and that is reported

16 in Exhibit 3, tab N, I believe, involved bore holes at

17 the NEF site.

18 And that was, I think, five bore holes

19 down to 100 feet. Is that right?

20 WITNESS PEERY: Correct.

21 MR. LOVEJOY: And that was essentially to

22 aid in the construction planning wasn't it?

23 WITNESS PEERY: Yes, the Mactec borings

24 were geotechnical borings but they also logged the

25 cuttings as they went down and were able to get

1 geologic information from the alluvial material at the
2 site and the depth to red beds from those borings as
3 well.
4 JUDGE ABRAMSON: Counsel, can I pick this
5 up for a second?
6 MR. LOVEJOY: Please.
7 JUDGE ABRAMSON: I understand where you're
8 going is that there's a lot of drilling but not much
9 of it on this site, is that the point?
10 WITNESS PEERY: That's the fact.
11 JUDGE ABRAMSON: Okay. Mr. Peery, I think
12 I heard you say, or begin to say, something about how
13 the hydrogeology might vary in this region. So the
14 question I want to ask is if one looked at the
15 hydrogeology in these neighboring areas, would one
16 expect those -- the data gathered there to be
17 representative of what one would get when one did
18 drilling on the NEF site, and is the drilling that was
19 found on the NEF site in fact consistent with the
20 drilling that was found -- the results found in these
21 other sites?
22 WITNESS PEERY: Yes, sir. The drilling at
23 the NEF site was consistent with what was found at the
24 other sites, primarily alluvial materials overlying
25 the Chinle red beds, also some marker beds that can be

1 traced across these various locations, particularly
2 what is referred to as a 220 foot zone that has some
3 limited amounts of water in it.
4 And that can be found throughout the
5 various sites. So the hydrogeologic setting is very
6 consistent through this area.
7 JUDGE ABRAMSON: So would one expect to
8 find material variations, variations that would affect
9 the water that seeped into the soil on the NEF site?
10 Would one expect to find variations in those
11 properties over the regions where data is being
12 presented to us in these exhibits?
13 WITNESS PEERY: No, we would expect the
14 conditions at the NEF site to be very similar to the
15 other sites with respect to the sediments. And when
16 you're talking about water seeped into the ground, I'm
17 not sure --
18 JUDGE ABRAMSON: Well I think the issue
19 seems to be being framed that what would seep into the
20 NEF site might go somewhere else?
21 WITNESS PEERY: Go back to the shallow --
22 JUDGE ABRAMSON: And do determine that one
23 has to do more drilling on the NEF site because one
24 doesn't know the properties adequately at the NEF
25 site.

1 And it sounds to me like we're being
2 advised that there's a lot of drilling, not right on
3 the NEF site, but which gives information which tells
4 us how these ground layers behave in the region, and
5 there's no reason to expect them to be different from
6 what's on the NEF site.
7 Am I framing this the way we're -- we're
8 all hearing this the same?
9 MR. LOVEJOY: I think we all understand
10 your question, yes.
11 WITNESS PEERY: That's exactly right. We
12 would expect the conditions at the NEF site to be
13 similar to the other sites, and movement of water to
14 be similar as well.
15 So there isn't a real need to drill 100
16 bore holes at the NEF site to document hydrogeologic
17 setting as based upon the other three sites that were
18 mentioned because the borings at the NEF site confirm
19 that it's very similar to the other sites.
20 JUDGE ABRAMSON: Thank you.
21 WITNESS PEERY: Yes, sir.
22 MR. LOVEJOY: Well, was it a waste of
23 money to drill those holes at the NEF site?
24 WITNESS PEERY: No, absolutely not. It's
25 always good when you go into a site to do the

1 confirmation work. I would consider that it was
2 imperative to drill the holes to document that the
3 hydrogeologic setting was consistent with what's found
4 at the other sites in the area.
5 MR. LOVEJOY: Now looking at the Cook-
6 Joyce report in '03 of the NEF site, there were nine
7 borings. And one of them -- let's see, this is LES
8 Exhibit 3, tab L.
9 One of them, according to testimony, had
10 cuttings that were slightly moist at six to 14 feet,
11 and I take it that was in the alluvium. Is that so?
12 WITNESS PEERY: Yes, that was in the
13 alluvial material.
14 MR. LOVEJOY: And then one of them at B-2
15 had slight moisture at 35 to 41.4 feet. And where is
16 that with relation to the alluvium of the Chinle?
17 WITNESS PEERY: That was at the interface
18 between the alluvial contact at the Chinle. And I
19 should point out the way samples are logged in the
20 field.
21 When you're logging samples in the field
22 you use a relative scale of moisture. And although
23 with some variations the scale would generally be
24 something on the order of dry, slightly moist,
25 moderately moist, moist, very moist, saturated.

1 And the sheer mention of moisture within
2 the alluvial sediments is not an indication that
3 saturated conditions exist at the site. It's simply
4 just moisture within the sediments.
5 MR. LOVEJOY: Well, it's moisture in both
6 of these holes. It's moisture present in -- at least
7 in the vadose zone, is it so? Isn't that so?
8 WITNESS PEERY: Yes. And that's not
9 inconsistent with anything that I've previously said.
10 It's entirely possible for precipitation to infiltrate
11 some degree into the sediments, and then ultimately
12 the loss to evaporotranspiration processes.
13 I think the point that really needs to be
14 made here is that the sheer mention of slight moisture
15 and moist sediments does not indicate saturated
16 conditions.
17 In fact, generally the laboratory analysis
18 from alluvial sediments in the area, moisture contents
19 are generally on the order of a few percent, 10
20 percent, one that I recall as high as 20 percent.
21 So it's not a saturated condition. I know
22 if I was logging the borings, the simple fact that
23 moisture was in the sediments would not indicate
24 saturated conditions.
25 It would be logged as wet or saturated,

1 something like that.

2 MR. LOVEJOY: Your testimony said, you're

3 referring to B9 at this point, that the moisture there

4 is likely infiltrated precipitation that had yet to

5 evaporotranspire since Cook-Joyce Incorporated locates

6 drilling locations in low spots rather than high

7 spots, i.e. at the top of a dune.

8 Rainfall may preferentially collect and

9 infiltrate in to the ground and then become available

10 for evaporotranspiration.

11 MR. REPKA: Is there a Q and A you're

12 reading from there?

13 MR. LOVEJOY: It's on page 31, must be

14 question and answer 38.

15 JUDGE ABRAMSON: Thirty-one of the

16 direct --

17 MR. LOVEJOY: Of the direct.

18 JUDGE ABRAMSON: Actually you don't know

19 whether that water, at that location, had actually

20 been present further down, at an earlier time, do you?

21 MR. LOVEJOY: You mean that this water

22 could have generated from the Chinle red beds, is that

23 what you are asking?

24 JUDGE ABRAMSON: No. That you presumably

25 generated from the surface, you say it was -- there

1 was drilling in a low spot, so you hypothesized that
2 the water went down to the low spot, don't you?
3 MR. LOVEJOY: I guess what I hypothesized
4 is that you can have a greater infiltration right in
5 the low spot and that, ultimately, that moisture, in
6 the shallow alluvial sediments is subject to
7 evaporotransporation by evidence of the simple fact
8 that there are no saturated conditions in the alluvial
9 material at this site.
10 So it is not inconsistent with what I've
11 been saying about the evaporotransporation rates being
12 significantly higher than precipitation rates in this
13 area.
14 And with regards to this water potentially
15 being deeper, I assume you mean this water is
16 infiltrating into the red beds. And I should point
17 out that the permeabilities of the red bed materials
18 out here have been documented to be on the order of 10
19 to the minus 8, and 10 to the minus 9 centimeters per
20 second, which is quite low.
21 So water can't move through those red beds
22 at any rate faster than that, whether the movement of
23 groundwater is up or down, depending on the
24 hydrogeologic setting, the permeability is the factor
25 that controls the rate of movement through the water.

1 And with those permeability rates water
2 doesn't infiltrate readily into the red beds.
3 JUDGE ABRAMSON: Well, we will get the
4 permeabilities later. But the question really was,
5 you don't know, because you just have an investigation
6 that gave us a snapshot in time, but you don't know
7 how much deeper the water may have been present at
8 this same location, at an earlier time, do you?
9 MR. LOVEJOY: No. But I guess I would
10 have to tie it back into the vast amount of data that
11 is available at all the other sites that I've talked
12 about, which are within this same hydrogeologic
13 setting.
14 Invariably the sediments, within the
15 Chinle red beds are generally reported as dry, as
16 noted in course from the other locations, occasional
17 areas where some slight moisture might be documented.
18 But the vast majority of all the cores, from the sites
19 that you've referenced earlier, from the drilling,
20 indicate that the Chinle red beds are dry and,
21 therefore, the water doesn't infiltrate any existence
22 into them.
23 JUDGE ABRAMSON: Perhaps I'm
24 misunderstanding what is being said about the slightly
25 moist portion of these borings. But is it, we have a

1 boring core that comes up, and part of it is moist.
2 What was it like below that, on the boring that was
3 pulled out?
4 Or did the boring stop at these -- I'm
5 reading a testimony that says Mactec boring B-2, for
6 example, was found to be moist between 35 and 41 feet
7 below ground. What was it found to be below 41 feet
8 below ground, or did the boring stop at --
9 WITNESS PEERY: The boring stopped at 41
10 feet below ground surface.
11 JUDGE ABRAMSON: I see. So what -- Mr.
12 Lovejoy, is what you are saying, because the boring
13 stopped there we don't have data for what it was like
14 below that, is that --
15 MR. LOVEJOY: We don't have data for the
16 present day for what was below that. And we don't
17 know what infiltration occurred in the past. There
18 may have been substantial infiltration, and this may
19 be the remnant of it.
20 Episodic infiltration, and episodic
21 recharge, and Mr. Rice will talk about this, can go
22 down, can actually flow, for example, at the contact
23 with the Chinle. And then, after a while, many of
24 these sources can dry up. But it doesn't mean that it
25 didn't happen, and may not happen again.

1 JUDGE ABRAMSON: Is that an accurate
2 statement?
3 WITNESS PEERY: No, it is not an accurate
4 statement.
5 JUDGE ABRAMSON: Could you tell me why?
6 WITNESS PEERY: A good example of what
7 happens in this environment is pointed out by the
8 Wallach quarry and the Baker spring that I referred
9 to, earlier. These people, essentially, have sumps
10 that are dug into the red bed surface that just ponds
11 the water on top of them, it doesn't really infiltrate
12 because of the low permeability of the sediments.
13 These are really clayey materials and, in
14 fact, when -- you are probably aware of this but as
15 clay materials get wet, they tend to hydrate and
16 swell, and you wouldn't expect them to just sit there
17 with open fractures if water was present on them.
18 There has been no determination, from any
19 of these sites, that an interconnected fracture
20 network, that would indicate that water is transmitted
21 through episodic recharge events.
22 JUDGE ABRAMSON: And these borings that we
23 are talking about are in the red bed, they are not --
24 WITNESS PEERY: They terminated in the red
25 bed.

1 JUDGE ABRAMSON: Terminated in the red
2 bed?
3 WITNESS PEERY: Yes.
4 JUDGE ABRAMSON: And there was red bed
5 below them, we believe, lots?
6 WITNESS PEERY: Lots of red bed. The
7 first report of occurrence of a water bearing zone
8 below the ground surface is approximately 220 feet.
9 The red beds start off at depths ranging from 20 to 50
10 feet, nominally --
11 JUDGE ABRAMSON: So when we say the
12 borings stopped at 40 feet, it was into the red bed?
13 WITNESS PEERY: Yes, sir.
14 JUDGE ABRAMSON: And didn't go deeper
15 because the belief was it was red bed for another 100
16 or more feet below that, is that --
17 WITNESS PEERY: Yes, sir, that is correct.
18 And there is also three monitoring wells at this site
19 that are completed in the 220 foot zone which is the
20 only potential water bearing zone to that depth.
21 MR. LOVEJOY: Mr. Peery, these weren't,
22 the ones at Mactec, these were not core holes, were
23 they?
24 WITNESS PEERY: Mactec collected samples
25 with split spoons.

1 MR. LOVEJOY: Were these the ones that
2 were reported on -- I see Mactec's name on it, but
3 they are reported in the Cook-Joyce report, were they
4 core holes?
5 WITNESS PEERY: They were holes where they
6 were -- they didn't core the sediments, they collected
7 the sediment samples using split spoons.
8 MR. LOVEJOY: Now, in the Holt report,
9 which you refer to, there was, groundwater was found
10 in, my notes say, eight, maybe I'm off a little, but
11 there were several bore holes that Holt found
12 groundwater in, is that right?
13 WITNESS PEERY: I recall, off the top of
14 my head, I recall two that groundwater was found. My
15 memory may not be perfect on that, but --
16 MR. LOVEJOY: You might check LES exhibit
17 3, tab E, page 11.
18 (Witness reviews document.)
19 MR. LOVEJOY: The first paragraph there is
20 reference to two at shallow depths where there was
21 water found. And then in the next paragraph they
22 refer to B-4, B-7, B-10, and B-20, four others, deeper
23 wells with water level measurements stated.
24 WITNESS PEERY: Yes, that is right. I
25 guess when I said my memory was water in two of them,

1 I was still stuck on the alluvial issue, the shallow
2 groundwater that we've been talking about.
3 But yes, certainly, they did find water in
4 the deeper zone, which I referred earlier to a sort of
5 anomaly 220 foot deep sump.
6 MR. LOVEJOY: Did you take an anomaly?
7 WITNESS PEERY: Nominally, not anomaly.
8 MR. LOVEJOY: And the Lehman and Rainwater
9 report, which is tab I, had encountered groundwater in
10 17 of the 35 bore holes, is that right? That is tab
11 I, and I'm looking at page 16.
12 WITNESS PEERY: I'm sorry, could you
13 repeat that page again?
14 MR. LOVEJOY: Page 16 of the report.
15 WITNESS PEERY: Could you refer me to
16 exactly where you are on that page?
17 MR. LOVEJOY: It is section 4.2 of WCS
18 Flying W ranch. It says, groundwater is not present
19 continuously beneath the WCS Flying W ranch, but was
20 encountered in 17 of 35 bore holes completed.
21 (Witness reviews document.)
22 WITNESS PEERY: Yes, it does cite that.
23 However, I'm not sure, just looking at that reference,
24 how many of those were deep wells, or how many were
25 shallow, what zones they were completed in.

1 MR. LOVEJOY: Okay. And Cook-Joyce had
2 previously examined the WCS site, and actually the
3 report was -- and they found, they refer to something
4 as the OAG unit.
5 What does that refer to?
6 WITNESS PEERY: That refers to the antlers
7 formation, the unit I have been referring to as the
8 alluvial material.
9 MR. LOVEJOY: And they found saturation in
10 seven bore holes, according to my notes. Take a look
11 at page 6-2.
12 (Witness reviews document.)
13 MR. LOVEJOY: And this was in the alluvial
14 unit.
15 WITNESS PEERY: It says here, saturated
16 conditions were encountered in the OAG unit at 7 of
17 the total of 172 borings located at both the RCRA
18 permitted area. And it goes on.
19 But, again, that really emphasizes what I
20 started off, earlier today, saying that shallow
21 groundwater, in this alluvial material, is found in
22 very isolated areas, and is not continuous throughout
23 this part of Lea.
24 MR. LOVEJOY: In this area, taking into
25 account the WCS site, and the area explored through

1 the Avlis project, do there occur, perched bodies
2 below so-called playa lakes, perked in the alluvium?
3 WITNESS PEERY: Yes, there is a reference,
4 beginning with Nicholson and Clebsch, he refers to
5 them as buffalo wallows, or sometimes they are
6 referred to as playas, which are depressions in the
7 ground surface where water can pond and cause these
8 localized perched water systems within the alluvium.
9 And that is, primarily, where you would
10 expect to find those. And there aren't any of those
11 on the NEF site that have been identified.
12 MR. LOVEJOY: Is it possible that such
13 bodies could actually be created by the NEF site at
14 some of the storm water basins?
15 WITNESS PEERY: I'm not sure if that would
16 be the case. My opinion is that any water that
17 infiltrated, and you are trying to say the storm water
18 detention basin is a big drainage capture, like a
19 playa, but still my opinion is that as water
20 infiltrates through that site, since there is no
21 shallow groundwater present there now, the mechanism
22 for water movement is primarily upwards through
23 evaporotransporation rates.
24 And any water bodies, as I stated earlier,
25 that may temporarily form, would be subject to

1 evaporotransporation. So I wouldn't expect the NEF
2 site to become, or act like a playa.
3 MR. LOVEJOY: Well, now, what you've just
4 said is if it formed, then there would be
5 evaporotransporation, but there is no reason that a
6 perched water body would not form under a storm water
7 basin, if water leaked downwards, is there?
8 WITNESS PEERY: It would depend on the
9 amount of precipitation at any given time. It would
10 depend on the condition of the sediments beneath the
11 detention basin. It could depend on any number of
12 items.
13 JUDGE ABRAMSON: Are you talking about a
14 lined basin, counsel?
15 MR. LOVEJOY: A lined basin would have to
16 leak, Your Honor.
17 JUDGE ABRAMSON: Right.
18 MR. LOVEJOY: And some of the basins are
19 lined, and some are not.
20 JUDGE ABRAMSON: Thank you. And are you
21 concerned with a perched water body forming in either
22 instance?
23 MR. LOVEJOY: Yes, one would be concerned
24 with that.
25 Now, you referred, before to the Walvoord

1 study, and this is the source of the theory that you
2 are using, under which evaporotransporation would
3 cause any water in the alluvium to simply go upwards
4 and transpire, isn't that so?
5 WITNESS PEERY: That is certainly a
6 document that I have relied on to verify what is
7 documented in the field. Since there is no perched
8 water bodies in the alluvium, beneath the NEF site,
9 obviously there is a mechanism that is removing the
10 water from that alluvial interface.
11 And so the Walvoord study seems to
12 simulate that quite well, the study that is related to
13 thick vadose zone within arid environments. And the
14 results of that study indicate that the primary
15 mechanism for water movement in thick arid zone vadose
16 is upwards to evaporotransporation.
17 MR. LOVEJOY: And the study is LES exhibit
18 5, is it not? Why don't you take a look?
19 (Witness reviews document.)
20 CHAIR BOLLWERK: Mr. Lovejoy, whenever you
21 find a good breaking point in your questions, and that
22 is up to you, we will take a break at that point.
23 MR. LOVEJOY: We can do it at any time.
24 CHAIR BOLLWERK: It is really up to you,
25 I don't want to interrupt what you are doing.

1 MR. LOVEJOY: Well, why don't we give the
2 witness a chance to go over the Walvoord study and
3 take a break?
4 CHAIR BOLLWERK: All right, let's take a
5 break. We will take five minutes and be right back.
6 (Whereupon, the above-entitled matter
7 went off the record at 11:05 a.m. and
8 went back on the record at 11:01 a.m.)
9 CHAIR BOLLWERK: Back on the record. Just
10 a reminder, if you happened to turn on your cell
11 phone, while you were out on the break, if you would
12 turn it off again, we would appreciate it.
13 MR. LOVEJOY: Mr. Peery, do you have the
14 Walvoord report, there, LES exhibit 5 in front of you?
15 WITNESS PEERY: Yes, I do.
16 MR. LOVEJOY: This, how much territory, so
17 to speak, does this report examine in reaching its
18 conclusions?
19 WITNESS PEERY: I'm not sure I understand
20 that question.
21 MR. LOVEJOY: What area does this report
22 concern?
23 WITNESS PEERY: Well, it is talking about
24 the general arid soils, thick arid soils, desert
25 environments. That could be applicable to any number

1 of places in New Mexico as well as other states.

2 MR. LOVEJOY: So this report applies to

3 the arid southwest, so to speak?

4 WITNESS PEERY: Sure, where you have thick

5 arid soils.

6 MR. LOVEJOY: And it is not a specific

7 study of data generated, certainly, from the NEF site?

8 WITNESS PEERY: No, but because it is a

9 study of thick desert scils it is applicable to the

10 NEF site, to the mechanisms that removes water,

11 explains the mechanism that removes water from the

12 vadose that would potentially infiltrate during

13 precipitation events.

14 MR. LOVEJOY: So you are relying on this

15 study in expressing your opinion, is that right?

16 WITNESS PEERY: I'm relying on this study,

17 in part, and in part from the observations in the

18 field that indicate that there is no saturated zone in

19 the alluvium above the red bed, so there has to be,

20 obviously, a mechanism that, an evaporotransporation

21 mechanism, that gets rid of water.

22 MR. LOVEJOY: This study, or this report,

23 involves a one dimensional flow model, doesn't it?

24 WITNESS PEERY: Yes.

25 MR. LOVEJOY: Could you explain, to the

1 Board, what a dimensional flow model is?

2 WITNESS PEERY: It simulates water

3 movement through a one dimensional slab of material,

4 vertically.

5 MR. LOVEJOY: And looking at page 44-5, of

6 this publication, and it, it is a sentence, continuing

7 on from the page before, it says: Additional

8 assumptions imposed in this study, but not inherent to

9 FEHM, which is a model, include: One, one day

10 vertical flow adequately represents the hydrodynamics.

11 That is the one, the model we just spoke

12 of, is that right?

13 WITNESS PEERY: That is correct.

14 MR. LOVEJOY: Two, airflow is negligible.

15 Three, chloride behaves conservatively, non-absorbing,

16 and non-reactive, and is non-volatile. And, four,

17 fractures, macro-pores or other preferential flow

18 paths do not affect the system.

19 Are those all fundamental assumptions of

20 this study?

21 WITNESS PEERY: Yes, they are. In fact,

22 any model, whether it is a vadose zone model, a

23 groundwater flow model, models of any kind, always

24 incorporate some type of simplifying assumptions to

25 help us model the physical system of the world.

1 And, in fact, I address this a little bit
2 in my rebuttal testimony. If you would refer to,
3 specifically, question and answer 10, on page 10 of
4 the rebuttal testimony, with respect to the,
5 specifically, to the preferential flow paths not
6 affecting the system, as part of this model the
7 authors performed a sensitivity analysis, and what
8 they did was they varied various inputs in the model,
9 to see how the model responded.
10 And, specifically, if you could read this,
11 we refer to it on page 11, which is the latter portion
12 of answer 10, they accounted for significant
13 variations in soil type, by considering sand, silt,
14 and silty clay, saturated permeability, porosity,
15 geothermal gradient, water table depth, fixed root
16 zone matric potential and vapor diffusion.
17 So they looked at a lot of different
18 things and concluded that their model applies to a
19 broad range of thick unconsolidated vadose zones in
20 semi-arid to arid regions.
21 So I think even with their simplifying
22 assumptions that they had to make to model the natural
23 system, that it is still a valid model.
24 MR. LOVEJOY: The variations they applied
25 in their sensitivity analysis did not include adding

1 preferential flow paths, did they?

2 WITNESS PEERY: No, but it included

3 looking at different materials. So sand, silt, and

4 silty clay, so by modifying the way that water would

5 move through the system, obviously, water would move

6 better through some of these soil types than others,

7 and the saturated permeability.

8 So I guess, in a round-about way, you can

9 say they do. But they don't specifically handle what

10 is referred to as preferential flow paths.

11 MR. LOVEJOY: Okay. So without that

12 addition of that element, of preferential flow paths,

13 the Walvoord model would not apply to locations where

14 there were preferential flow paths, isn't that so?

15 WITNESS PEERY: I suppose that if you had

16 some type of preferential flow path that would be

17 present it could, it may limit the model's use.

18 However, getting back to the NEF site, we don't have

19 significant preferential flow paths at this site.

20 As I talked about earlier we don't have

21 extensive gravel units that are connected in channels

22 throughout the site. So I think it is still an

23 applicable model for this site.

24 MR. LOVEJOY: And if at the NEF site there

25 were fractures, which allowed water to flow downward

1 through a fracture zone, then the Walvoord model would
2 not be applicable?
3 WITNESS PEERY: The alluvial sediments
4 would, most likely, not contain fracturing.
5 MR. LOVEJOY: So is your answer correct,
6 but the alluvial presence of sediments don't contain
7 those fractures?
8 JUDGE KELBER: Mr. Lovejoy, I couldn't
9 hear you. Could you just --
10 MR. LOVEJOY: I'm sorry. The witness made
11 a statement, in answer to my question, and I asked the
12 witness whether his answer is my statement is correct,
13 mine, but adding the additional information he had.
14 Is that so?
15 WITNESS PEERY: If fracturing were to
16 occur, in the alluvial setting, at the NEF site, it
17 may be possible that this model wouldn't be
18 appropriate. However, there is no evidence to suggest
19 any type of fracturing within the alluvial material at
20 the NEF site.
21 JUDGE ABRAMSON: Perhaps I can get a
22 little bit more information for Dr. Kelber and myself.
23 It is a one-dimensional model, Dr. Kelber and I are
24 quite familiar with what one-dimensional models are
25 all about.

1 This is, tell me what this model is
2 attempting to do. It is attempting to predict, is it
3 attempting to predict the flow rates of water through,
4 via various processes through a relatively continuous,
5 or discontinuous medium?
6 WITNESS PEERY: Yes, sir. That is exactly
7 right, it is trying to predict the flow processes
8 through a number of various processes within the soil.
9 JUDGE ABRAMSON: And so it is basically
10 predicting the hydraulic resistance to various flow of
11 various types, right?
12 WITNESS PEERY: Yes.
13 JUDGE ABRAMSON: Through the, and one
14 inputs the medium's characteristics, and from that the
15 code calculates the flow rates?
16 WITNESS PEERY: Yes, the code calculates
17 the amount of water that would be evaporotranspired.
18 JUDGE KELBER: Let me interject at this
19 point. There are various forces acting here. One is
20 a counter to gravity, namely evaporotransporation.
21 This comes about because of the action of agitation,
22 as possibly capillary action elsewhere, but mostly
23 through vegetation, I would gather.
24 And you claim that that is the dominant
25 rate?

1 WITNESS PEERY: The dominant rate is --

2 JUDGE KELBER: The dominant force, I

3 should say.

4 WITNESS PEERY: The dominant force is

5 evaporotransporation.

6 JUDGE KELBER: Acting on the water. There

7 are other faces, namely gravity, which tend to move it

8 in the other direction. So this simple balance of

9 forces, and the difficulty is in calculating what the

10 resistance to flow is in the downward direction,

11 assuming you know what evaporotransporation rate is.

12 I don't see the difficulty here. And I

13 fully understand the limitations of one-dimensional

14 versus two-dimensional, or three-dimensional models.

15 In fact, if the water were to spread out in the

16 horizontal directions it would, clearly,

17 evaporotransporation would be even more dominant.

18 So I don't think, I think I fully

19 understand what you are getting at, with the

20 limitations of this model.

21 JUDGE ABRAMSON: So let me then finish.

22 So that is what this model does, and Mr. Lovejoy then

23 I understand that what you are concerned about is that

24 it may be that a model of a set of full planes, of

25 continuous planes of various materials, is not an

1 accurate model of the site, that there may be
2 discontinuities that would cause, that would allow
3 flow to not be one directional.
4 Is that --
5 MR. LOVEJOY: Yes, there are
6 discontinuities.
7 JUDGE ABRAMSON: Okay. And so that is
8 what this is about, this discussion?
9 MR. LOVEJOY: The discussion of this
10 model, exactly.
11 JUDGE ABRAMSON: Okay, thank you.
12 MR. LOVEJOY: Thank you, Your Honor. The
13 materials, hydraulic conductivity does increase when
14 it is wetted, doesn't it?
15 WITNESS PEERY: It depends on the type of
16 material.
17 MR. LOVEJOY: Well, think about the
18 alluvium at the NEF site, would its conductivity
19 increase when it is wetted?
20 WITNESS PEERY: Some materials have
21 greater hydraulic conductivity when they are
22 saturated. Some water can move through more quickly
23 until they become saturated.
24 The example would be gravel. Gravel, in
25 an unsaturated zone often, because of the poor

1 pressure within the gravel, of course the drain
2 material often acts as a barrier to flow until it
3 becomes saturated, fully saturated, and water would
4 preferentially move through sandy units instead, until
5 it clearly reached saturation.
6 MR. LOVEJOY: And you said that there are
7 instances where water would flow downward beneath the
8 playa at the NEF site, or at nearby sites, is that
9 right?
10 WITNESS PEERY: No, I didn't say at the
11 NEF site. I said water flows down through the playas
12 at the nearby WCS site.
13 MR. LOVEJOY: And you would expect that
14 process to occur at the NEF site, would you not?
15 WITNESS PEERY: As I previously stated,
16 there is not a playa at the NEF site, and I also
17 stated the ability of water to infiltrate through the
18 storm water, site storm water detention basin, would
19 be based on the temperature outside, whether the
20 sediments beneath the pond were saturated, what their
21 moisture content was, and the air temperature, and
22 other things like that.
23 MR. LOVEJOY: So how would the saturation
24 of the sediments affect that flow?
25 WITNESS PEERY: If the sediments were

1 already saturated beneath the pond?

2 MR. LOVEJOY: Yes.

3 WITNESS PEERY: You would continue to have

4 some degree of infiltration until the time where the

5 water was subject to evaporotransporation. Again, the

6 dominant mechanism in these deep arid soils is through

7 vertical migration, or evaporotransporation of water

8 that is infiltrated into the soil.

9 MR. LOVEJOY: Would you term that

10 infiltration a preferential flow path?

11 WITNESS PEERY: No, I would not.

12 MR. LOVEJOY: Can you explain that?

13 WITNESS PEERY: Infiltration is just

14 simply water moving through sediments, it is not a

15 preferential flow path.

16 MR. LOVEJOY: Would there be a

17 preferential flow path at the location where that

18 water is infiltrating?

19 WITNESS PEERY: I don't believe there

20 would be evidence to suggest preferential flow paths

21 for infiltration. Maybe I just don't understand the

22 question.

23 JUDGE ABRAMSON: Would it change the one-

24 dimensional behavior?

25 WITNESS PEERY: If we had a preferential

1 flow path --

2 JUDGE ABRAMSON: No, forget the

3 preferential flow path, and let me just ask about this

4 infiltration if you were, along sediments. If that

5 is radial, rather than vertical, would that change the

6 one-dimensional behavior of the flow?

7 In other words, we are talking about,

8 basically, we have been doing a one-dimensional, up

9 and down calculation. Now we are postulating that

10 there is an indentation, I think -- am I correct, that

11 is what a playa is?

12 WITNESS PEERY: Yes.

13 JUDGE ABRAMSON: An indentation. So we

14 have an indentation, and water sits in the

15 indentation, and it seeps in --

16 WITNESS PEERY: Yes, so once we couple it

17 with the two-dimensional flow and say, the water gets

18 to a point where it starts to migrate out, and

19 saturates the gravel area, and starts to move out

20 horizontally, then it increases the surface area of

21 the water in the system, and it is subject to even

22 greater rates of evaporotransporation.

23 JUDGE ABRAMSON: Which I think is what Dr.

24 Kelber was saying, suggesting, earlier. So, sorry,

25 counsel, but is that where we are going?

1 MR. LOVEJOY: Well, we are going to a
2 slightly different area here, but it does connect.
3 And let me ask you this. Aren't there
4 reports, already, in the literature that you've been
5 looking at, about recharge of the Dockum group
6 underneath the alluvium, coming from overlying areas,
7 overlying strata?
8 WITNESS PEERY: The reports that I have
9 referenced refer to recharged of the Dockum group
10 occurring more than 10,000, 15,000 years ago, those
11 are the reports that I have been referencing, the
12 Dutton and Simkins 1986 report would be the specific
13 one --
14 MR. LOVEJOY: Well, I'm looking at that
15 report, on page 32, where they list the conclusions,
16 over on the right-hand column. Do you have it?
17 WITNESS PEERY: What is the exhibit
18 number, please?
19 MR. LOVEJOY: LES exhibit 6. Now, they
20 are referring to specific river ventilations. It
21 says, in the Pecos and Canadian River valley
22 groundwater basins, groundwaters from the Ogallala
23 formation, Edwards Trinity groups, and permian
24 formations flow into the Dockum group.
25 WITNESS PEERY: That may be true, but we

1 don't have the Ogallala aquifer overlying our site.
2 And, as you are well aware, the Ogallala is a vast
3 groundwater resource that ranges on its basin edges
4 from, you know, a few feet of saturation to over 200
5 feet of saturation.
6 So the reference to having recharge from
7 Ogallala certainly doesn't apply.
8 MR. LOVEJOY: Okay, let me show you
9 another one. Do you have NIRS/PC exhibits there,
10 number 33? It is a report by Mehta -- 33.
11 CHAIR BOLLWERK: Do you want to go ahead
12 and mark it for identification at this point?
13 MR. LOVEJOY: Yes, please, I'm sorry.
14 CHAIR BOLLWERK: Why don't you go ahead
15 and identify it? I think you just did, but --
16 MR. LOVEJOY: Number 33, NIRS exhibit 33
17 for identification is a paper entitled: Controls on
18 the Regional Scale Salinization of the Ogallala
19 Aquifer Southern High Plains Texas, USA by Mehta et
20 al.
21 CHAIR BOLLWERK: Let the record reflect
22 that NIRS/PC exhibit 33 has been marked for
23 identification.
24 (Whereupon, the above-
25 referenced to document was

1 marked as NIRS/PC Exhibit No.
2 33 for identification.)
3 WITNESS PEERY: I have that exhibit in
4 front of me.
5 MR. LOVEJOY: I'm looking at page 851.
6 Let me just ask you, this says, on the right column in
7 the final paragraph, it refers to the Dockum group.
8 And it says, the present recharge to the
9 lower Dockum aquifer is primarily through downward
10 leakage from the Ogallala aquifer. Is that the
11 process you were just talking about?
12 WITNESS PEERY: That is the process I
13 described that wasn't applicable to our site, because
14 there is no Ogallala overlying our site.
15 And with regards to this reference, this
16 is a different hydrogeologic setting in regards to
17 where we are. This is in the northeast part of Texas,
18 near the panhandle, some 270 to 300 miles away.
19 Obviously there is some other things going
20 on with this that make it not applicable, related to
21 the Amarillo uplift, and upwelling of water from the
22 Dockum groups through some sort of network into the
23 Ogallala aquifer, that is primarily what this paper is
24 about.
25 JUDGE ABRAMSON: I'm sorry, what page was

1 that?

2 MR. LOVEJOY: That should have been page

3 851 of exhibit 33.

4 JUDGE ABRAMSON: And where on page 851,

5 can you just point us to it, where on 851.

6 MR. LOVEJOY: It should be the right

7 column, last paragraph.

8 JUDGE ABRAMSON: -- shallow?

9 MR. LOVEJOY: Yes.

10 JUDGE ABRAMSON: Okay.

11 MR. REPKA: Now that you've seen that, do

12 you want to hear what he said, again?

13 JUDGE ABRAMSON: Yes, please.

14 WITNESS PEERY: What I was saying is that

15 it doesn't apply to our location for several reasons.

16 One being that the presence of the Ogallala, in this

17 area, and the non-presence of the Ogallala at the NEF

18 site.

19 Additionally, this study is from the

20 northeast portion of Texas, near the panhandle, by

21 Oklahoma. Also the reference, hydrogeologic setting

22 is different, it has some discussion about the

23 Amarillo uplift in there, in addition to the paper

24 primarily being related to an area that has been

25 fractured, or something, where water is upwelling into

1 the Ogallala, causing a brine water quality within the
2 Ogallala pressure water quality aquifer.
3 So it is not very applicable to our site.
4 MR. LOVEJOY: Do you have the LES exhibits
5 there? Maybe we should move a little closer to home.
6 WITNESS PEERY: Yes.
7 MR. LOVEJOY: The Holt report refers to
8 moisture being found at the WCS site, at the alluvial
9 Chinle contact, at numerous locations. Do you
10 remember that?
11 MR. REPKA: Which exhibit, again, are we
12 referring to?
13 MR. LOVEJOY: LES exhibit 3, in your tabs
14 E, F, and G, the report is separate from the well
15 logs.
16 WITNESS PEERY: Yes, I remember this
17 report.
18 MR. LOVEJOY: And you might want to look
19 at the well logs which are in tab G. And by my notes
20 you should look at B-23, B-37, --
21 WITNESS PEERY: Let me start with 23. I'm
22 sorry, I'm trying to find the log, give me a moment.
23 MR. LOVEJOY: I am, too, my expert is
24 finding the exact reference.
25 JUDGE ABRAMSON: They seem to be ordered

1 by boring number.

2 MR. LOVEJOY: Okay, here it is. I've got

3 B-23, and --

4 JUDGE ABRAMSON: It is about five pages

5 in.

6 MR. REPKA: Try looking under grid number

7 7-I, in the upper right-hand corner.

8 JUDGE ABRAMSON: Have you found boring B-

9 4? It is right after boring B-4, at least in my

10 volume.

11 MR. LOVEJOY: Do you see the reference?

12 WITNESS PEERY: Yes, I have boring log B-

13 23 in front of me.

14 MR. LOVEJOY: Do you see, listed under

15 stratigraphic intervals, the Ogallala, and then

16 triassic underneath it, on the right-hand side?

17 WITNESS PEERY: Yes, I do.

18 MR. LOVEJOY: And would you associate that

19 with the contact between alluvium and the Chinle?

20 WITNESS PEERY: Yes, I would.

21 MR. LOVEJOY: Over in the logging data box

22 it says, moist, among other things. Do you see that?

23 WITNESS PEERY: Yes, it does. And if you

24 turn it over, and look at the other side of the log,

25 for the next description at depth 54, what we were

1 just looking at was from 37 to 54 feet.

2 If you look at the log from 54 to 59 and

3 a half feet, it is reported as dry in that location,

4 which would, to me, indicate that the Chinle is an

5 effective barrier to vertical migration of water.

6 MR. LOVEJOY: But there was water

7 reported?

8 WITNESS PEERY: There was some moist -- it

9 doesn't say water, it says moist. And, again, as I

10 described earlier, when you log headings, moist does

11 not indicate saturated conditions. You would expect

12 someone to report saturated conditions as such, not

13 just the occurrence of moist sediments.

14 MR. LOVEJOY: A few pages on, under B-37,

15 I see a similar entry, moist, at the Ogallala triassic

16 for --

17 WITNESS HARPER: I would like to add a

18 little more information on the classification of the

19 cuttings. I had discussions with the individuals who,

20 and I'm referring back to the borings on the NEF site,

21 I had discussions with the individuals who logged all

22 the slightly moist cuttings, and the moist cuttings.

23 And in borings B-2 and B-9. And, in both

24 cases, they indicated that those were just indicative

25 of moisture, and of not-saturated conditions. As a

1 matter of fact, they mentioned that when they took the
2 alluvium cuttings, and rolled them in their hand, they
3 just very slight coagulated, which just indicated a
4 slight amount of moisture.
5 MR. LOVEJOY: That is a different
6 location.
7 WITNESS HARPER: Different location,
8 correct.
9 MR. LOVEJOY: Do you see --
10 WITNESS PEERY: Are we referring to
11 another boring after that one, or are we still looking
12 at B-23?
13 MR. LOVEJOY: I was referring to B-37.
14 WITNESS PEERY: To 37, or 27?
15 MR. LOVEJOY: B-37, which is -- sorry,
16 they are not in a numerical order. It is 8-C.
17 JUDGE ABRAMSON: So 8 Charlie?
18 MR. LOVEJOY: It's 8 Charlie.
19 WITNESS PEERY: I have B-37, grid number
20 8-C, in front of me.
21 MR. LOVEJOY: And do you see the entry
22 moist at about the contact between alluvium and the
23 Chinle?
24 WITNESS PEERY: Yes, I do.
25 MR. LOVEJOY: Okay. And, again, this

1 follows the same, or at least a similar pattern to
2 what I just described at the previous boring, where
3 you have some reports of moist material in the upper
4 portion of the Chinle.
5 But as you get to 61 to 81 feet log, we
6 have reported dry within the Chinle sediments, there.
7 MR. LOVEJOY: I think the next log is B-
8 18. Let me ask you to look at that one. Let me ask,
9 these logs use the expression Ogallala. What is that
10 referring to?
11 WITNESS PEERY: Initially, the initial
12 investigators in this area thought that the -- what
13 I'm referring to as the alluvium in a sense, and are
14 currently referred to as the antlers formation, the
15 initial investigators thought it was Ogallala, the
16 published geologic maps in this part of New Mexico had
17 described it as Ogallala, which is essentially an
18 alluvial material, also.
19 And so the investigators, in '93, called
20 it that. So it doesn't really change the designation,
21 or the physical properties of that overlying material.
22 MR. LOVEJOY: How do you refer to that?
23 WITNESS PEERY: I have just been referring
24 to it as the alluvial material, but I would refer to
25 it as the antlers.

1 MR. LOVEJOY: Would you look on B-18,
2 which is, I think the next one? Yes. Look again at
3 the contact report.
4 WITNESS PEERY: Yes, I have B-18 grid 8-B
5 in front of me.
6 MR. LOVEJOY: And do you see the entry
7 moist under the loggers information report?
8 WITNESS PEERY: Yes, I do, and that looks
9 to be at the contact between the alluvium and the red
10 beds. But, yes, I see that. No mention of saturated
11 conditions, but moisture.
12 MR. LOVEJOY: That means water, doesn't
13 it?
14 WITNESS PEERY: That means a relatively,
15 on a relative scale it means unsaturated conditions.
16 JUDGE ABRAMSON: Counsel, we have the
17 picture on this.
18 MR. LOVEJOY: Well, I will just --
19 JUDGE KELBER: Are we going through all,
20 what are they, 7 out of 109 borings that had moisture
21 at WCS?
22 JUDGE ABRAMSON: Do you have any that
23 differ from these?
24 MR. LOVEJOY: I will just read the logs
25 into the record.

1 JUDGE ABRAMSON: Okay, that is fine.

2 MR. LOVEJOY: And you can check the list,

3 if you would like.

4 JUDGE ABRAMSON: Yes. If there is

5 something more, another point you want to make about

6 this, fine. Otherwise let's move on.

7 MR. LOVEJOY: Okay. By my notes the

8 entries show moisture at the contact of the alluvium

9 and the Chinle in well logs B-23, B-37, B-18, B-33, B-

10 13, B-27, B-46, B-36, B-44, B-19, B-25, B-35, B-20, B-

11 45, B-51, B-52.

12 Mr. Peery, have you studied these logs in

13 preparation for your testimony?

14 WITNESS PEERY: Yes, I have. And what I

15 found was that you see the repeated pattern that we

16 described on the first couple of logs, where there is

17 a mention of moisture at the alluvial contact, the

18 triassic red beds.

19 It is almost invariably followed by the

20 mention of dry Chinle below it indicating that water

21 does not migrate vertically through that Chinle red

22 bed surface.

23 MR. LOVEJOY: You said, in your rebuttal

24 testimony, referring to bore hole B-2, on the NEF

25 site, that --

1 WITNESS HARPER: What question are you
2 referring to?
3 MR. LOVEJOY: Question 11, question and
4 answer 11, on page 12. So in the case of boring B-2,
5 referring to this moisture, it may have worked its way
6 down, over long periods of time, to the low permeable
7 Chinle clays.
8 Is that your interpretation, also, as to
9 the moisture at the contact point shown in these logs,
10 in the Holt report?
11 WITNESS PEERY: Yes, that is the most
12 likely mechanism to get water to the alluvial contact
13 of some infiltrated water that is subsequently lost to
14 evaporotransporation, and just from a standpoint that
15 you might understand a little better, clays are able
16 to hold on to water better than sands, and silts, and
17 gravels, and things like that.
18 So it would take a longer period of time
19 for water to be lost from the clayey material.
20 MR. LOVEJOY: How long does it take to get
21 down there?
22 WITNESS PEERY: I don't know how long it
23 takes to get down there.
24 MR. LOVEJOY: I'm going to ask you
25 something about the Lehman Rainwater report, again,

1 which is LES exhibit 3, tab I. On page 17 of this
2 report --
3 WITNESS PEERY: I have page 17 in front of
4 me.
5 MR. LOVEJOY: -- it says, in the middle of
6 the first carryover paragraph, water table elevations
7 suggest that groundwater here likely reflects local
8 recharge, and not regional lateral flow within the
9 high plains aquifer.
10 The many closed surface depressions, along
11 the crest of the red bed ridge could act as local
12 recharge points.
13 Why don't you take a look at that and I'm
14 going to ask you whether you agree with that
15 determination.
16 (Witness reviews document.)
17 MR. REPKA: Would you repeat your
18 statement again, please?
19 MR. LOVEJOY: I read that text and I asked
20 whether the witness agreed with it.
21 WITNESS PEERY: It appears that Dr. Lehman
22 is referencing recharge to the alluvial sediments near
23 the WCS site, and in reference to where there is
24 depressions in the groundwater surface, where the
25 caprock caliche is at or near the land surface.

1 So it refers to recharge within a specific
2 area, not throughout the entire southern Lea County
3 alluvial sediments overlying the Chinle red beds.
4 MR. LOVEJOY: What is different about this
5 area?
6 WITNESS PEERY: One of the differences is
7 the presence of the caprock at the surface, as noted
8 previously, when I discussed the Wallach quarry, some
9 places the caprock is quite fractured, and
10 precipitation can infiltrate through the fractured
11 caprock and get into the alluvial sediments, which
12 then reduces its ability to be evaporotranspired
13 locally.
14 And the presence of the, essentially the
15 playa type setting, the depressions in the surface,
16 which have helped form these localized alluvial
17 groundwater systems.
18 MR. LOVEJOY: Would you look at figure 10,
19 which is on page 30?
20 WITNESS HARPER: I might add too, there is
21 no caprock caliche at the NEF site.
22 MR. LOVEJOY: Sorry?
23 WITNESS HARPER: There is no caprock
24 caliche at the NEF site.
25 MR. LOVEJOY: Yes, thank you. Could you

1 look at figure 10 on page 30? What does this depict?
2 WITNESS PEERY: Figure 10's title is
3 groundwater elevation and saturated thickness.
4 MR. LOVEJOY: And, are there -- there are
5 lines here. Is this -- are these isopacs?
6 WITNESS PEERY: Well, one of the contours
7 shown is the groundwater table elevation. And the
8 other contour is the saturated thickness.
9 MR. LOVEJOY: Okay.
10 WITNESS PEERY: And, if you'll note, the
11 saturated thickness is quite small, with the largest
12 contour interval being about ten feet and also
13 delineates the extent of the saturated tube, the
14 amount adhered to the east and the west.
15 So, the saturated extent of this alluvium
16 does not extend into New Mexico, but rather appears
17 that it's just in the Texas portion there in the main
18 part of this exhibit.
19 MR. LOVEJOY: The other than the northern
20 part of this map, say section 17 and 18, what is the
21 gradient? What way is the water flowing?
22 WITNESS PEERY: What is the gradient?
23 MR. LOVEJOY: What direction? Do you
24 know?
25 WITNESS PEERY: The gradient is to the

1 south-east.

2 MR. LOVEJOY: The south-east?

3 WITNESS PEERY: Yes.

4 MR. LOVEJOY: And is that so, say, in the

5 southern part, in sections 8 and 9?

6 WITNESS PEERY: Yes.

7 MR. LOVEJOY: Okay.

8 WITNESS PEERY: It becomes more eastward,

9 but it still has a southern component. There's a note

10 here. It's hard to see, on the very eastern portion

11 of this, about drainage to Salt Lake.

12 I'm not sure what that refers to, if

13 that's a surface water feature or if it refers to

14 drainage of this alluvial water to some larger plio-

15 system. I'm not sure.

16 MR. LOVEJOY: Would you look at figure 2

17 on page 22?

18 JUDGE KELBER: Before you go on, what

19 you've just said is that the water that we're talking

20 about, which is in Texas, is flowing into the rest of

21 Texas.

22 WITNESS PEERY: Yes.

23 JUDGE KELBER: It has nothing to do with

24 New Mexico?

25 WITNESS PEERY: No, this is primarily

1 about water flowing -- there's a small portion of it
2 near the New Mexico border several miles north of the
3 WCS site.
4 But, the vast majority of this water is
5 just water Texas flowing somewhere else in Texas.
6 JUDGE KELBER: Thank you.
7 WITNESS PEERY: Yes, sir.
8 JUDGE ABRAMSON: Would you remind me what
9 exhibit this is?
10 MR. LOVEJOY: This is LES Exhibit 3 Tab I.
11 JUDGE ABRAMSON: Tab I, thank you.
12 MR. LOVEJOY: The Lehman rainwater report.
13 JUDGE ABRAMSON: Thank you.
14 MR. LOVEJOY: On figure two -- do you have
15 that?
16 WITNESS PEERY: Yes, I have figure 2.
17 MR. LOVEJOY: Does this depict the
18 presence of the caprock caliche?
19 WITNESS PEERY: Yes, it does.
20 MR. LOVEJOY: And, actually, there is
21 groundwater present as shown on figure 10 in several
22 areas, not overlain by the caprock caliche, isn't it?
23 WITNESS PEERY: Yes, that's true. And
24 there's also a significant amount of the saturated
25 area underneath the caprock caliche.

1 MR. LOVEJOY: Okay. So, the presence of
2 the caprock caliche is not necessary for the formation
3 of groundwater?
4 WITNESS PEERY: No. It's not the only
5 mechanism that's necessary. The other one is to have
6 these playa areas, these big depressions in the
7 surface of the ground where water can -- as we
8 discussed previously.
9 JUDGE KELBER: Is what we're discussing
10 here a rather well-known phenomenon, namely water
11 tends to run downhill?
12 WITNESS PEERY: I'm sorry, sir?
13 JUDGE KELBER: Is what we are discussing
14 through this last hour or so a well-known phenomenon,
15 water tends to run downhill?
16 WITNESS PEERY: Certainly it appears to be
17 that way.
18 JUDGE KELBER: Thank you.
19 MR. LOVEJOY: Now, no methods have been
20 used to determine the age of water present at the NEF
21 site as far as you know, is that right?
22 WITNESS PEERY: The water is present at
23 the 220 foot zone within the Chinle sediments. But no
24 methods have been undertaken to try to determine the
25 age of that, rather, by reference we refer to the

1 Dutton & Simpkin's 1986 report which describes the age
2 of the water in the Chinle formation.
3 MR. LOVEJOY: And for what area is that?
4 WITNESS PEERY: It covers -- the study
5 indicates that it covers a portion of New Mexico into
6 Texas, as I recall, looking at the Dockum group
7 aquifer or the Santa Rosa aquifer.
8 CHAIR BOLLWERK: Are we referring to an
9 exhibit here? Is that the same one? Are we still --
10 WITNESS PEERY: I refer to a different
11 exhibit. And I apologize for not mentioning the
12 exhibit number.
13 MR. LOVEJOY: It's Dutton & Simpkin, it's
14 LES Exhibit eight.
15 WITNESS PEERY: Exhibit 6.
16 MR. LOVEJOY: LES Exhibit 6.
17 JUDGE ABRAMSON: Okay.
18 WITNESS PEERY: I'm sorry.
19 MR. LOVEJOY: Now, concerning -- you've
20 spoken about permeabilities in the Chinle. And you
21 said that, in general, it is extremely impermeable.
22 And, actually, isn't it so that at the NEF site, there
23 has been one test of permeability of the Chinle? Is
24 that right?
25 WITNESS PEERY: I believe that is correct.

1 MR. LOVEJOY: Okay. And, that was a slug-
2 test. And that's the kind of test which defines
3 permeability in situ with respect to the immediately
4 surrounding areas, is that right?
5 WITNESS PEERY: Yes. A slug-test is able
6 to generally only test that portion of the formation
7 very near the well. And, the unfortunate thing is the
8 slug test -- the unfortunate thing is that a more
9 detailed analysis of the water in the 220 foot zone,
10 which is where the slug-test was performed, couldn't
11 be performed.
12 The sediments are very low yielding. The
13 slug-test indicated a permeability on the order 3.7
14 times ten to the minus six centimeters per second. So
15 it also recovers quite slowly.
16 We couldn't do a pumping test in this kind
17 of environment because, by the time you run a pump
18 into the well and fill the drop-pipe and get it to the
19 surface, you might be fortunate enough to get a few
20 gallons out, but that would be it.
21 So, a slug-test is really the best
22 mechanism you have to test this kind of environment.
23 MR. LOVEJOY: At the time the slug-test
24 was being run, were any other tests considered?
25 WITNESS PEERY: As far as I'm aware, there

1 were no other tests considered --

2 MR. LOVEJOY: And --

3 WITNESS PEERY: -- because, --

4 WITNESS HARPER: The slug-test was chosen

5 based on recommendations from the consultant Cooke-

6 Joyce, based on their familiarity with the adjacent

7 sites.

8 JUDGE ABRAMSON: Were slug-tests performed

9 on other sites?

10 WITNESS PEERY: Cooke-Joyce performed two

11 slug tests at the WCS site. And, as I recall, the

12 permeability from those were on the order of ten to

13 the minus eight for the same water bearing unit

14 present at the NEF site.

15 JUDGE ABRAMSON: And the drillings

16 indicate that that same unit is relatively consistent

17 across this area of testing?

18 WITNESS PEERY: Yes, it's found throughout

19 the WCS site and at the NEF site.

20 JUDGE ABRAMSON: So, is there any reason

21 to believe that a -- we have three tests, right, three

22 slug tests that we are performing?

23 WITNESS PEERY: Yes, sir.

24 JUDGE ABRAMSON: To your knowledge. And,

25 were they all the same, give the same result, give

1 relatively consistent results? Did they vary a little
2 or a lot?
3 WITNESS PEERY: They were all pretty
4 close. The one at the NEF site had a permeability, a
5 conductivity of ten to the minus six centimeters per
6 second.
7 And, at the WCS site, ten to the minus
8 eight centimeters.
9 JUDGE ABRAMSON: What's the typical error
10 bounds for that kind of test? Ten to the minus six
11 plus or minus ten to the minus six or --
12 WITNESS PEERY: Well, probably not that
13 much. In order of magnitude it certainly isn't
14 unreasonable to expect from that kind of test.
15 JUDGE ABRAMSON: So, the geology is the
16 same across this area. And the tests are consistent.
17 And the lowest permeability was ten to the minus six?
18 No, the lowest was ten to the minus eight.
19 WITNESS PEERY: Ten to the minus eight.
20 JUDGE ABRAMSON: And the highest was ten
21 to the minus six.
22 WITNESS PEERY: So, within the error bar
23 of what I describe we're talking the same kind of
24 environment.
25 JUDGE ABRAMSON: Thank you.

1 MR. LOVEJOY: Now, there have been no
2 tests to determine hydraulic properties of the
3 alluvium. Is that right?
4 WITNESS PEERY: No, there have been no
5 tests.
6 MR. LOVEJOY: Okay. And, what kind of
7 tests could have been done?
8 WITNESS PEERY: Well, I mean, there's any
9 number of tests that could have been done, including
10 some laboratory permeability tests which would
11 probably be the best.
12 But, in the absence of any groundwater
13 there, there was no testing done.
14 MR. LOVEJOY: There are some permeability
15 figures that show up in exhibit 1, which is part of
16 the environmental report in table 3.3-2. And these
17 are lab data, is that right?
18 WITNESS PEERY: I'm sorry, you're
19 referring to LES Exhibit 1 or --
20 MR. LOVEJOY: LES Exhibit 1, yes.
21 MR. REPKA: And the table number again
22 was?
23 MR. LOVEJOY: It was 3.3-2.
24 MR. REPKA: Thank you.
25 WITNESS PEERY: You're at table 3.3-2?

1 MR. LOVEJOY: Yes, 3.3-2.

2 WITNESS PEERY: Okay.

3 MR. LOVEJOY: And the question was, are
4 these lab tests, the results of lab tests of
5 permeability?

6 WITNESS PEERY: My understanding is, that
7 these are laboratory permeabilities.

8 MR. LOVEJOY: Okay. And, I think you've
9 said that lab tests would be biased towards showing
10 higher permeabilities than in situ tests. Is that
11 right? Is that what you said?

12 WITNESS PEERY: Yes. For the Chinle
13 formation and the silt stones, you know, the
14 consolidated materials beneath the site in the red-
15 beds group sediments, the sample collection methods
16 lead to fracturing of themselves, which would then in
17 turn lead to higher laboratory permeabilities.

18 Whenever you drill into a formation and
19 try to collect these you have, you know, rotation of
20 the drilling equipment. Also, if the sediments are
21 consolidated and hard, there's also some pounding as
22 these things are collected.

23 So, you do end up with some additional
24 fracturing within the sediment as they are collected.
25 In fact, Dr. Rainwater in his 1996 report, which is --

1 I've got the one -- which is, I think Exhibit H in
2 your exhibits, in our exhibits.
3 MR. CURTISS: It should be LES Exhibit
4 three tab H.
5 WITNESS PEERY: Thank you. Dr. Rainwater
6 on evaluation of the cores that you referenced in the
7 Holt report indicated that there were few fractures in
8 those cores not created by sampling methods.
9 So, it is my opinion also that the
10 laboratory permeabilities would tend to bias towards
11 the high side or showing greater permeability, if you
12 will.
13 MR. LOVEJOY: But a lab -- or rather a
14 core taken and then analyzed in the lab would not
15 reflect any permeabilities attributable to fractures
16 that were missed by the core, would they?
17 WITNESS PEERY: Not that were missed by
18 the core. But, as I stated earlier, there was over 50
19 laboratory -- vertical laboratory permeability -- or
20 samples collected for laboratory permeability at the
21 WCS site.
22 Approximately six horizontal permeability,
23 in all of those, indicate that the permeability is
24 very low. It doesn't give rise to the fact that there
25 is some vast network of fractures that occur

1 underneath the site.

2 Indeed, it doesn't appear to be born out

3 in the data themselves. And, while I'm on the point

4 of fracturing, I'd like to point out that it's not

5 just the mere presence of a fracture that creates a

6 fast flow path.

7 What it is, is the presence of

8 interconnected fractures. That's what it takes to

9 move water through sediments that create vast flow

10 paths.

11 If you had a significant amount of

12 fracturing, for instance, as Mr. Rice has

13 hypothesized, in this environment, you would have to

14 have some pretty substantial fracturing within the

15 clays.

16 It couldn't heal up as they became

17 saturated because, as I mentioned earlier, the clays

18 swell. In addition to that, the sandy silt stone

19 present at the 220 foot depth would also have to be

20 fractured.

21 And it would therefore then have a higher

22 permeability. It has been documented that the

23 permeabilities of that zone are quite low.

24 Furthermore, if an extensive inter-connected fracture

25 occurred, the water present at the 220 foot zone would

1 not be present under confined conditions.

2 It would be present under un-confined

3 conditions. And it is present under confined

4 conditions both at the NEF site and the WCS site.

5 JUDGE ABRAMSON: Mr. Peery, if there were

6 -- if the clay layer were discontinuous, that is, if

7 it had a gravel path that went through it, that would

8 permit such an interconnection between the two water

9 bearing layers, right?

10 WITNESS PEERY: Within the clay unit

11 itself?

12 JUDGE ABRAMSON: Yes. Suppose we're

13 talking about a large, thick, horizontal strata of

14 clay. I understand that clay, once it gets moist,

15 swells up and heals up the cracks.

16 But, suppose that instead of just a crack,

17 that there were actually a penetration through it

18 containing gravel or something. Then gravel could

19 flow through it.

20 WITNESS PEERY: Yes, sir. That's what it

21 would take. It would take sand or gravel-filled

22 fractures to --

23 JUDGE ABRAMSON: And, is there any

24 evidence from any of these borings that such a thing

25 exists?

1 WITNESS PEERY: Not that I've seen.

2 MR. LOVEJOY: Well, you said several

3 things in your answer to one of the previous

4 questions. You said something about permeability

5 tests at the WCS site.

6 Which report are you referring to? Which

7 data are you referring to?

8 WITNESS PEERY: You can probably reference

9 it by looking in my direct testimony. It's actually

10 the WCS 2004 report, if that helps us narrow it down.

11 MR. LOVEJOY: I see the discussion on page

12 17. Is that what you mean?

13 JUDGE ABRAMSON: Seventeen of?

14 MR. LOVEJOY: Direct testimony.

15 WITNESS PEERY: Yes, of the direct

16 testimony, page 17, answer 24.

17 MR. LOVEJOY: Okay.

18 WITNESS PEERY: LES Exhibit 3, tab O would

19 be the appropriate exhibit.

20 MR. LOVEJOY: And you refer to the fact

21 that the aquifer at 220 feet, 225 feet is under

22 confined conditions. In hydrology, is there an

23 expression leaky aquifer or semi-confined aquifer?

24 Have you ever heard that?

25 WITNESS PEERY: Certainly.

1 MR. LOVEJOY: Certainly?

2 WITNESS PEERY: Yes, I have heard that

3 term.

4 MR. LOVEJOY: What is it?

5 WITNESS PEERY: It just means that water

6 can leak through -- if it's under confined conditions,

7 that water can leak through the beds that may keep it

8 confined.

9 And that leakage rate is dependent upon

10 the permeability of the confining unit. In this case,

11 the permeability of the confining unit is, again, ten

12 to the minus eight.

13 So, any leakage through this would be at

14 those rates. Yes, it's limited by the permeability of

15 the overlying sediment.

16 MR. LOVEJOY: Where do you get ten to the

17 minus eight?

18 WITNESS PEERY: That's from the laboratory

19 data from the WCS site that I just referred to.

20 JUDGE ABRAMSON: But it might be as high

21 as ten to the minus six. Did I understand that from

22 the data we talked about earlier?

23 WITNESS PEERY: Yes, the permeability of

24 the overlying shales and clay stones overlying the 220

25 foot zone, they have permeabilities of ten to the

1 minus eight to tent to the minus ten with horizontal
2 reports of the same, ten to the minus eight and ten to
3 the minus 11, actually.
4 So, that would be the limiting factor for
5 upward leakage.
6 MR. LOVEJOY: Can you say what you're
7 referring to in making that statement?
8 WITNESS PEERY: I was referring to the
9 table you pointed me at earlier.
10 MR. LOVEJOY: That's in Exhibit 1?
11 WITNESS PEERY: The NEF environmental
12 report, table 3.3-2.
13 MR. LOVEJOY: And those are lab test
14 values?
15 WITNESS PEERY: Correct.
16 MR. LOVEJOY: And you say in your
17 rebuttal, and you've said here, that lab test values
18 generally overstated permeability.
19 WITNESS PEERY: In this type of geologic
20 setting, yes.
21 MR. LOVEJOY: Okay. Would you look at --
22 and perhaps I should identify now for the record --
23 NIRS/PC Exhibit 43, a report by Olson & Daniel. I'll
24 identify it.
25 It's entitled permeability and groundwater

1 contaminant transport, a symposium sponsored by ASTM
2 committee on soil and rock perches.
3 WITNESS PEERY: I'm sorry, could you
4 repeat the exhibit number again?
5 MR. LOVEJOY: It's number 43.
6 WITNESS PEERY: Forty-three?
7 CHAIR BOLLWERK: Let the record reflect
8 that NIRS/PC Exhibit 43 has been marked for
9 identification.
10 (Whereupon, the above-
11 referenced to document was
12 marked as NIRS/PC Exhibit No.
13 43 for identification.)
14 MR. LOVEJOY: And I'm looking at the
15 table, table four, comparing laboratory and field
16 conductivity measurements.
17 MR. REPKA: Do you have a page number for
18 that?
19 MR. LOVEJOY: It comes just after page 55,
20 page 56. And you can see there's a couple of columns
21 over which the legend K centimeters per second shows
22 up.
23 And then there are two columns, laboratory
24 and field. And, I'll just ask you to --
25 MR. REPKA: Do you have it Mr. Peery,

first?

WITNESS PEERY: Yes, I have that in front of me.

MR. REPKA: Okay, go ahead.

MR. LOVEJOY: The question is, how many times was the laboratory value greater than the field value, just in these columns?

JUDGE ABRAMSON: Sorry, which was the table number, please?

MR. LOVEJOY: Table four.

JUDGE ABRAMSON: Table four.

WITNESS PEERY: I have addressed this in my rebuttal testimony.

JUDGE ABRAMSON: All right, there's a question pending then or has he answered it?

MR. LOVEJOY: He was answering it.

WITNESS PEERY: I was starting to answer it. And I address this document in my rebuttal testimony as part of question and answer 22 on page 21.

(Pause.)

CHAIR BOLLWERK: Is that the entire answer or are you ready?

WITNESS PEERY: No, I'm ready Your Honor.

CHAIR BOLLWERK: All right.

1 WITNESS PEERY: I'd like to read something
2 from page 22 of my rebuttal exhibit. It says that --
3 this is the first sentence on the page, not -- the
4 range and the ratio of fields hydraulic conductivity
5 in the laboratory and hydraulic conductivity is from
6 0.3 to 46,000.
7 But, nearly 90 percent of the observations
8 lay within the range of 0.38 to 64. In other words,
9 laboratory measured hydraulic conductivity values were
10 in fact in numerous cases greater than field measured
11 cases.
12 In any case, field values that exceeded
13 laboratory values by more than a ratio of ten to one
14 were rare and appeared to reflect the use of
15 laboratory values back-calculated from consolidation,
16 i.e. Terzagh's theory as opposed to the use of
17 directly measured values.
18 Another thing I'd like to point out
19 related to this table, it's my understanding that your
20 witness Mr. Rice's contention is that field measures
21 are always better or give better data than laboratory
22 measurements.
23 There is no documentation here to support
24 that the laboratory data collected is indeed of a
25 higher quality or more representative of the systems

1 from which they were collected than corresponding
2 laboratory data would have been.
3 And, in fact, further in this report it
4 indicates that field measurements for the unsaturated
5 zone are at a rudimentary stage of development.
6 MR. LOVEJOY: It says that in Olson &
7 Daniel?
8 WITNESS PEERY: Yes, sir.
9 MR. LOVEJOY: Well, they only measure the
10 immediate area of the test, don't they? Is that what
11 you mean?
12 WITNESS PEERY: I'm just referencing that
13 from your document.
14 MR. LOVEJOY: Excuse me?
15 WITNESS PEERY: I just wanted to reference
16 that from your document.
17 JUDGE ABRAMSON: Counsel, can I ask you a
18 question?
19 MR. LOVEJOY: Yes.
20 JUDGE ABRAMSON: Are you focusing
21 particularly on the permeability of the clay layers?
22 Or are you worried about permeability of other layers
23 as well?
24 Is the issue here whether or not water can
25 get down to the Ogallala aquifer?

1 JUDGE KELBER: Ogallala, that's the wrong
2 aquifer. Santa Rosa.
3 JUDGE ABRAMSON: Oh, the Santa Rosa
4 aquifer.
5 MR. LOVEJOY: On of the issues is whether
6 it does get down there. And they've maintained that
7 the Chinle is impermeable and would not admit that
8 flow.
9 The flow also may occur, as he has
10 discussed, along the top of the Chinle where the
11 alluvium contacts the Chinle.
12 JUDGE ABRAMSON: Okay.
13 MR. LOVEJOY: So, they are both
14 possibilities.
15 JUDGE ABRAMSON: But, what's the reason
16 for this intense focus on whether we've got an
17 accurate measurement of permeability or not? Are we
18 worried about the permeability of the clay?
19 MR. LOVEJOY: The Chinle -- yes, the red
20 beds. That's where they're focusing on the
21 permeability and the rock --
22 JUDGE ABRAMSON: And the measurements
23 we've seen are largely laboratory data. And we've
24 seen numbers that run from -- for this one we're
25 talking ten to the minus eight to ten to the minus

1 eleven?

2 WITNESS PEERY: Yes, sir.

3 JUDGE ABRAMSON: And, if we're off by two

4 orders of magnitude, what does it do? Is it still

5 relatively impermeable at ten to the minus six? What

6 I'm wondering, is this worth all the effort we're

7 putting into it.

8 MR. LOVEJOY: Well --

9 JUDGE ABRAMSON: So we're off -- if we're

10 off by a factor of 100, we still have ten to the minus

11 six for a permeability. Does it matter?

12 MR. LOVEJOY: Well, we may be off by

13 considerably more than that due to missing the

14 fractures that --

15 JUDGE ABRAMSON: Okay, fractures is

16 another issue. You're spending a lot of time on

17 permeability. Where's it going?

18 MR. LOVEJOY: Okay. Maybe we'll come back

19 to it. I'll -- let me move on to a question of the

20 fractures.

21 JUDGE ABRAMSON: Please.

22 MR. LOVEJOY: We looked previously at the

23 laws that were attached to Mr. Holt's report in

24 addition to the moisture -- there were a lot of

25 reports of fractures in those logs. Do you remember

1 that?

2 WITNESS PEERY: I recall that there were

3 reports of fractures in the report. But, I wouldn't

4 say lots of fractures.

5 CHAIR BOLLWERK: Mr. Lovejoy, I just want

6 to mention one thing. When you turn around and speak,

7 I see the Court Reporter's ears going up. So, if

8 you're talking when you're facing the box, he's

9 missing it.

10 MR. LOVEJOY: I'm sorry.

11 CHAIR BOLLWERK: I just want to make sure

12 the record's complete, that's all.

13 MR. LOVEJOY: I need to remember the

14 electronic part.

15 MR. REPKA: And I'll ask Mr. Peery to

16 maybe move that microphone a little closer.

17 WITNESS PEERY: Yes, sir.

18 MR. LOVEJOY: If you could look at Exhibit

19 3, tab G, LES exhibit 3 tab G again. I'm looking now

20 at the log of B-43.

21 JUDGE ABRAMSON: B-43?

22 MR. LOVEJOY: Yes, B-43, grid 7-D.

23 JUDGE ABRAMSON: Seven D, okay.

24 MR. LOVEJOY: I see an entry there.

25 Apparently in the Chinle the logger entered possible

1 vertical fracture with black mineralization along
2 fracture plane at 57 degrees crumbly to 61 degrees.
3 And, in the same log, further down, just
4 above the 100 foot point, entries are possible primary
5 slickenside 84-B, possible primary slickenside, 95-B.
6 Do you see those entries?
7 WITNESS PEERY: No, I don't.
8 MR. LOVEJOY: In lob B-43, you don't see
9 those?
10 JUDGE ABRAMSON: On the last page of B-43
11 I see this.
12 WITNESS PEERY: One foot, is that where
13 you started?
14 MR. LOVEJOY: Just above the 61 to 65 foot
15 entry.
16 WITNESS PEERY: Yes, I see that.
17 MR. LOVEJOY: And, on the following page,
18 do you see the references to possible primary
19 slickenside?
20 WITNESS PEERY: Yes, I see that.
21 MR. LOVEJOY: What --
22 WITNESS PEERY: Also, good to know here
23 that the sediments are dry in here as well. So, we
24 have a Blockey fracture, which is to say 69.8 to 96
25 feet of Blockey fracture, which you would expect with

1 a clay material.

2 JUDGE ABRAMSON: Would you tell me what a

3 Blockey fracture is?

4 WITNESS PEERY: Well, if you had a really

5 dry, hard piece of clay, for instance, and you broke

6 it apart, it would have a Blockey structure, not a

7 bunch of striations and lineament screwed in. So, we

8 have a report --

9 JUDGE KELBER: If you got those fractures

10 wet, what would happen?

11 WITNESS PEERY: They would swell and --

12 JUDGE KELBER: Swell or close up?

13 WITNESS PEERY: Yes, sir.

14 JUDGE KELBER: Thank you.

15 MR. LOVEJOY: And, and what's the meaning

16 of a primary slickenside?

17 WITNESS PEERY: If it was identified

18 correctly, slickensides are often related to movement

19 of the earth past itself. It could be lineament,

20 something associated with joints from fractures or

21 faults at distance, that sort of thing.

22 JUDGE ABRAMSON: Would it imply that one

23 block of clay slipped on another?

24 WITNESS PEERY: Just a, yes, just a

25 movement of material past itself, not necessarily --

1 JUDGE ABRAMSON: If they found something
2 in between them, like a gravel separating level, would
3 that have been indicated in the log?
4 WITNESS PEERY: Yes. If they had found
5 something like that, it would have been indicated.
6 JUDGE ABRAMSON: And slickenside tells us
7 that there's slick layers of blocks that slipped?
8 WITNESS PEERY: This tells us there's a
9 smooth surface as it moved past itself, and not much
10 more than that. And the presence of mineralization
11 just tells us that mineral has essentially filled what
12 might have been a fracture at one time and closed it
13 off.
14 MR. LOVEJOY: You're talking about the
15 fracture with black mineralization along a fracture
16 plan that's referred to?
17 WITNESS PEERY: Yes.
18 MR. LOVEJOY: And, how would the
19 mineralization get there?
20 WITNESS PEERY: Well, there could be any
21 number of ways. You have to remember, these sediments
22 were deposited hundreds of millions of years ago.
23 And, they were deposited in an aqueous
24 environment. Subsequent to that time, there were many
25 things that happened that could have allowed water to

1 move up or down through these sediments and create
2 some mineralization.
3 Maybe it was the initial drying of the
4 sediments themselves. It's very difficult to just
5 speculate on something like that. The mere presence
6 of mineralization and what is reported to be a
7 fracture is not a concern because, obviously, there's
8 nothing there anymore.
9 It is filled with material. So, you don't
10 have an open fracture network.
11 JUDGE KELBER: ·You mentioned mechanisms
12 for water to move either up or down. And, if there
13 were a significant number of fractures, and I'm
14 talking about interconnected or continuous fractures
15 in the red beds, would you expect the major
16 differences in hydraulic head encountered in the
17 various saturated strata?
18 WITNESS PEERY: No, sir. There was a
19 significant amount of fracturing in this area. We
20 wouldn't anticipate having a confined unit at all that
21 would be present under unconfined conditions and have
22 much higher permeabilities.
23 JUDGE KELBER: In other words, if there
24 were continuous factors, water would pretty much come
25 to an equilibrium.

1 WITNESS PEERY: Yes, it would.

2 JUDGE KELBER: Thank you.

3 JUDGE ABRAMSON: Let me follow-up on that.

4 I want to kind of ask the inverse question. If, in

5 fact, there were connective fractures that allowed

6 flow between the two layers that contained water,

7 would you see a different hydrostatic pressure in

8 those two zones than you currently see?

9 WITNESS PEERY: I would suspect if you had

10 an extensive inter-connected fracture network, that

11 we'd have hydraulic heads or water table elevations,

12 if you will, much closer to the ground surface than

13 they are now.

14 I mean, we would have water where all

15 these things are reported dry that would be reported

16 as saturated.

17 JUDGE ABRAMSON: Is that because the

18 pressure at the lower level is high enough to pump it

19 up if there were a spout?

20 WITNESS PEERY: That coupled with the fact

21 that you would have all this vast amount of water

22 theoretically entering these red bed sediments. So

23 you could then develop a little more water elevation

24 that way.

25 But, the presence of all this dry material

1 indicates that that's not occurring.

2 MR. LOVEJOY: You referred to -- I think

3 you referred to a closed fracture. Does the entry

4 here say that the fracture where there was

5 mineralization was closed?

6 WITNESS PEERY: It doesn't say whether it

7 was closed or open.

8 MR. LOVEJOY: And the mineralization --

9 WITNESS PEERY: And is also say s possible

10 vertical fracture. So, I'm not sure what that means.

11 It sounds like there was some indecision associated

12 with that.

13 MR. LOVEJOY: But it does say black

14 mineralization along cracks reported?

15 WITNESS PEERY: Yes.

16 MR. LOVEJOY: And the mineralization would

17 have arrived there by what?

18 WITNESS PEERY: As I previously stated,

19 water moving up or down, I would suspect that would be

20 the mechanism.

21 MR. LOVEJOY: Would you look at B-49 which

22 is a few logs on. It's under grid 8-B, grid number 8-

23 B.

24 WITNESS PEERY: Unfortunately it's not a

25 few logs on in mine, so it's going to take me a

1 minute.

2 JUDGE ABRAMSON: It's 8 boy, grid 8 boy.

3 Right after grid 71. And right before B-37 that we

4 were looking at before, at least in my binder.

5 MR. CURTISS: Have you located the page?

6 WITNESS PEERY: Yes, sir, I have. B-49 in

7 grid 8-B.

8 MR. LOVEJOY: Do you have those?

9 WITNESS PEERY: Yes, I do.

10 MR. LOVEJOY: Do you see the entry

11 vertically oriented F-R-A-C-S, at approximately 84, 85

12 feet?

13 WITNESS PEERY: Yes, I see that.

14 MR. LOVEJOY: How do you interpret that?

15 WITNESS PEERY: I would interpret it that

16 someone logged some vertically oriented fractures at

17 that depth. Again, I just have to point out that it's

18 also within a zone that's reported as dry.

19 Those fractures could be a result of the

20 sampling process. There's no report of saturated

21 conditions here.

22 MR. LOVEJOY: Are you finished?

23 WITNESS PEERY: Yes, sir.

24 MR. LOVEJOY: Could you flip forward to B-

25 32 of 8-E?

1 JUDGE ABRAMSON: Counselor, before we go
2 on to that, Mr. Peery, what's that -- at the bottom of
3 that block where we note it says vertically oriented
4 fractures at 84, something it says healed fracture
5 oriented,
6 Does that tell us anything, give us any
7 additional information?
8 WITNESS PEERY: I think that would
9 indicate that it is reported at the WCS site that
10 fractures in the Chinle have a large degree of ability
11 to heal themselves because of the clay material.
12 And so they end up swelling back shut.
13 They become --
14 JUDGE ABRAMSON: Swelling comes from
15 moisture?
16 WITNESS PEERY: Yes. In this case there
17 wasn't any moisture --
18 JUDGE ABRAMSON: So it said at some point
19 moisture got it, and at some point --
20 WITNESS PEERY: And filled itself back in,
21 yes.
22 MR. LOVEJOY: B-32?
23 WITNESS PEERY: I'm sorry, could you
24 repeat that one?
25 MR. LOVEJOY: Well, I asked you to look at

1 B-32, if you could do so.

2 WITNESS PEERY: Which is where? Grid

3 number --

4 MR. LOVEJOY: Grid 8-E.

5 WITNESS PEERY: 8-E. I have quarry number

6 B-32 from grid 8-E in front of me.

7 MR. LOVEJOY: And at 101.4 to 105 feet,

8 there's an entry that says sandstone is calcium

9 carbonate cemented hard blocky fracture with platy

10 fracture in silt stone intervals, dry.

11 How do you interpret that, the reference

12 to the fracture, two references?

13 WITNESS PEERY: Well, it sounds as though

14 one of the -- I'm just having a hard time reading this

15 because the print's pretty small. So calcium

16 carbonate cement, that again is a type of mineral that

17 would be expected to fill these fractures up had they

18 occurred when water moved through them at some point

19 in time -- hard blocky fracture.

20 Again, that blocky fracture would refer to

21 the blocky structure that I reported earlier that

22 would be associated with clay materials. Platy

23 fracture in silt stone intervals, dry.

24 A platy fracture in a silt stone interval

25 would likely be related to some horizontal bedding

1 plane possibly, but again we have reports of some
2 fractures which may or may not have occurred during
3 the drilling process and under dry conditions.
4 JUDGE ABRAMSON: Do we gain any additional
5 information by looking up at the 84.9 to 93.4 interval
6 where they characterize it as clay with blocky
7 fractures?
8 Is that -- if we add that to the
9 information about what's going on at 101 to 105 feet
10 does that tell us anything?
11 WITNESS PEERY: I think it just tells us
12 we have a lot of -- more of the same dry blocky
13 structure, not a lot of -- not any evidence of any
14 fracture network, interconnected fracture network that
15 could move water through.
16 MR. LOVEJOY: From the well log, Mr.
17 Peery, would you expect to be able to identify
18 interconnectings between fractures?
19 WITNESS PEERY: Well, I would certainly
20 think that if you had, as your witness has
21 hypothesized, this interconnected network that can act
22 as a fast flow path, well certainly I would expect to
23 be able to identify that through a lot of these
24 borings having very high moisture and saturated
25 conditions.

1 That certainly is not the case. We don't
2 see that, and so I have no reason to believe that
3 there is an interconnected fracture network here.
4 MR. LOVEJOY: So you wouldn't find
5 interconnected fractures from the occurrence of
6 fractures in the bore hole, you would look for the
7 moisture also?
8 WITNESS PEERY: Well, sure, yes. If
9 they're interconnected in order to move water
10 downwards they would have to intersect each other.
11 Just having a series of fractures hanging out in the
12 middle of a formation doesn't touch them o anything
13 that can transmit water through them.
14 Just a fracture by itself, if it's not
15 interconnected to a network that provides a mechanism
16 to move water through the formation, it doesn't do any
17 good in terms of movement of water through the system.
18 MR. LOVEJOY: Okay look now please at well
19 log number B-13, grid 9-C.
20 JUDGE ABRAMSON: Counselor, we're going
21 down the same path we were last time. More of the
22 same or are we going to get to something that's
23 different here?
24 MR. LOVEJOY: We -- I can read into the
25 record several of the entries if you want.

1 JUDGE ABRAMSON: If they're all the same
2 sort, if you have point to make about them let's make
3 it. If you have something unique you'd like to show
4 us, please show us.
5 MR. LOVEJOY: Okay. On B-13 --
6 JUDGE ABRAMSON: Which is?
7 MR. LOVEJOY: Grid 9-C. The entry as I
8 see it says natural at 16 and a half to 28 and a half
9 feet natural fractures, moist or moisture along
10 fractures.
11 WITNESS PEERY: I'm sorry, what was the
12 depth on that again? I was --
13 MR. LOVEJOY: The depth was 16 and a half,
14 28 and a half feet.
15 WITNESS PEERY: Okay, and your question
16 related to that?
17 MR. LOVEJOY: The entry says natural
18 fractures, moisture along fractures. At the end of the
19 entry.
20 WITNESS PEERY: Okay. What's the
21 question?
22 MR. LOVEJOY: Well the question is how
23 does he interpret that?
24 WITNESS PEERY: This is a description of
25 fractures within the caliche caprock that we discussed

1 earlier that isn't present at the NEF site.

2 MR. LOVEJOY: Okay. Let me just -- let me

3 jump forward. Can you find B-21?

4 WITNESS PEERY: We shall look.

5 JUDGE ABRAMSON: Give us a group number.

6 MR. LOVEJOY: That is 9-G2.

7 JUDGE ABRAMSON: Thank you.

8 WITNESS PEERY: I have B-21, 9-G2 in front

9 of me. It's in a little bit of disarray in order so

10 --

11 MR. LOVEJOY: Okay.

12 WITNESS PEERY: -- if you could point me

13 to the right footage.

14 MR. LOVEJOY: The entry above it says

15 below 180 feet. This one is an entry of 186. It says

16 45 degree slickenside at 186 feet with calcite

17 crystallization along slickenside. What would that

18 indicate?

19 WITNESS PEERY: That was --

20 MR. LOVEJOY: B-21

21 WITNESS PEERY: I may not be looking at

22 the right grid number.

23 MR. LOVEJOY: 9-G2.

24 MR. REPKA: What was the elevation again?

25 JUDGE ABRAMSON: There's no elevation

1 indicated on the page, but it's the page before the
2 one at 196 to 208 feet.
3 WITNESS PEERY: Okay, thank you. Yes,
4 this is similar to what we discussed earlier.
5 Slickenside's the place where sediments could slip
6 past themselves.
7 Calcite, stilling, crumbly texture. I
8 just would interpret that to be very similar to other
9 things we've discussed already.
10 MR. LOVEJOY: This is mineralization along
11 the fracture, is that right?
12 WITNESS PEERY: Yes, calcite filled.
13 JUDGE ABRAMSON: Is this in a clay?
14 WITNESS PEERY: Yes, sir. This is also
15 within a clay unit.
16 JUDGE ABRAMSON: If we got a lot of
17 moisture in there, this doesn't indicate that there's
18 -- it says mineralization. Does that tell you that
19 there's material fill between two chunks of clay?
20 WITNESS PEERY: Yes it just tells us when
21 there was a fracture at one time it subsequently
22 filled with mineralization and no longer acts as an
23 interconnected fracture because it has something
24 filling it, not an open space.
25 JUDGE ABRAMSON: If we get a lot of water

1 in there, would this pressure -- would the clay swell
2 and --
3 WITNESS PEERY: Yes, the clay would swell
4 and --
5 JUDGE ABRAMSON: -- make that even
6 tighter?
7 WITNESS PEERY: -- tighten up on that.
8 Yes, sir.
9 JUDGE KELBER: Let me go back to the
10 question asked earlier. I thought that answer was
11 good enough at the time, but maybe it wasn't. If
12 there is a significant number of fractures in the red
13 beds, would you expect major differences in hydrolic
14 head encountered in the various saturated strata?
15 You answered that once before. Maybe if
16 you answer it once again the answer will sink in. If
17 we can quit playing bingo.
18 WITNESS PEERY: The way it is now, if we
19 just stressed how it is now, the confined bed, 220
20 foot, is such a low permeability that it keeps that
21 water under pressure, and if we have a lot of
22 fracturing there we would expect it to be an
23 unconfined aquifer, and that the water level would be
24 much higher within these sediments.
25 On the order MW-2 for instance at the NEF

1 site, the water level in that is something like 120
2 feet below ground surface. So all these logs we keep
3 referring to here, anything in that area we would
4 expect to be saturated if there was a very defined and
5 extensive fracture network over here. And we don't
6 see it.
7 MR. LOVEJOY: Is there anything in this
8 report that says this fracture's closed at 186 feet?
9 WITNESS PEERY: No, but there is nothing
10 that says it's open either.
11 JUDGE ABRAMSON: It's a slickenside. Does
12 that tell you it's a fracture? It tells me that --
13 I'm trying to understand what a slickenside is and I'm
14 picturing this as two chunks of clay sliding on each
15 other and there was at one point some sort of a plane
16 where water flowed and we got mineral deposition at
17 one point?
18 I see your expert shaking his head that
19 that sounds like the right interpretation of this.
20 That doesn't tell me whether there's a big gap or a
21 little gap or anything. Is that right? Okay.
22 Counselor, if we have some unique
23 characteristics in one of these other boring holes
24 let's get it in.
25 MR. LOVEJOY: Okay.

1 JUDGE ABRAMSON: And otherwise just tell
2 us you're got lots of other data points that look like
3 this.
4 MR. LOVEJOY: There's a lot of data points
5 showing fractures in the Holt report. B-36 shows a
6 vertical fracture with black secondary mineralization.
7 B-36 shows another fracture at 89, 91
8 feet. B-44 shows slickenside which is a, in effect, a
9 slip joint with mineralization, calcium carbonate,
10 along the fractured plane.
11 B-35 shows a fracture with indications of
12 ferrous oxide mineralization along the fracture plane.
13 B-20 shows scattered calcite filled veins of 172 to
14 243 feet.
15 B-45, again, vertical fractures
16 disseminated throughout with calcium carbonate in
17 layers. At about the alluvial Chinle contact point.
18 Yes, there are numerous logs reporting fractures in
19 the Holt report.
20 And I'll leave that for the record. You
21 can certainly consult with those, and I'm sure Mr.
22 Peery may feel that he can offer some explanation of
23 them.
24 But let me go on to another issue, really
25 quite a related issue. In your rebuttal, you talk

about the appearance -- I'm looking at pages 19 and 20 here.

WITNESS PEERY: I have page 19 in front of me.

MR. LOVEJOY: Yes. You talk about the possibility of mineralized veins occurring in rock on a smaller localized scale. The bottom of 19, you say it's misleading to suggest that the mere presence of such mineralized veins, particularly on a smaller localized scale is an indication that the fractures have acted as a groundwater flow path.

But you can't really tell whether mineralization in fractures is occurring on a smaller localized scale from an entry in a well log, can you? You just have the data, the single data point.

WITNESS PEERY: I think the data really speaks for itself. There's a lot of data from the Holt report.

MR. LOVEJOY: Yes.

WITNESS PEERY: There's a lot of data from the WCS site, and there are some mentions of fractures. I'm not disputing that. What I am disputing is that there is no evidence to suggest that there is an interconnected fracture network out here that can act as a fast flow path.

1 Indeed, I also said earlier that,
2 obviously to get mineralization, water had to move
3 either up or down through the sediments at some time.
4 They were water laid deposits.
5 The alluvial material over them,
6 obviously, water laid deposits. The mere presence of
7 fractures which may or may not have been connected or
8 created by the drilling process, and some limited
9 mentions of slickensides, and fracture fills with
10 calcite or iron oxide materials, things like that,
11 does not provide the evidence that there are fast flow
12 paths and a vast interconnected network at this site.
13 And I've already gone into it a couple
14 time also, relating to how that would affect water in
15 the confined zone as well. So I don't know what else
16 to tell you on that point.
17 MR. LOVEJOY: Now you talk about fractures
18 being caused by the drilling process. Well, the
19 drilling process would not cause mineralization would
20 it?
21 WITNESS PEERY: No, certainly not, and I
22 haven't suggested that it would.
23 MR. LOVEJOY: Okay. And you say in your
24 rebuttal that mineral deposits observed by Jack Holt
25 and associates were deposited -- I'm looking at the

1 top of page 20.

2 I beg your pardon, it starts on the bottom

3 of 19. It says first it is probable that the mineral

4 deposits observed by Jack H. Holt and associates were

5 deposited when climatic and geologic conditions were

6 very different from those which exist at the site

7 today.

8 How can you tell when mineralization --

9 mineral deposits were deposited?

10 WITNESS PEERY: I don't know that you can

11 tell specifically when they were deposited, but what

12 we can say is that the lack of moisture where these

13 fractures are reported, particularly -- I mean almost

14 invariably these mentions of fractures, the sediments

15 are dry a those locations.

16 So I don't think it's a huge leap of faith

17 to say that that hasn't happened, that the

18 mineralization hasn't occurred recently. In order to

19 get clay materials to dry out it takes quite a long

20 time.

21 And, you know, hundreds of millions of

22 years is a significant time for things to happen.

23 MR. LOVEJOY: Well, you talk about the

24 dryness. There were holes that Holt drilled which

25 were dry when he initially drilled them which later

1 filled with water, weren't there?

2 WITNESS PEERY: Sure. The ones in the 220

3 foot zone, which is the confined aquifer identified at

4 both the LES site and the WCS site.

5 JUDGE ABRAMSON: Is that like drilling a

6 well?

7 WITNESS PEERY: Yes. When they first

8 drilled into the confined aquifer, the 220 foot zone

9 at the WCS site, it was the initial investigation

10 process out there, and they weren't aware of whether

11 or not that zone had -- would have a saturated

12 condition in it.

13 So they left the holes open, or

14 subsequently completed wells in them. And the

15 permeability as we discussed earlier, that unit is so

16 low that it took weeks for these water levels to rise

17 up in the holes or in the wells.

18 And they reported after they purge them,

19 some of them do take weeks or more to equilibrate.

20 JUDGE KELBER: Now that's the type of

21 water rise that you would expect from that zone if

22 there were a continuous bed of fractures,

23 interconnected or otherwise.

24 WITNESS PEERY: If there was a continuous

25 bed of fractures in that zone, we wouldn't have

1 expected a water rise like that.

2 JUDGE ABRAMSON: Because it would have

3 already been dispersed.

4 WITNESS PEERY: It would be under

5 unconfined conditions, and we would have expected the

6 water level to be essentially -- while you were

7 drilling, when you hit it essentially where the top of

8 the water table is as opposed to where the water

9 surface rises to from this confined --

10 JUDGE ABRAMSON: So if I can put this in

11 pedestrianese, lawyerese, maybe, we have a layer at

12 200 and some feet that's got clay on top of it. You

13 drill a hole down through the clay.

14 If the water could have escaped from that

15 layer previous to this, when you sick the hole through

16 the clay into it, the water wouldn't rise. But the

17 water did rise up into the clay?

18 WITNESS PEERY: That's correct.

19 JUDGE ABRAMSON: And that would lead you

20 to believe that at least there weren't a lot of places

21 where it could escape very much?

22 WITNESS PEERY: That's correct.

23 JUDGE KELBER: As far as dating the events

24 of these things, I realize it's very difficult. But

25 I was puzzled by the presence of ferrous oxide coming

1 from northern Minnesota.

2 I know that that's often times a product

3 of bacterial action that took place, oh, quite a few

4 million years ago. They have a lot of it in or had a

5 lot of it in northern Minnesota.

6 Is that an indication of what happened

7 here, or are there other mechanisms that would form

8 ferrous oxide?

9 WITNESS PEERY: It would probably be other

10 mechanisms here.

11 MR. LOVEJOY: May I inquire about the

12 Panel's plans --

13 CHAIR BOLLWERK: I was just going to ask

14 you, so we're in the same place. How much longer do

15 you think you have?

16 MR. LOVEJOY: Well, I have I would say 30

17 minutes maybe.

18 JUDGE ABRAMSON: Let's finish and then go.

19 I'm in favor of crunching along here folks. Anybody

20 object?

21 MR. REPKA: None here.

22 JUDGE ABRAMSON: We've only got 30

23 minutes, let's do it.

24 MR. LOVEJOY: I would, if I may say, I

25 would like an opportunity before concluding to consult

1 with my colleagues.

2 CHAIR BOLLWERK: All right. Maybe what we

3 can do is conclude, take lunch. You can talk with

4 them at that point. And if you need something, you

5 come back we can do it.

6 JUDGE ABRAMSON: Yes, that works.

7 CHAIR BOLLWERK: All right.

8 (Pause.)

9 MR. LOVEJOY: Now, Mr. Harper, you've had

10 an easy day.

11 WITNESS HARPER: So far.

12 MR. LOVEJOY: Let me ask you a few. You

13 had a role in preparation of groundwater discharge

14 permit applications, is that right?

15 WITNESS HARPER: Correct.

16 MR. LOVEJOY: And that states -- and it's

17 LES Exhibit 4, I believe, here. In discussing the UBC

18 storm water retention basin over on page 18 --

19 WITNESS HARPER: Is that 13?

20 MR. LOVEJOY: Eighteen. Right up at the

21 top, the discussion starts with the phrase any minor

22 leakage.

23 WITNESS HARPER: Yes.

24 MR. LOVEJOY: Is this discussing the USB

25 storm water retention basin?

1 WITNESS HARPER: Yes.

2 MR. LOVEJOY: it says any minor leakage
3 past the liner will infiltrate into the ground under
4 the basin. The infiltrated waters are potentially
5 expected to recharge the limited groundwater system at
6 the 214 to 220 foot depth, or return to the atmosphere
7 via evaporotranspiration.

8 Was that your expectation when you
9 prepared this?

10 WITNESS HARPER: No, the purpose of this
11 section of the permit was to -- if you turn back to
12 page 17, the section is called the 20.0.2.3109.C
13 approval demonstration.

14 And the purpose of this section was to
15 demonstrate that under either condition the
16 groundwater permit was approvable by the state. And
17 as you'll notice later on in that paragraph, the last
18 sentence there, therefore based on the above it is
19 concluded that even if any of the basin water is
20 infiltrated into the ground, the applicable
21 groundwater stand as provided in 20.6.2 NMAC will be
22 met. The purpose of this statement here was to say
23 irregardless of whether the water infiltrates or
24 evaporates, or evaporotranspires, that the impact on
25 groundwater would be negligible, and therefore that

1 the approval, that the NMED should be able to approve
2 the groundwater discharge permit.
3 And then we explain, as I said later on in
4 the paragraph, that even if it was to infiltrate into
5 the ground, which was not what we believe happens
6 since we expect to evaporotranspirate.
7 MR. LOVEJOY: But you actually expected it
8 to recharge the limited groundwater system, or to
9 evaporotranspirate. Is that right?
10 WITNESS HARPER: No, again, the purpose of
11 this section was to do a demonstration that under
12 either scenario, the groundwater permit would be
13 approved.
14 I think if you look at the last sentence
15 in that section on page 19, the whole purpose of this
16 section of the ground water discharge permit was to
17 demonstrate that the discharges resulting from
18 operation of the NEF are approvable under
19 20.6.2.3109.C
20 And we addressed this issue in our
21 testimony also. This was a section that you said you
22 raised was an apparent contradiction.
23 MR. LOVEJOY: Well, I'm looking now at
24 page 17 where the discussion of the site storm water
25 detention basin. And that's an unlined basin, is that

1 right?

2 WITNESS HARPER: Correct, that is.

3 MR. LOVEJOY: And, in the middle of the

4 page it says the SSDB will receive runoff from various

5 parts of the site including roads, parking areas, and

6 building roofs.

7 The quality of the runoff will be typical

8 of industrial facility storm water runoff. The runoff

9 is expected to meet the standards in 20.6.2.3103 NMAC.

10

11 Some of the runoff will infiltrate into

12 the ground under the basin. And that was your

13 expectation, right?

14 WITNESS HARPER: Under the unlined basin,

15 yes. Some of the water that falls through this basin

16 will either immediately evaporate or infiltrate into

17 the ground.

18 And then the next sentence goes on that

19 the infiltrated waters are expected to potentially

20 recharge the limited groundwater system at the 214 to

21 222, or return to the atmosphere via

22 evaporotranspiration.

23 MR. LOVEJOY: So that was your expectation

24 when you prepared this.

25 JUDGE ABRAMSON: Counselor --

1 WITNESS HARPER: Again, the last sentence
2 of this paragraph is a similar point that I made on
3 the previous discussion of the other basin. We were
4 attempting to make an approval demonstration.
5 And the last sentence says therefore based
6 on the above, even if any of the infiltrated waters
7 reach the groundwater, the applicable groundwater
8 standards will be met.
9 MR. LOVEJOY: And you made similar
10 statements in this document concerning the site septic
11 systems.
12 WITNESS HARPER: Correct.
13 MR. LOVEJOY: On the top of page 19.
14 WITNESS HARPER: Correct. In each case we
15 provided a similar approval demonstration.
16 MR. LOVEJOY: Okay. Now there's been some
17 discussion in this case about assigning a probability
18 to leakage in some of the lined basins. The TEEB, or
19 the long one, UVC storage path storm water basin.
20 You made an estimate previously, an made
21 some calculations based on the estimate that 50
22 percent of water entering the storm water basin would
23 infiltrate. Do you remember doing so?
24 WITNESS HARPER: That was in response to
25 an NRC RAI back in May of '04.

1 MR. LOVEJOY: Yes.

2 WITNESS HARPER: We were asked to -- if we

3 could estimate the amount that infiltrated into the

4 ground versus immediately evaporated from the basin.

5 MR. LOVEJOY: Okay.

6 WITNESS HARPER: There are no detailed --

7 the detailed design of that basin has not been

8 performed yet. And therefore we simply made an

9 assumption to answer that RAI that a 50 percent

10 evaporation and a 50 percent infiltration would be a

11 reasonable assumption to make.

12 JUDGE ABRAMSON: is that for an unlined

13 basin or a lined basin?

14 WITNESS HARPER: THAT was for a lined

15 basin.

16 JUDGE ABRAMSON: And there was another

17 analysis --

18 WITNESS HARPER: And then we went on to

19 say that essentially all the water that infiltrated

20 would return to the atmosphere via

21 evaporotranspiration.

22 MR. LOVEJOY: You had some analyses also

23 that you did which incorporated a one millimeter per

24 hour leakage rate. Is that correct?

25 WITNESS HARPER: We had a one millimeter

1 per hour infiltration rate. And the purpose of that,
2 there was an RAI received from the NRC to evaluate the
3 basins.
4 And basically they want us to look at low
5 range of all years and high range of all years. And
6 the underlying purpose of that evaluation is to
7 demonstrate that the basins would not fill up and
8 overflow.
9 And so we used a minimal infiltration rate
10 from published sources for soils in order to maximize
11 the build up of water in the basin to demonstrate that
12 it would not overflow.
13 JUDGE ABRAMSON: Did you use a 100 year,
14 or what was the worst year you used?
15 WITNESS HARPER: Well, what we did was the
16 site storm water detention basin is sized for a 100
17 year 24 hour return period rainfall, with allowance
18 for some additional freeboard.
19 The treated effluent evaporative basin is
20 designed for twice the 24 hour 100 year rainfall with
21 an additional freeboard, as is the UBC storage pad
22 storm water -- the UBC's storm water storage pad basin
23 is also designed for twice the 100 year 24 hour
24 rainfall.
25 JUDGE ABRAMSON: Do you know enough about

1 meteorology to tell me whether twice the 100 year is
2 approximately -- a probability of twice the hundred
3 year rain, 24 hour rainfall, is approximately the
4 probability of the 200 year 24 hour rainfall?
5 Or would that be like a 400 year 24 hour?
6 Do we know how that works meteorologically?
7 WITNESS HARPER: I did not evaluate that.
8 I mean I have data analysis like that in different
9 areas, but not this particular area.
10 JUDGE ABRAMSON: Okay, thanks.
11 WITNESS HARPER: But the magnitude of the
12 rainfall was about six inches for the 24 hour 100
13 year. So we're looking at a 12 inch rainfall, which
14 in that area is equivalent to almost the annual
15 rainfall. It would be pretty rare.
16 JUDGE ABRAMSON: Well, 100 year is already
17 pretty rare. I'm trying to get a handle on how rare
18 twice that is. It's okay.
19 MR. LOVEJOY: So each of these
20 calculations involving leakage from one of these
21 basins included assumptions which were arbitrarily
22 made for purposes of say, calculating the capacity of
23 the basin. Is that right?
24 WITNESS HARPER: Well, we only had
25 infiltration for the storm water detention basin. The

1 other -- the lined basins we demonstrated that all the
2 water would only leave the basin by evaporation.
3 MR. LOVEJOY: Well, it's a fact though
4 that occasionally lined basins leak, isn't it?
5 WITNESS HARPER: Well, we have two lined
6 basins at the NEF, and we talk about the first one
7 which is the treated effluent evaporative basin. It's
8 about a three quarter acre basin.
9 And the common design for that basin, and
10 I'll talk it from the bottom up, it's going to have a
11 two foot prepared clay layer at the bottom of the
12 basin.
13 Then it will have the -- membrane liner
14 will sit on top of the two feet of clay. Then there
15 will be a drainage collection system consisting of
16 pipes, and a drainage map, which is the leak detection
17 system.
18 Above that there is another liner which is
19 a double lined basin. And then on top of that there
20 is a one foot -- a minimum one foot layer of clay.
21 Now the basin, that particular basin, has been
22 designed to preclude any leakage.
23 And in our testimony we have characterized
24 that any leakage from that basin should be literally,
25 essentially zero. And then a similar case would be to

1 the UBC storage pad basin.

2 And that only has a single liner versus

3 the double liner. And again, it's two feet of clay,

4 the liner, and then one foot of clay.

5 JUDGE ABRAMSON: You don't have the

6 leakage detection system under your UBC, that -- it's

7 just in the double lined system --

8 WITNESS HARPER: Correct

9 JUDGE ABRAMSON: -- where you have the

10 leakage detector.

11 JUDGE KELBER: Can leaks be repaired?

12 WITNESS HARPER: From what I've seen in

13 the literature, they have methods to, and I believe

14 some of them are described in the Layne and the Dracus

15 paper, I believe, where they're using certain

16 electrical registering techniques, leaks can be

17 identified and them located and patched.

18 I'd also like to point out that both of

19 the basins with the liners on them, the liners will be

20 installed in accordance with NMED liner installation

21 guidelines.

22 And the liners will also be approved, pre-

23 approved by both professional engineer and NMED prior

24 to installation.

25 JUDGE ABRAMSON: Is this a technology

1 that's in wide use, these liners?

2 WITNESS HARPER: Yes, they are.

3 JUDGE ABRAMSON: So there should be a lot

4 of experience with installation?

5 WITNESS HARPER: Yes, there is.

6 MR. LOVEJOY: And LES is committed to a

7 very high level of installation oversight during these

8 design and construction of the basins? And the design

9 of these basins is not complete. Is that right?

10 WITNESS HARPER: That is correct.

11 MR. LOVEJOY: Can I just ask you -- I'll

12 read it to you, I could show it to you also, some

13 testimony you gave previously in the deposition.

14 WITNESS HARPER: Okay.

15 MR. LOVEJOY: Do you have your deposition

16 there?

17 WITNESS HARPER: No, not in front of me.

18 MR. LOVEJOY: I'm just going to ask you if

19 you remember being asked these questions and giving

20 the answers.

21 WITNESS HARPER: Okay.

22 MR. LOVEJOY: The question was can I ask

23 each of you witnesses, you were both present, have you

24 ever known a liner of a basin to leak. And Mr. Peery

25 said I don't have a lot of experience with lined

1 sites.

2 And the question was okay, Mr. Harper --

3 answer Mr. Harper. During my career I believe at some

4 points I have read articles, overheard cases where

5 liners have leaked.

6 Question, can you remember the causes that

7 were attributed to those leakages? Answer, Mr.

8 Harper, since I don't have any particular examples

9 they would just be this.

10 I would assume the usually suite of

11 potential reasons why a liner could leak. Question

12 what's the usual suite? Answer, Mr. Harper, improper

13 installation for example.

14 Question, anything else. Answer, Mr.

15 Harper, some type of puncture due to poor maintenance

16 practice or burrowing animals, something else would be

17 potential. Do you remember so stating?

18 WITNESS HARPER: Yes, I have the

19 deposition in front of me here.

20 CHAIR BOLLWERK: Does it have a number?

21 Someone? Was it marked as an exhibit?

22 MR. CURTISS: I believe it's NIRS exhibit.

23 WITNESS HARPER: Now on page 117, I'd like

24 to address the point there about --

25 MR. LOVEJOY: Exhibit 17.

1 CHAIR BOLLWERK: NIRS Exhibit 17?

2 MR. LOVEJOY: Yes.

3 CHAIR BOLLWERK: You want to go ahead and

4 mark it for identification then?

5 MR. LOVEJOY: Well, yes.

6 CHAIR BOLLWERK: It's the -- it's his

7 deposition of what date? If I could just --

8 MR. LOVEJOY: I believe it's September

9 17th.

10 CHAIR BOLLWERK: All right. And this is

11 NIRS Exhibit 17? Should be marked for identification

12 then.

13 (Whereupon, the above-

14 referenced to document was

15 marked as NIRS/PC Exhibit No.

16 17 for identification.)

17 WITNESS HARPER: I'd like to pick up on

18 line 21 there. I noted there that improper

19 installation is one particular potential reason for

20 leaks.

21 The liners that will be installed at the

22 NEF, we're committed to follow the NMED guidelines for

23 liner installation. And as I said, also, the liners

24 would be pre-approved by an engineer, a professional

25 engineer, and NMED prior to installation.

1 Therefore I would not expect -- improper
2 installation to not be an issue for the NEF lined
3 basins.
4 On the second point, there is puncture due
5 to poor maintenance practice for burrowing animals.
6 The lined basins at the facility will be incorporated
7 into a -- will have inspection programs. And also, the
8 basins are lined or will be --
9 JUDGE ABRAMSON: Mr. Harper, this is
10 already in your testimony, right?
11 WITNESS HARPER: Pardon?
12 JUDGE ABRAMSON: Isn't this already in
13 your testimony?
14 WITNESS HARPER: (No verbal response.)
15 JUDGE ABRAMSON: We don't need you to
16 repeat your testimony. If you're adding something,
17 add it. But we don't need to hear a repeat of what's
18 already in front of us in writing.
19 WITNESS HARPER: I'm sorry. It's already
20 in my testimony.
21 MR. LOVEJOY: Let me ask you Mr. Harper
22 about the plans for monitoring. I think some of them
23 have been refined a bit in your testimony. LES plans
24 to install one up-gradient monitoring well with a
25 screen at what point?

1 WITNESS HARPER: We plan to install
2 monitoring wells at five locations at the north end of
3 the site, at the location designated MW1. There will
4 be two wells, two monitoring wells, one at the -- in
5 the alluvium, one at the 220 foot design level.
6 MR. LOVEJOY: Did you say two monitoring
7 levels?
8 WITNESS HARPER: As you'll see in the
9 revised testimony, since we want to monitor in both
10 the up-gradient locations, we plan to monitor is in
11 the alluvium layer and at the 220 foot level.
12 Therefore, we need to have two different
13 wells so that we can measure in the two different
14 areas. And that was one of the clarifications made in
15 the testimony.
16 MR. LOVEJOY: Is that a modification from
17 the --
18 WITNESS HARPER: No.
19 MR. LOVEJOY: -- the typed script of the
20 testimony.
21 WITNESS HARPER: No.
22 MR. LOVEJOY: Okay.
23 WITNESS HARPER: We've always committed to
24 monitor both the shallow alluvium and the 220 at that
25 location. However, the testimony implied it was in

1 the same hole.

2 And that's what we corrected this morning.

3 Because, if we screened them both in the same hole,

4 you wouldn't know which one you were measuring.

5 MR. LOVEJOY: So, there are going to be

6 two up-gradient monitoring wells, one screened in the

7 alluvium, one screened at the 220 foot zone?

8 WITNESS PEERY: Correct.

9 MR. LOVEJOY: And, down-gradient, how many

10 wells?

11 WITNESS HARPER: We have two wells down-

12 gradient in the 220 zone. They're immediately down-

13 gradient from the UVC storage pad. And there are

14 additional two wells down-gradient of the basins.

15 And that figure is in the groundwater

16 discharge perimeter showing the location of the

17 monitoring well.

18 MR. LOVEJOY: So there are going to be six

19 monitoring wells?

20 WITNESS HARPER: Six monitoring wells at

21 five locations.

22 MR. LOVEJOY: Okay. And --

23 WITNESS HARPER: And that position is

24 consistent with the groundwater discharge perimeter.

25 MR. LOVEJOY: And two wells that are down-

1 gradient from the TEEB, is that correct? Will there
2 be two?
3 WITNESS HARPER: Two wells along the down-
4 stream perimeter of the site. I would like to refer
5 attachment A in the groundwater discharge perimeter,
6 which provides the approximate location of the five
7 locations.
8 MR. REPKA: LES Exhibit 4 you're referring
9 to?
10 WITNESS HARPER: Correct.
11 MR. LOVEJOY: Exhibit A?
12 MR. REPKA: Four.
13 WITNESS HARPER: Exhibit 4, attachment A.
14 Attachment A of Exhibit 4.
15 (Pause.)
16 WITNESS HARPER: As you can see on that
17 figure, two locations, MW4 and MW5 are essentially on
18 the southern boundary of the site down-gradient of the
19 three basins.
20 MR. LOVEJOY: All right. And, the one
21 that is down-gradient of the storage pad, storm water
22 retention basin, is screened at 220 feet?
23 WITNESS HARPER: Correct.
24 MR. LOVEJOY: Now, where is the one that
25 is down-gradient of the site storm water detention

1 basin?

2 WITNESS HARPER: That is also screened at

3 the 220 level.

4 MR. LOVEJOY: So, if there were water

5 leaking out of something and ponding at the alluvial

6 Chinle contact, wouldn't it flow down the slope of

7 that contact?

8 WITNESS HARPER: Well, as I just discussed

9 on the -- let's go back and talk basin by basin. The

10 TEEB will have -- is going to be a double-lined basin

11 with leak detection.

12 And, given the design commitments and the

13 installation commitments, any leakage from that basin

14 is considered to be essentially zero. The UVC storage

15 pad storm water retention basin likewise, given the

16 design commitments, the installation procedures and

17 the commitments to the NMED guidelines, any leakage

18 from that basin should also be essentially zero.

19 And the groundwater monitoring program has

20 been structured to monitor the existing groundwater

21 layers at the site. And the first identifiable

22 groundwater layer at the site is at the 220 level.

23 MR. LOVEJOY: So, I take it -- just

24 hypothetically for the moment, abandon your assumption

25 of zero leakage from the TEEB and the UVC basin. If

1 there is leakage, and it goes down to the contact with
2 the Chinle, these monitoring wells would not identify
3 that.
4 WITNESS HARPER: Well, I guess what I
5 would like to add to that is that, the two basins are
6 designed such that there's essentially no leakage from
7 those two basins.
8 MR. LOVEJOY: Well, you're here as an
9 expert, Mr. Harper. And I'm entitled to ask a
10 hypothetical question.
11 WITNESS HARPER: Okay.
12 MR. LOVEJOY: So, can you just set aside
13 for the moment the assumption that these two basins
14 are going to behave throughout their life perfectly?
15 Just assume for the moment that maybe one might leak.
16 Isn't it a fact that these monitor wells
17 will not identify that?
18 WITNESS HARPER: I'll go back to the high
19 evaporotranspiration rates at the site to address your
20 point there. Even if we hypothetically assumed there
21 was some minor leakage from those basins, the leakage
22 would be subject to, as we discussed earlier, subject
23 to the same evaporotranspiration features that the
24 current rainfall is on the site.
25 I do not expect to find any basin water

1 flowing down the -- any water that would leak from the
2 basins flowing down the Chinle interface.
3 MR. LOVEJOY: Does that apply also to the
4 site storm water detention basin which is not lined?
5 WITNESS HARPER: Well, the site storm
6 water detention basin, correct, it is not lined. And
7 it, again, would be subject to the same
8 evaporotranspiration feature that the site is
9 presently exposed to.
10 MR. LOVEJOY: So what you're saying --
11 excuse me, were you finished?
12 WITNESS HARPER: Therefore I do not expect
13 any infiltrated waters from the site storm water
14 retention basin to likewise flow down the Chinle
15 interface.
16 MR. LOVEJOY: So you're essentially saying
17 that there's no need to monitor this facility?
18 WITNESS HARPER: No, that's not the case.
19 We have monitoring -- we are committed to monitor in
20 the first -- in the only -- in the shallowest
21 identified groundwater regime on site, which is the
22 220 level.
23 JUDGE ABRAMSON: Let me pursue this in an
24 -- I'd like to make sure I understand what we're
25 monitoring. You're going to have wells that monitor

1 this water bearing layer at 200 feet, right?

2 WITNESS HARPER: Correct.

3 JUDGE ABRAMSON: Is that correct?

4 WITNESS HARPER: Correct.

5 JUDGE ABRAMSON: Both of you, and this is

6 -- below this 200 foot water bearing layer, as I

7 understand it, there is a relatively thick clay layer,

8 is that correct?

9 WITNESS HARPER: That is correct.

10 JUDGE ABRAMSON: And that relatively thick

11 clay layer extends from that down to the Chinle

12 interface that Counselor is worried about, is that

13 correct?

14 WITNESS PEERY: Yes. The next water

15 bearing zone identified below that 220 foot zone is at

16 about 600 feet.

17 JUDGE ABRAMSON: Okay. So, we have three

18 to 400 feet of clay below that 200 foot layer. If

19 something gets into the 200 foot layer, would you

20 detect it with these monitoring wells?

21 Are they positioned so that they would

22 detect something that came off of one of these basins?

23 WITNESS HARPER: Well, the --

24 JUDGE ABRAMSON: I don't want to hear

25 about evaporotranspiration.

1 WITNESS HARPER: No. The hydraulic slope
2 in the 220 foot zone is generally to the south,
3 southwest.
4 WITNESS PEERY: On the confined units to
5 the south, south-east, the slope of the defined water
6 unit.
7 WITNESS HARPER: And that would be why we
8 located MW4 -- the location of MW4 and MW5.
9 JUDGE ABRAMSON: So the monitoring wells
10 are located so that if something got into the 220 foot
11 layer you wouldn't detect it?
12 WITNESS PEERY: It would --
13 JUDGE ABRAMSON: It it's going to get to
14 the Chinle, let's assume that that's where we're
15 starting, because that's where Counselor is asking,
16 would it have to get into the 220 foot layer first?
17 WITNESS PEERY: It would have to get into
18 the 220 foot layer first.
19 JUDGE ABRAMSON: And, if it got into the
20 220 foot layer, we've got wells that will monitor it.
21 WITNESS PEERY: That's right.
22 JUDGE ABRAMSON: Okay. Thank you. I
23 understand your point. We're not going to know
24 whether it got down to the Chinle because we don't
25 have wells that go down there.

1 But, what I -- do you want to pursue this?
2 Go ahead.
3 MR. LOVEJOY: There is another point
4 higher up, where the alluvium contacts the Chinle.
5 JUDGE ABRAMSON: Which is how deep?
6 MR. LOVEJOY: How deep is that, Mr.
7 Harper?
8 WITNESS HARPER: It is, it varies
9 approximately 20 to 50 feet, I'm not sure what the
10 exact depth is at that location.
11 MR. LOVEJOY: And since the Chinle is said
12 to be so impermeable water that infiltrates down might
13 be claimed to flow along the top of the Chinle, the
14 20, 50, 60 foot point, and that is the point that is
15 not monitored.
16 JUDGE ABRAMSON: And how do we respond to
17 that? Assume that it is going to get out of these
18 basins, is there -- are we going to detect it if it
19 doesn't get below the Chinle, if it is running along
20 the top?
21 WITNESS PEERY: Well, just to back up a
22 little bit. When the NMED reviewed the Draft
23 Environmental Impact Statement they took the Staff's
24 calculation of water movement off of the site,
25 potential water movement off of the site, in that

1 shallow alluvial system that we tracked fairly early
2 on.
3 It appears they took that at face value.
4 And I wouldn't be surprised if part of the permitting
5 issue they would require a monitoring well down the
6 slope of the red bed surface from there.
7 CHAIR BOLLWERK: So the answer is no, it
8 wouldn't detect it?
9 WITNESS PEERY: That is correct.
10 CHAIR BOLLWERK: Thank you.
11 JUDGE ABRAMSON: But I don't, let me ask,
12 is this something that LES would be willing to do, to
13 deal with this, or is it something you wait for NMED
14 to tell you, you must do? Is this a big deal, or a
15 little deal?
16 MR. CURTISS: I think we will consult and
17 advise you after the break.
18 JUDGE ABRAMSON: Okay, thank you.
19 CHAIR BOLLWERK: We are now right at 30
20 minutes.
21 JUDGE ABRAMSON: Well, let's see where he
22 is.
23 MR. LOVEJOY: In your testimony, and I
24 will find it right now you were speaking about
25 groundwater monitoring. And I think it is understood,

1 I think there is common ground here, that the facility
2 may give off hazardous constituents which ought to be
3 monitored, pesticides, PAHs of various organics.
4 And the monitoring plan does not include
5 them right now, is that right?
6 WITNESS HARPER: The monitoring plan
7 presently includes what we, I guess LES'
8 recommendation of what we should be monitoring, we
9 have proposed to monitor for certain things, as
10 described in the groundwater discharge permit
11 application in chapter 6 of the ER.
12 We believe that what we have specified to
13 monitor is appropriate.
14 MR. LOVEJOY: Okay. It is also shown in
15 the Draft Environmental Impact Statement table 6-9,
16 well 6-9 is the storm water monitoring, 6-9 is the
17 storm water monitoring program, and 6-8 is
18 physicochemical sampling, and 6-8 includes groundwater
19 monitoring.
20 And what it says, under sampling and
21 collection, it just says metals, organics, and
22 pesticides. That is not very specific, is it?
23 CHAIR BOLLWERK: Are you referring to an
24 exhibit?
25 MR. LOVEJOY: I think it is NRC exhibit 1,

1 page 6-17, and 6-18.

2 JUDGE ABRAMSON: Staff exhibit, right.

3 MR. LOVEJOY: It's 6-17 and 6-18.

4 CHAIR BOLLWERK: Is this 1, or 1-A, which

5 is the -- I'm sorry, 1-A or 1-B, which is the redacted

6 version?

7 MR. LOVEJOY: My version is unredacted but

8 I don't think that there is a difference.

9 CHAIR BOLLWERK: So it would be 1-A, then?

10 MS. CLARK: This is not a redacted

11 portion.

12 CHAIR BOLLWERK: I'm sorry?

13 MS. CLARK: This is not a redacted

14 portion.

15 CHAIR BOLLWERK: So it would be 1-B, then,

16 the redacted non-sensitive version is what we are

17 dealing with?

18 MS. CLARK: Yes.

19 CHAIR BOLLWERK: All right. Why don't we

20 go ahead and let the record reflect that exhibit 1-B

21 has been marked for identification. This is Staff's

22 1-B, excuse me.

23 (Whereupon, the above-

24 referenced to document was

25 marked as Staff Exhibit No. 1-B

1 for identification.)

2 MR. LOVEJOY: Do you have those pages, Mr.

3 Harper?

4 WITNESS HARPER: Yes, I do.

5 MR. LOVEJOY: So on table 6-8, with

6 respect to groundwater, and under the heading sampling

7 and collections, it just says, metals, organics and

8 pesticides, correct?

9 WITNESS HARPER: In the Draft

10 Environmental Impact Statement, that is correct.

11 MR. LOVEJOY: And is this the current

12 proposal by LES?

13 WITNESS HARPER: The monitoring proposal

14 for LES is described in the ER and in the groundwater

15 discharge permit. I haven't done a one to one

16 comparison between the table 6-8 here and the DEIS,

17 and what we have proposed.

18 MR. LOVEJOY: Where is it in the ER?

19 WITNESS HARPER: In the ER I'm looking in

20 section 6, which is LES exhibit 2. We checked the

21 table 6.1-4, describes the radiological environmental

22 monitoring program.

23 MR. LOVEJOY: Okay. And does table 6.2-1,

24 on --

25 WITNESS HARPER: It describes the

1 physicochemical, correct.

2 MR. LOVEJOY: Okay, and then --

3 WITNESS HARPER: And then 6.2-2 is the

4 storm water.

5 MR. LOVEJOY: And as to 6.2-1 under

6 samplings and collections with respect to groundwater

7 I see the same language, metals, organics, and

8 pesticides. Is that the current LES proposal?

9 WITNESS HARPER: The physicochemical

10 sampling, and I will also refer you to the groundwater

11 discharge permit on page 22.

12 CHAIR BOLLWERK: That is exhibit 4, do I

13 have the right exhibit?

14 MR. LOVEJOY: That is correct.

15 WITNESS HARPER: Yes.

16 MR. LOVEJOY: Page 22, you said?

17 WITNESS HARPER: Page 22. It is either on

18 page 22, on the right-hand column of the table there,

19 it lists the groundwater monitoring parameters for the

20 wells, including PH, uranium, isotopic, fluoride, TBS

21 and sulfate.

22 MR. LOVEJOY: Well, we were talking, a few

23 minutes ago, about PAHs, organics, and alcohol and

24 pesticides. They would not be identified by

25 monitoring along these lines, would they?

1 JUDGE ABRAMSON: Counselor, are you --

2 WITNESS HARPER: The --

3 CHAIR BOLLWERK: Sorry, excuse me just a

4 second. Counselor, are you worried about those

5 particular contaminants in the storm water runoff

6 basin, or are you worried about them for all basins?

7 MR. LOVEJOY: Certainly they would be most

8 prevalent in that unlined basin, and would hit the

9 groundwater. Yes, they could get into the other open

10 basins too.

11 JUDGE ABRAMSON: I understand. But that

12 would be the principal place you would expect them to

13 collect, right?

14 MR. LOVEJOY: They would collect there,

15 then they would go down, certainly, from the storm

16 water basin.

17 CHAIR BOLLWERK: I think there is a

18 question pending? You may have to repeat it. I'm not

19 sure if he --

20 WITNESS HARPER: The existing LES

21 monitoring program is laid out to be considered to be

22 reasonable parameters for measurement. We are

23 currently in the process of going to, obtaining, we

24 have applied for a groundwater discharge permit from

25 the state.

1 And any additional monitoring requirements
2 to address certain constituents as to what you are
3 referring to would be an outcome, if required, from
4 the groundwater discharge permit application.
5 But right now we believe what we have
6 proposed is adequate for monitoring runoff in the case
7 of the site storm water detention basin is runoff from
8 parking lots, paved roads, and building roofs,
9 essentially.
10 And what we have proposed here is typical
11 and actually is even, we have proposed even more than
12 what I typically use to at other facilities where we
13 do similar monitoring.
14 JUDGE ABRAMSON: Counselor, let me ask
15 you, the chemicals that you identified, that you are
16 asking about monitoring, are they things that NMED,
17 the New Mexico Environmental Department, would
18 typically require monitoring for industrial
19 facilities, or are they outside that norm?
20 MR. LOVEJOY: I believe that they would.
21 And I think that they would also be in the Clean Water
22 Act storm water monitoring permit requirement, or
23 should be.
24 JUDGE ABRAMSON: Does the Staff know, has
25 the Staff looked at this matter?

1 MS. CLARK: Sorry, we don't know.

2 JUDGE ABRAMSON: You don't know, okay.

3 Well, maybe we can find out somehow.

4 WITNESS HARPER: But my experience is that

5 a nuclear facility, which is storm water is regulated

6 by the US EPA, you do not monitor for those types of

7 constituents.

8 JUDGE ABRAMSON: That is for a nuclear

9 power plant? But for -- are you saying for all EPA

10 regulated facilities?

11 WITNESS HARPER: That is at a nuclear,

12 that is with several nuclear power plants --

13 JUDGE ABRAMSON: All right, I don't think

14 that is the issue here but thank you.

15 MR. LOVEJOY: I believe we can break --

16 WITNESS HARPER: However, the point I was

17 trying to make is that those particular NMED permit

18 monitoring requirements are for parking lots and paved

19 areas at these plants.

20 JUDGE ABRAMSON: I assume that LES is

21 applying for all the relevant permits.

22 MR. CURTISS: Yes. And I think the point

23 that the witness has made, and it can be, I think, a

24 matter of the record, even without knowing what the

25 state monitors, if the state requires monitoring for

1 those constituents, through the groundwater discharge
2 permit review, the Applicant will comply as a result.
3 CHAIR BOLLWERK: What power plants are you
4 talking about, and where?
5 WITNESS HARPER: I've been involved with
6 storm water runoff monitoring at the Seabrook Station
7 in New Hampshire.
8 CHAIR BOLLWERK: Right, but that is not
9 New Mexico, right?
10 WITNESS HARPER: Correct.
11 CHAIR BOLLWERK: Okay.
12 MR. LOVEJOY: I believe we can break for
13 lunch at this point.
14 CHAIR BOLLWERK: All right. I have about
15 20 until 2, let's give it until 3 o'clock. We are not
16 going to run a lunch time crowd, so we don't have to
17 worry about that. I'm hoping by 3 o'clock we can all
18 be back here and reconvene.
19 In terms of the exhibits we have marked
20 for identification, I know that we have some out of
21 order. I don't know how you are binding these
22 together, or keeping them, or giving them to our
23 clerk.
24 But it would be good to give her the
25 original and two copies of whatever, the LES 26, NIRS

1 33, 43, 17, and Staff 1-B, if you could give those to
2 her, and then at some point we will admit them.
3 Very good, then let's go ahead and take a
4 break. We will reconvene at 3 o'clock. Thank you.
5 (Whereupon, at 1:41 p.m. the above-
6 entitled matter was recessed for lunch.)

1 A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

2 3:00 p.m.

3 CHAIR BOLLWERK: Back on the record,

4 please. Let's take care of one administrative matter.

5 LES exhibit 26, which is your exhibit, but they had

6 used it for cross examination.

7 MR. REPKA: Yes, sir. We had identified

8 it in connection with Contention EC-2, but it has been

9 identified I have copies, and I would be willing to

10 move it into evidence at this time.

11 CHAIR BOLLWERK: All right, if you could

12 just give it to our law clerk and then we will go

13 ahead and deal with that in a minute.

14 MR. REPKA: Well, why don't I identify it

15 again, as the Lea County Regional Water Plan, prepared

16 for Lea County Water User's Association, dated

17 December 7th, 2000, and we will move that that be

18 accepted into evidence.

19 CHAIR BOLLWERK: Okay. Let's hold that

20 thought for one second and let me turn to Mr. Lovejoy

21 and see, I offered you the opportunity, if you had any

22 thoughts during lunch, that you would be able to ask

23 some additional questions.

24 Are you finished, or do you have anything

25 else?

1 MR. LOVEJOY: Just a couple.

2 CHAIR BOLLWERK: All right. And then we

3 will turn not only to that exhibit, but the rest of

4 them, we put in, and we will deal with those.

5 MR. LOVEJOY: All right. Mr. Peery, in

6 your rebuttal you referred to some wells that Mr. Rice

7 himself referred to. I'm looking at answer A-6.

8 And you say, at the bottom of page 5, the

9 particular wells identified by Mr. Rice, to the extent

10 they even still exist, are located up gradient of, and

11 substantially far from the NEF site.

12 Therefore any postulated releases from the

13 proposed NEF would not affect these facilities. How

14 far away is substantially far, how far away are these

15 wells?

16 MR. PEERY: The wells are located, the

17 nearest well is located to the NEF facility are

18 approximately three miles from the site.

19 MR. LOVEJOY: And they are completed in

20 the alluvium, is that right?

21 MR. PEERY: I don't know what they are

22 completed in. Some of the well records I looked at,

23 from the Office of the State Engineer, they are not

24 specific as to what formations are necessarily

25 completed in.

1 The reference to the Eunice well was a
2 Dockum well, however. The reference to the Eunice
3 well was a Dockum well. And it should be noted that
4 the city of Eunice now has its well filled in the
5 Ogallala, and the Lea County underground water basin,
6 which is located about 10 to 12 miles from the NEF
7 site.
8 MR. LOVEJOY: Do you know the depths of
9 the other wells?
10 MR. PEERY: I don't recall, off-hand.
11 MR. LOVEJOY: And your statement is that
12 these are up-gradient. How do you know that?
13 MR. PEERY: The Eunice well would be a
14 little bit up and up-gradient, should it still exist.
15 I should point out that 40 years ago, actually it
16 would be about 44 years ago, this reference that Mr.
17 Rice cited, the wells were constructed primarily of
18 steel, even the domestic wells.
19 And so they may not even exist any more,
20 they may have been corroded, or plugged off, or
21 something. And the other reference here is to the
22 town of Oil Center, 12 miles northwest of the site.
23 That would also be up-gradient of the NEF
24 facility.
25 MR. LOVEJOY: But do you know what stratum

1 it is in, it is completed in?

2 MR. PEERY: That one claims to be in the

3 Dockum group.

4 MR. LOVEJOY: Were there some domestic

5 wells mentioned, as well?

6 MR. PEERY: In the reference that you cite

7 here, I don't believe so.

8 MR. LOVEJOY: I was going by -- excuse me,

9 were you finished?

10 MR. PEERY: No, go ahead, please.

11 MR. LOVEJOY: Well, your answer says,

12 citing a reference that is over 40 years old, Mr. Rice

13 states that alluvial wells approximately three miles

14 west of the proposed site, have been used for domestic

15 purposes.

16 So that is what I'm asking about.

17 MR. PEERY: Yes, the 1961 Nicholson and

18 Clebsch reference indicates that there are some

19 alluvial wells approximately three miles from the site

20 to the west of the site.

21 MR. LOVEJOY: And you think they are up-

22 gradient?

23 MR. PEERY: Those would be off-gradient.

24 MR. LOVEJOY: Those would be down-

25 gradient, is that what you are saying?

1 MR. PEERY: They would be off-gradient and
2 potentially up-gradient from the confined zone at 220
3 foot depth. Wells west of the NEF facility would be,
4 that are completed in the 220 foot zone, would be off-
5 gradient and potentially up-gradient.
6 The shallow alluvial wells, there is no
7 groundwater in the alluvium at the NEF site, so I
8 can't make a reference as to the condition of those
9 wells.
10 MR. LOVEJOY: So are you saying that this
11 must be a mistake in the report, that there were wells
12 in the alluvium?
13 MR. PEERY: No, I'm not saying that at
14 all. I'm saying that the alluvial wells -- let me say
15 this. I don't think the report is mistaken that there
16 were wells in the alluvium over 40 years ago, along
17 the Monument Draw area.
18 What I'm saying is that there is no
19 shallow groundwater at the NEF site. But I don't
20 dispute that there were wells completed in the
21 alluvium some 40 years ago.
22 MR. LOVEJOY: And can you speak of the
23 gradient, if you are also maintaining there is no
24 groundwater at the NEF site? If there --
25 MR. PEERY: -- in the shallow alluvium

1 would have been generally in a southerly direction at
2 the location that these wells are described.
3 MR. LOVEJOY: So they would not be up-
4 gradient, is that right?
5 MR. PEERY: Wells west of the -- well, I
6 think maybe we are mixing apples and oranges here.
7 Since there is no alluvial water at the NEF site you
8 can't apply the term up-gradient and down-gradient to
9 a saturated zone that does not exist.
10 So the wells in the shallow alluvium,
11 along Monument Draw, would be in a shallow perched
12 aquifer, or shallow alluvial aquifer, if you will,
13 that would tend to have a groundwater flow direction
14 that would be, generally, to the south.
15 When referring to the deeper water within
16 the Dockum group sediments, if you want to refer to
17 the Santa Rosa, the water in the Santa Rosa generally
18 flows in a southeastwardly direction.
19 So wells completed in the Dockum group
20 aquifer, to the west and north of the NEF site, would
21 be up-gradient.
22 MR. LOVEJOY: But one would not refer to
23 those as alluvial wells, would one?
24 MR. PEERY: No, I was just making the
25 distinction between the two water bearing units.

1 JUDGE ABRAMSON: Mr. Peery, just so I'm
2 clear, if there are shallow alluvial wells west of the
3 site, they would get any feed from their north, is
4 that correct? They would, flow would be north to
5 south?
6 MR. PEERY: Yes, sir.
7 JUDGE ABRAMSON: So since the site is east
8 of them, what came out onto the site would not feed
9 into those wells, is that correct? If anything came
10 out.
11 MR. PEERY: If anything came out. Again,
12 if we get back to the Staff's conservative estimate,
13 there would be flow in a southwesterly direction
14 towards Monument Draw.
15 The condition, as it is today, or at least
16 40 years ago, was shallow alluvial water, along
17 Monument Draw, which is a north-south running feature.
18 So the groundwater gradient would be from north to
19 south along that saturated alluvial material.
20 Does that help?
21 JUDGE ABRAMSON: Well, I'm trying to get,
22 I thought I had a simple principle in mind, and maybe
23 I misunderstood. If something comes out -- here is
24 the question.
25 If something comes out into the

1 groundwater, on the NEF site, into the shallow
2 alluvium, will it go toward those wells that are
3 mentioned, those shallow alluvial wells?
4 Or will it go, or will it be directed
5 south of them?
6 MR. PEERY: As I recall there was
7 potentially a well or two located approximately where
8 a theoretical plume would arrive at Monument Draw,
9 with the rest of them being north at that spot.
10 JUDGE ABRAMSON: Okay. So we are back to
11 the theoretical plume based on the Staff's
12 conservative estimate?
13 MR. PEERY: Conservative estimate, yes,
14 sir.
15 JUDGE ABRAMSON: Thank you. Does this
16 clarify this or not?
17 MR. LOVEJOY: I think, yes, that clarifies
18 that.
19 JUDGE ABRAMSON: Thank you.
20 MR. LOVEJOY: Thank you, that is all I
21 have.
22 CHAIR BOLLWERK: All right, that is it
23 then? Let me make, backup one step here. LES had
24 indicated that maybe after lunch you would have
25 something to say about monitoring wells?

1 MR. CURTISS: Yes, Mr. Chairman. There
2 are really two issues that I think we can address, and
3 we will direct you to the discussion in the direct
4 testimony for the Applicant's position on this.
5 With respect to the issue of monitoring
6 wells, and the issue of monitoring at the alluvium
7 Chinle interface, as we indicated this morning, that
8 is the subject of a pending groundwater discharge
9 permit review, with the state of New Mexico.
10 And if the state of New Mexico, in
11 assessing the particulars of the monitoring system,
12 should decide to impose a requirement that monitoring
13 be done at that interface, obviously the Applicant
14 here, the Applicant in that proceeding, would comply
15 with that.
16 Similarly, on the issue of monitoring of
17 the PAH in the parking lot, raises the same issue.
18 That issue, as well, is a matter that the State of New
19 Mexico will address, and if the state determines, in
20 its jurisdictional authority in that area, that PAHs
21 need to be monitored in the parking lot, certainly LES
22 would be prepared to do that.
23 I would refer you, in terms of the
24 discussion, as to why we think those issues reside
25 uniquely at the state level, to the direct testimony

1 of LES at answer 62, and the rebuttal testimony at
2 answer 29, question and answer.
3 And I think that lays out, in much more
4 detail, why we think that is an issue that is vested
5 uniquely in the state, and not a question of a NEPA
6 issue for this proceeding.
7 CHAIR BOLLWERK: All right, let me see if
8 there is anything further you want to say on that
9 subject, given that discussion?
10 MR. LOVEJOY: The matter may well be
11 regulated by the state, but it might also be
12 something, an impact that should be addressed under
13 NEPA, potential impact.
14 JUDGE ABRAMSON: Does the Staff have a
15 position on this? Or does the Staff want to formulate
16 one and get back to us?
17 MS. CLARK: On the --
18 JUDGE ABRAMSON: On whether or not these,
19 the monitoring of this potential effluent is something
20 that should be covered in taking a hard look.
21 MS. CLARK: Well, what I would say is that
22 we, in the Draft Environmental Impact Statement, look
23 at what monitoring wells will be installed, and what
24 they will measure.
25 But we don't determine whether those are

1 adequate or sufficient because that duty lies with the
2 state, not with the NRC. We deal with it in one
3 respect as to radiological effluents. We will look at
4 that issue in connection with the safety evaluation.
5 JUDGE ABRAMSON: So if I'm hearing this
6 correctly, what the Staff is saying is that what is
7 specifically to be monitored in the groundwater, aside
8 from radiological, is a matter for the local, the
9 state jurisdictional agencies under EPA, is that
10 correct?
11 MS. CLARK: That is correct.
12 JUDGE ABRAMSON: And that in NEPA needs
13 analysis the Staff is not required to look at what
14 needs to be monitored, in terms of assessing the
15 consequences, or the costs, environmental costs, in
16 doing the cost benefit analysis?
17 MS. CLARK: Well, we consider it in our
18 environmental analysis.
19 JUDGE ABRAMSON: So you consider the
20 possibility of the effluent?
21 MS. CLARK: Yes.
22 JUDGE ABRAMSON: But you don't consider
23 the need to monitor, you let the state with the need
24 to monitor?
25 MS. CLARK: Right.

1 JUDGE ABRAMSON: I'm trying to see if we
2 are drawing a line.
3 MS. CLARK: To the extent that, yes,
4 because we would not impose requirements as to
5 monitoring, because that is within the state
6 jurisdiction.
7 So we look at where the monitoring wells
8 will be situated, we asses whether, you know, what
9 that will evaluate. But we do it in the context of
10 our whole analysis of how the plumes will flow, and
11 how LES is dealing with them.
12 But we don't set requirements for those,
13 at least in terms of these effluents.
14 JUDGE ABRAMSON: Don't set requirements in
15 terms of monitoring, is that what you mean?
16 MS. CLARK: Correct.
17 JUDGE ABRAMSON: Okay.
18 MR. CURTISS: And that is certainly
19 consistent with our view that the Agency has an
20 obligation, and has fulfilled that obligation to
21 evaluate the environmental impacts of the operation,
22 construction, and decommissioning of this facility,
23 including the impacts associated with any releases at
24 the site.
25

1 And so we think the agency has satisfied
2 that obligation in its Draft Environmental Impact
3 Statement, as to the specific remedy for that, it is
4 our view that NEPA is not a remedy statute, in that it
5 can direct a particular monitoring scheme, groundwater
6 monitoring at the alluvium chinle interface, but that
7 is uniquely a matter for the jurisdiction of others.
8 And in this case these are matters that
9 are being addressed in the review by NMED of the
10 groundwater discharge permit application.
11 JUDGE ABRAMSON: Thank you folks.
12 CHAIR BOLLWERK: Anything further you want
13 to say on that subject?
14 MR. LOVEJOY: Well, the DEIS does include
15 the schedules of the monitored constituents, storm
16 water, surface water, and groundwater. And it may be
17 appropriate if there are certain constituents which
18 are likely to be present, which are not monitored, for
19 the DEIS to make that point.
20 It is a disclosure document, and it is not
21 an enforcement statute, or a document.
22 JUDGE ABRAMSON: How do you see the
23 disclosure falling within the NEPA requirement that
24 they take a hard look at the environmental
25 consequences?

1 In other words, as I'm hearing the role,
2 as described by the Staff, and the Applicant, the role
3 is to asses the environmental consequences, and they
4 are distinguishing that from an obligation to
5 prescribe or evaluate the way the environmental
6 effluents might be monitored.
7 They are only looking at the consequences
8 of the projected releases. How would you fit the
9 concept that the Draft Environmental Impact Statement
10 is, perhaps, deficient by not specifying monitoring,
11 how would you fit that into the context of an
12 evaluation of the environmental consequences?
13 MR. LOVEJOY: Well, I think it has come
14 out, and I think most of the witnesses agree that
15 there are various hazardous constituents, which would
16 not be identified by a monitoring plan as laid out in
17 the Draft Environmental Impact Statement at present.
18 And that could be stated.
19 CHAIR BOLLWERK: All right, thank you.
20 Although given the way we've been proceeding I'm not
21 sure I need to ask this question. But are there any
22 questions from the Board members for these witnesses?
23 JUDGE KELBER: I could, but I won't.
24 CHAIR BOLLWERK: You certainly can, this
25 is the opportunity. I actually did have a question.

1 There was some testimony early on, or
2 earlier, about, for instance, some borings that were
3 done back in 1993. I think the number was 55 plus.
4 There was another, I guess, Cook-J, am I pronouncing
5 that correctly, who did your work on the --
6 MR. PEERY: The Cook-Joyce?
7 CHAIR BOLLWERK: Cook-Joyce, I'm sorry,
8 like 220 was another number that was put in. And then
9 there were 9 and 5 that were done at your site. I
10 mean, there is a significant magnitude of difference
11 in there.
12 Why, who made the decision that only 9 and
13 5 were required in terms of the --
14 MR. PEERY: The reason that there was a
15 limited number of borings done at the NEF site was
16 because Cook-Joyce, as you mentioned, had done a
17 significant amount of work at the WCS site immediately
18 to the east of this site.
19 And as they went out to evaluate this
20 site, and do their borings, and installation of the
21 monitoring wells in the 220 foot zone, they found that
22 the site hyrdrogeologic setting was similar to the
23 site at the WCS immediately to the east.
24 And, therefore, because they had so much
25 information on the area, and it correlated well with

1 the NEF site, they didn't go over and put in 100
2 holes, or something on that nature.
3 CHAIR BOLLWERK: So this is Cook-Joyce's
4 decision, not LES' decision, necessarily, as to how
5 many of these were done?
6 WITNESS HARPER: No. LES worked in
7 concert with Cook-Joyce to lay out the program. And
8 with LES made the determination that they would go
9 forward with them.
10 CHAIR BOLLWERK: Were there other options
11 that were given to them? You said this program.
12 Were there other programs, other options, were they
13 given you can drill this many wells, or this many, or
14 this many, pick one?
15 WITNESS HARPER: No.
16 CHAIR BOLLWERK: So this was Cook-Joyce
17 but LES had accepted their recommendation?
18 WITNESS HARPER: Accepted their
19 recommendation, and LES evaluated it and then accepted
20 it.
21 CHAIR BOLLWERK: All right. Any other
22 questions?
23 JUDGE KELBER: All right, I have one final
24 question. Discussing the possibility that water might
25 flow through the alluvium to the, what is this draw?

1 MR. PEERY: Monument Draw.

2 JUDGE KELBER: Yes, Monument Draw. In
3 that process the water flowing through gravel and
4 sand, reminds me of the fact that in general if you
5 want to filter contaminated water you filter it
6 through gravel and sand.

7 Would this alluvium have the properties of
8 filtering this water?

9 WITNESS HARPER: A good filter will remove
10 contaminants.

11 JUDGE KELBER: Is this alluvium a good
12 filter? Assuming, for the sake of argument, that
13 there is a continuous alluvium to this draw, Monument
14 draw --

15 MR. PEERY: Alluvium will filter certain
16 contaminants, but there are some dissolved
17 contaminants that aren't readily filtered out just by
18 the, I guess, the porous space of the material itself.

19 However, it could readily absorb on to
20 soil material.

21 JUDGE KELBER: To get it adsorbed?

22 MR. PEERY: Yes.

23 CHAIR BOLLWERK: All right. Anything
24 further? All right, then, gentlemen we appreciate
25 your appearance before the Board. Thank you for your

1 -- you have a choice, we can do it now, or we can do
2 it at the very end, which would you prefer?
3 MR. REPKA: We will defer to the very end.
4 CHAIR BOLLWERK: All right.
5 MR. REPKA: You are referring to redirect?
6 CHAIR BOLLWERK: Yes, well, redirect, or
7 sur rebuttal, I don't know which way you want to put
8 it. But we can do redirect now, if you want. It is
9 up to you.
10 MR. REPKA: Well, I really only had one
11 question. I can ask that question, it is really a
12 follow-up of a question you just asked.
13 CHAIR BOLLWERK: All right.
14 EXAMINATION BY MR. REPKA OF
15 GEORGE A. HARPER AND ROGER L. PEERY
16 MR. REPKA: And that was a reference, Mr.
17 Lovejoy asked some questions this morning regarding
18 the number of monitoring wells in prior work, prior to
19 the wells at the NEF site. Do you recollect that?
20 WITNESS HARPER: Yes.
21 MR. PEERY: Yes.
22 MR. REPKA: And I just wanted to ask the
23 question, was, in presenting the number of wells
24 sequentially, the way Mr. Lovejoy did, 50 by so and
25 so, and then 200 by Cook-Joyce, was that a fair and

1 accurate representation of the work that had been
2 done?
3 MR. PEERY: It may have double counted
4 some of the borings that had been done, and I think,
5 as I recall, the number for the WCS site was actually
6 somewhere over 200 borings, and 110 monitoring wells.
7 And I think what happened was that Mr.
8 Lovejoy may have double counted something from the
9 Holt report in that. So there is a distinction there.
10 MR. REPKA: Because the Holt Cook-Joyce
11 report credited the Holt report?
12 MR. PEERY: Yes.
13 MR. REPKA: Okay, I understand. I have
14 nothing further at this time.
15 CHAIR BOLLWERK: Anything further, Mr.
16 Lovejoy?
17 EXAMINATION BY MR. LOVEJOY OF
18 ROGER L. PEERY AND GEORGE A. HARPER
19 MR. LOVEJOY: Mr. Peery, you spoke about
20 some constituents being adsorbed on matter in the
21 alluvium. You haven't done any study of that issue,
22 have you?
23 MR. PEERY: Not at this site.
24 MR. LOVEJOY: Thank you.
25 CHAIR BOLLWERK: Anything further, then,

1 LES?

2 (No response.)

3 CHAIR BOLLWERK: All right, then.

4 Gentlemen, I thank you very much for your service to

5 the Board. We appreciate your coming and speaking

6 with us today.

7 (The witnesses are excused.)

8 CHAIR BOLLWERK: I guess we are ready for

9 the Staff's witness on EC-1. We do have one other

10 thing while the Staff is getting ready. We have a

11 couple of exhibits that dealt with this cross

12 examination.

13 LES 26, NIRS 33, NIRS 43, NIRS 17 and

14 Staff 1-B, does anyone have any objection to any of

15 those exhibits?

16 MS. CLARK: No.

17 MR. REPKA: No.

18 MR. LOVEJOY: No.

19 CHAIR BOLLWERK: Hearing none, then the

20 record should reflect that LES 26, NIRS 33, 43, 17 and

21 Staff 1-B are admitted into evidence.

22 (The documents referred to,

23 having been previously marked

24 for identification as LES

25 exhibit No. 26; NIRS/PC exhibit

1 Nos. 33, 43, and 17; Staff
2 exhibit No. 1-B, were admitted
3 in evidence.)
4 MS. CLARK: Okay, at this time the Staff
5 calls Mr. Alan Toblin to the stand.
6 Whereupon,
7 ALAN TOBLIN
8 was called as a witness by counsel for the Staff and,
9 having been duly sworn, assumed the witness stand, was
10 examined and testified as follows:
11 CHAIR BOLLWERK: Thank you, sir.
12 MS. CLARK: Mr. Toblin, before you, do you
13 have a document reflecting your direct testimony you
14 prepared for this case?
15 WITNESS TOBLIN: Yes, I do.
16 MS. CLARK: Do you have any corrections to
17 make to that testimony at this time?
18 WITNESS TOBLIN: Just one correction. On
19 my testimony, page 24, answer 54, fifth line down, the
20 number 23,350 cubic meters should be 123,350 cubic
21 meters.
22 MS. CLARK: Do you have any other
23 corrections in your direct testimony?
24 WITNESS TOBLIN: No, I don't.
25 MS. CLARK: Mr. Toblin, did you also

1 prepare a rebuttal testimony to this proceeding?

2 WITNESS TOBLIN: Yes, I did.

3 MS. CLARK: Do you have that before you?

4 WITNESS TOBLIN: Yes.

5 MS. CLARK: Do you have any corrections or

6 revisions to that testimony?

7 WITNESS TOBLIN: No, I don't.

8 MS. CLARK: With the correction, as you've

9 made it, is your written testimony true and correct to

10 the best of your information, knowledge, and belief?

11 WITNESS TOBLIN: Yes.

12 MS. CLARK: And do you adopt -- I'm sorry?

13 CHAIR BOLLWERK: We are trying to find the

14 change here. The page, again? Answer 54, page 24? It

15 is different pagination, I think.

16 (Pause.)

17 CHAIR BOLLWERK: Okay, I interrupted you,

18 I'm sorry. We may have to start back wherever you

19 were.

20 MS. CLARK: As corrected do you adopt this

21 written testimony as your sworn testimony in this

22 proceeding?

23 WITNESS TOBLIN: Yes.

24 MS. CLARK: At this time I would like to

25 move to have this testimony entered into the record.

1 CHAIR BOLLWERK: Any objections from any
2 of the parties?
3 MR. LOVEJOY: No.
4 CHAIR BOLLWERK: All right, hearing no
5 objections then the testimony, The NRC Staff testimony
6 of Alan Toblin, concerning the NIRS Environmental
7 Contention 1, NIRS/PC EC-1 impacts upon ground and
8 water surface should be incorporated into the record
9 as if read.
10 (Whereupon, the pre-filed direct testimony
11 of Alan Toblin was inserted into the record as if
12 having been read.)

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February 3, 2005

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
LOUISIANA ENERGY SERVICES, L.P.	)	Docket No. 70-3103
(National Enrichment Facility)	)	ASLBP No. 04-826-01-ML

NRC STAFF TESTIMONY OF ALAN TOBLIN CONCERNING
NUCLEAR INFORMATION AND RESOURCE SERVICE AND PUBLIC CITIZEN
ENVIRONMENTAL CONTENTION 1 ("NIRS/PC EC-1")
(IMPACTS UPON GROUND AND SURFACE WATER)

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

A1. My name is Alan Toblin. I am employed as a consultant with Advanced Technologies and Laboratories International, Inc. ("ATL") in Germantown, Maryland. I am providing this testimony under a technical assistance contract between the staff of the Nuclear Regulatory Commission ("NRC Staff" or "Staff") and ATL. A statement of my professional qualifications is attached hereto.

Q2. Please describe your current responsibilities.

A2. I am currently performing work on the groundwater transport of contaminants and on the health consequence risk of chemical and radiological releases from potential accidents at nuclear facilities.

Q3. Please explain what your duties have been in connection with the NRC Staff's review of Louisiana Energy Services, L.P.'s ("LES") application to construct, operate and decommission a gas centrifuge uranium enrichment facility near Eunice, New Mexico.

A3. As part of my official responsibilities, I assisted the NRC Staff in its evaluation of the potential environmental impacts related to the construction, operation, and

decommissioning of a gas centrifuge uranium enrichment facility near Eunice, New Mexico. My specific role was to conduct an evaluation of potential impacts to ground and surface water and water supplies due to construction, operation and decommissioning of that proposed facility. I assisted in preparation of the Staff's "Draft Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico," NUREG-1790, issued September 2004, ("DEIS" attached as Staff Exhibit 1a). I also assisted the NRC Staff in preparing portions of the "NRC Staff's Response to Interrogatories and Document Request by Petitioners Nuclear Information and Resource Service and Public Citizen to Commission Staff," dated November 10, 2004.

Q4. What is the purpose of this testimony?

A4. The purpose of this testimony is to provide the NRC Staff's views concerning NIRS/PC EC-1 specifically regarding: (1) potential leakage from the stormwater detention basin and septic leach fields; (2) potential leakage from lined basins; (3) the presence of moisture in two borings; (4) hydrologic transport of contaminants through fracture zones; and (5) discharge of stormwater runoff.

Q5. What documents did you review in preparing this testimony?

A5. In preparing this testimony, I reviewed the DEIS, all references pertaining to the relevant sections on ground and surface water as set forth in the DEIS, and all materials as cited in this testimony.

Q6. Are you familiar with NIRS/PC EC-1?

A6. Yes. I understand that NIRS/PC EC-1, as admitted by the Licensing Board in its Memorandum and Order (Initial Prehearing Order) of April 15, 2004, and modified by the Licensing Board's Memorandum and Order (Ruling on Late-Filed Contentions) of November 22, 2004, states as follows:

Petitioners contend that the Environmental Report contained in the application does not contain a complete or adequate assessment of the potential environmental impacts of the proposed project on ground and surface water, contrary to the requirements of 10 C.F.R. 51.45.

The Draft Environmental Impact Statement, NUREG-1790 (September 2004) ("DEIS") likewise does not contain a complete or adequate assessment of the potential environmental impacts of the proposed project on ground and surface water, contrary to the requirements of 10 C.F.R. Part 51 in that:

> (A) The DEIS correctly notes that leakage from the stormwater detention basin and the septic leach fields will probably cause formation of perched bodies of groundwater at the alluvium/Chinle interface. (DEIS, 4-13, 4-14). The DEIS contains estimates of the dimensions of such water bodies, flow rates, and discharge areas. However, NRC provides no explanation of such calculations, and it is not possible to determine whether they are reasonable.
>
> (B) The DEIS does not contain an estimate of the probability and frequency of leakage through the liners of the treated effluent basin or the stormwater detention basin. The basins are to be lined with geosynthetic materials (DEIS at 4-11, 4-12), such liners are known to leak (EPA, Hydrologic Evaluation of Landfill Performance (HELP) Model, User's Guide for Version 3, EPA/600/R-94/168a, Sept. 1994), and such information is necessary to demonstrate the impact of such leakage. The DEIS should contain an estimate of the leakage rate and should show the fate of water and contaminants that leak from the basins.
>
> (C) According to the DEIS, "... no precipitation recharge (i.e., rainfall seeping deeply into the ground) occurs in thick, desert vadose zones with desert vegetation (Walvoord et al., 2002)" (DEIS at 3-35). However, cuttings from one of the borings drilled in September 2003 were "slightly moist" (ER Rev. 2 at 3.4-2). In addition, the clay at the bottom of boring B-2 was "moist" (SAR at Fig. 3.2-11). The DEIS should explain the presence of this moisture, which conflicts with its statements about lack of recharge.
>
> (D) The DEIS states: "Although the presence of fracture zones that can significantly increase vertical water transport through the Chinle Formation has not

been precluded, the low measured permeabilities indicate the absence of such zones." (DEIS at 3-35). Two permeability measurements have been made on the Chinle Formation at or near the site: laboratory measurement of core samples (ER Rev. 2 Table 3.3-2) and a slug test performed in MW-2 (Cook-Joyce, Hydrogeologic Investigation, Sec. 32, T. 21 R. 38, Nov. 19, 2003). Such extremely limited measurements, where faults are present, cannot describe the permeability of the entire site, and NRC should explain its reliance on such restricted data.

(E) The stormwater basin will discharge runoff containing numerous contaminants, which are not adequately identified in the DEIS, nor is their monitoring explained. LES has stated that the runoff will contain small amounts of oil and grease typically found in runoff from paved roadways and parking areas (RAI Response, May 20, 2004, at 33). However, other contaminants may be present, such as PAHs (USGS, Concentrations of PAHs and Major and Trace Elements in Simulated Rainfall Runoff from parking lots, 2003, Open File Report 2004-1208), other organics such as aliphatic hydrocarbons and alcohols (Barrett, M.E, et al., Review and Evaluation of Literature Pertaining to the Quality and Control of Pollution from Highway Runoff and Construction, Tech. Report CRWR 239, April 1993), and other contaminants from spills and accidents. Their presence should be disclosed. Further, stormwater should be monitored for such contaminants.

Q7. On behalf of the NRC Staff, have you conducted an evaluation of the potential impacts on hydrologic resources (i.e. ground and surface water) resulting from the construction, operation and decommissioning of the proposed NEF?

A7. Yes. I conducted an evaluation of the potential impacts to these hydrologic resources, which is set forth in various sections of the DEIS issued in September 2004. In particular, the impacts of the proposed NEF on hydrological resources in and around the region of the proposed Lea County site are discussed in DEIS §§ 3.7, 3.8, 4.2.6, 4.3.6, 4.4.3, and 6.1.1.2.

Q8. Have you reached a conclusion on behalf of the NRC Staff as to the potential impacts that may result from construction, operation, and decommissioning of the proposed NEF on hydrologic resources?

A8. Yes. I have reached conclusions as set forth in sections 3.7, 3.8, 4.2.6, 4.3.6, and 4.4.3 of the DEIS, which discuss the evaluation of the potential impacts due to construction, operation and decommissioning of the proposed NEF on hydrological resources in Lea County, and have determined that any such impacts would be small.

Basis (A) – Leakage from Stormwater Detention Basin and Septic Leach Fields

Q9. Are you familiar with Basis (A) for NIRS/PC EC-1?

A9. Yes. I understand that Basis (A) of NIRS/PC EC-1states that:

> (A) The DEIS correctly notes that leakage from the stormwater detention basin and the septic leach fields will probably cause formation of perched bodies of groundwater at the alluvium/Chinle interface. (DEIS, 4-13, 4-14). The DEIS contains estimates of the dimensions of such water bodies, flow rates, and discharge areas. However, NRC provides no explanation of such calculations, and it is not possible to determine whether they are reasonable.

Q10. Basis (A) refers to the alluvium/Chinle interface. Please describe the alluvium and Chinle and their relationship to each other and to other geologic formations beneath the proposed NEF site.

A10. Three significant geologic formations are found beneath the proposed NEF site: the Antlers Formation, the Chinle Formation and the Santa Rosa Formation. DEIS Table 3-8 includes descriptions of these formations at the proposed NEF site from the surface down, and sets forth their depths and thicknesses. At the proposed NEF site, the Antlers Formation (referred to as "Alluvial Deposits" in DEIS Figure 3-16) on average extends from a depth of 1.4 feet to 39 feet below the ground. The Antlers Formation is made up chiefly of sand and silty sand. Below the Antlers Formation lies the Chinle Formation, which on average

extends from a depth of 39 feet to 1,115 feet below the proposed NEF site. The Chinle Formation (also known as the Triassic Red Beds) is a highly impermeable claystone and silty clay layer with interbedded siltstone and sandstone, and this thick layer of rock beneath the proposed NEF site isolates the deep and shallow hydrologic systems located there. Below the Chinle Formation lies the Santa Rosa Formation, which ranges in depth from 1,115 feet to 1,425 feet below the ground at the proposed NEF site. The Santa Rosa Formation includes sandy beds containing a ground water aquifer. The low permeability of the overlying Chinle Formation inhibits potential ground water migration to the Santa Rosa aquifer, and there is no indication of a hydraulic connection between the Chinle and Santa Rosa Formations. (DEIS, at pp. 3-35 to 3-36).

Q11. Can you please explain what is meant by "perched bodies of groundwater at the alluvium/Chinle interface?"

A11. Perched groundwater is saturated groundwater that sits on top of an impermeable layer and flows downgradient. The impermeable layer (here, the Chinle Formation) creates a barrier to downward water movement. Perched groundwater is therefore higher than and apart from underlying aquifers. In this case, perched groundwater could form at the interface between the alluvial deposits in the Antlers Formation and the underlying Chinle Formation.

Q12. What would be the source of any potential perched bodies of water that could result from activities at the proposed NEF site?

A12. Discharge from the stormwater detention basin and septic fields would be the source of any such perched bodies of water.

Q13. Assuming that perched water bodies form beneath the site, did you consider the dimensions of these perched water bodies, their flow rates, and potential discharge locations in assessing the environmental impacts of the proposed NEF site?

A13. Yes.

Q14. In determining the potential environmental impacts to ground and surface water from the proposed NEF, what is the signficance of determining the flow rates of perched bodies of groundwater at the alluvium/Chinle interface?

A14. In this question and those that follow, I am interpreting the term "flow rate" to mean groundwater velocity or pore velocity, unless indicated otherwise. The flow rate indicates how rapidly the perched water would progress downgradient and where it might become available for use. The importance of determining the flow rate is related to water use and water quality. In this case, it is unlikely that the perched water under the proposed site would be used for human consumption because there are no nearby wells or springs, and the closest possible discharge location (Monument Draw) is not used due to its intermittent flow. There are no present users of groundwater downgradient, i.e., in the direction of flow, and any use of this perched water from the proposed site for human consumption in the future would be unlikely because of its limited extent and uncertain availability. The potential contaminants in any perched water bodies would be from normal site runoff and sanitary uses.

Q15. Did you perform a calculation to determine what the flow rates of perched bodies of groundwater at the alluvium/Chinle interface would be?

A15. Yes, pages 4-13 and 4-14 of the DEIS discuss these calculations, which were elaborated upon in "NRC Staff's Response To Interrogatories and Document Requests by Petitioners Nuclear Information and Resource Service and Public Citizen to Commission Staff," dated November 10, 2004. The estimated groundwater velocity of the basin and septic discharge at the alluvium/Chinle interface is based on an application of Darcy's Law. Darcy's Law relates the properties of the formation through which the water is being transported, in this case the Antlers alluvium, to the groundwater velocity. The Darcy Velocity (Vd) is equal to the hydraulic conductivity (kh) of the formation multiplied by the gradient (slope) of the

groundwater surface (dh/dl). (DeWiest, R.J.M., *Flow Through Porous Media*, Academic Press, New York, New York, 1969, at p. 3 ("DeWiest"), attached as Staff Exhibit 2). The chosen kh = 0.01 cm/sec, is on the conservative side (i.e., results in greater Darcy Velocity) of the range of site surface soils hydraulic conductivity provided in the LES ER, at pp. 3.4-14 and 3.4-15. This kh value is also on the conservative end of the range provided in Table 5.1 of *Data Collection Handbook To Support Modeling Impacts of Radioactive Material In Soil*, Yu, C., et al, Argonne National Laboratory, April 1993, at Table 3-1, p. 23, ("Yu") attached as Staff Exhibit 6. The gradient of the groundwater surface is assumed to follow the slope of the Chinle Formation surface, 0.02 cm/cm towards the south-southwest, as set forth on DEIS page 3-35.

Based on information at pages 3.4-6 and 3.6-3 of the LES Environmental Report, Revision 2 ("LES ER," LES Exhibit 1), the flow rate (taken here to mean the volumetric rate of water movement) from the basin is estimated as the precipitation, at a rate of 46.1 cm/yr, falling on the basin's drainage area of 39 hectares. In the calculation, runoff infiltration, evaporation of runoff water and basin water, and evapotranspiration have been ignored, resulting in a conservative estimate of flow rate. For example, because evapotranspiration is the combination of water that is evaporated and transpired from soil and plant surfaces as a part of their metabolic processes, not accounting for evapotranspiration leads to a conservative estimate of basin discharge flow rate since it assumes a greater volume of available water.

The resulting conservative estimate of flow from the stormwater detention basin, which is the product of precipitation rate and the drainage area, is 180,000 m^3/yr, accounting for units conversion. This value is in line with the estimate of annual stormwater flow released to the onsite retention/detention basins of 174,000 m^3/yr. (DEIS, at p. 4-12).

Q16. Please explain the results of your calculation of the flow rates of potential perched bodies of groundwater at the alluvium/Chinle interface.

A16. The resulting Darcy Velocity is 0.0002 cm/sec, or 63.1 m/yr. The actual velocity through the soil pores (i.e., the pore velocity or "Vp") is equal to the Darcy Velocity divided by site surface soil porosity (p). The chosen p = 0.25 (25 percent) is a conservative value. (Yu, at Table 3-1, p. 23; DEIS at pp. 3-34, 3-35). The resulting pore velocity of 252 m/yr is a conservative estimate for the reasons described in A15, above.

Q17. In determining the potential environmental impacts to ground and surface water from the proposed NEF, did you determine the dimensions of potential perched bodies of groundwater at the alluvium/Chinle interface that may develop?

A17. Yes. I conducted this evaluation in order to assess the potential availability for use by humans or livestock. The significance of any impact resulting from availability for use is dependent on water use and water quality. In this case, any potential perched water that may collect under the proposed site would not be used for human consumption because there are no nearby wells or springs, and the closest possible discharge location (Monument Draw) is not used due to its intermittent flow. There are no present users of groundwater downgradient, i.e., in the direction of flow, and the use of this perched water from the proposed site for human consumption in the future would be unlikely because of its limited extent and uncertain availability. The potential contaminants in any perched water bodies would be from normal site runoff and sanitary uses.

Q18. Did you perform a calculation to determine what the dimensions of potential perched bodies of groundwater would be at the alluvium/Chinle interface?

A18. Yes, pages 4-13 and 4-14 of the DEIS discuss the calculations, and A15, above, explains the basis of the calculations. In determining the dimensions of any potential perched water which may flow from the storm water detention basin and the septic field, I performed

separate calculations for each. By adding the results of those calculations, one can determine the total overall area of potential perched water. However, in reality, the perched water from these sources may be in separate streams or commingled. The first step in my calculation was to determine the cross sectional area of the water body. The perched water cross-sectional area that I calculated for the discharge from the stormwater detention basin, 2850 m^2, is equal to the flow rate from that basin (180,000 m^3/yr) divided by the Darcy velocity (Vd) (63 m/yr). For the septic system, I calculated the area to be 116 m^2 by dividing the actual system disharge, 7.3 million liters/yr (LES ER, at p.3.12-8, LES Exhibit 1), by Vd. For both calculations, the effect of evapotranspiration has been conservatively ignored.

Q19. How did you use this information to determine the dimensions of the potential perched bodies of groundwater at the alluvium/Chinle interface?

A19. For the stormwater detention basin, I assumed that the average width of the underlying perched water body was 1000 meters, approximately twice the width of the basin perpendicular to the direction of flow (DEIS, at p. 4-12); the perched water body depth, 2.85 meters, is its cross-sectional area as described in A18 above, divided by the assumed width.

The combined area of the leach fields is approximately 892 square meters (9,600 square feet) (LES ER, at p.3.12-8, LES Exhibit 1). For the septic system, I assumed that the average width of the underlying perched water body would be 100 meters, approximately three times its characteristic length of the square root of the combined area. The perched water body depth, 1.16 meters, is its cross-sectional area, as described in A18 above, divided by its width. As these releases travel downgradient, I would expect these releases to dissipate as a result of evapotranspiration.

Q20. In evaluating the environmental impacts to ground and surface water from the proposed NEF, did you determine the discharge areas of perched bodies of groundwater at the alluvium/Chinle interface?

A20. Yes. I determined the discharge areas in order to identify potential downgradient water users because determining such areas is part of the evaluation of potential environmental impacts to ground and surface water. In performing this evaluation, I first considered whether wells or springs were identified near the site and downgradient from it. I then identified the nearest downgradient water body into which perched water might discharge.

Q21. Please explain the results of your determination of the discharge areas of potential perched bodies of groundwater at the alluvium/Chinle interface.

A21. No wells or springs were identified near the site in the direction that perched water would flow. Monument Draw, approximately 3 miles south-southwest of the site, is an intermittent stream and the nearest downgradient water body to the proposed site. (DEIS, at p. 3-32). Therefore, it is likely that if any perched water does not evapotranspire before it reaches Monument Draw, it will discharge there. Nonetheless, the intermittent nature of flow in Monument Draw makes it an unpredictable, and therefore, unreliable source of water.

Basis (B) – Leakage from Lined Basins

Q22. Are you familiar with Basis (B) for NIRS/PC EC-1?

A22. Yes. I understand that Basis (B) of NIRS/PC EC-1states that:

> (B) The DEIS does not contain an estimate of the probability and frequency of leakage through the liners of the treated effluent basin or the stormwater detention basin. The basins are to be lined with geosynthetic materials (DEIS at 4-11, 4-12), such liners are known to leak (EPA, Hydrologic Evaluation of Landfill Performance (HELP) Model, User's Guide for Version 3, EPA/600/R-94/168a, Sept. 1994), and such information is necessary to demonstrate the impact of such leakage. The DEIS should contain an estimate of the leakage rate and should show the fate of water and contaminants that leak from the basins.

Q23. Basis B notes that the DEIS does not contain estimates of the probability, frequency or rate of leakage through basin liners. Can you provide such estimates?

A23. No, I cannot predict the probability, frequency or rate of leakage that will occur with any degree of certainty. The probability and frequency of leakage would depend on the performance of the specific liner material used in these types of basins over time. In order to calculate probability and frequency of leakage, I would have to assign numerical values to the number of tears that would occur per square foot of liner, as well as the number of tears that would be expected to occur over time. I am aware of no reliable estimates of these factors that could be applied to the particular basins which would be constructed at the proposed NEF, although some limited evaluations of leakage have been conducted. For example, one such study was conducted by the Southwest Research Institute in San Antonio, Texas, in which an electrical survey technique developed there found an average of 0.3 to 5 leaks per 10,000ft^2 of liner surveyed. However, the liners surveyed included a variety of materials and thicknesses and included a wide ranges of sizes and types of basins. Therefore, these results may not represent conditions at the basins to be constructed at the proposed NEF. More significantly, the findings varied widely, with some liners having no leaks, while others had as many as 70 leaks per 10,000 ft^2. In itself, this variability indicates that the average found in the 62 liners surveyed is subject to a large degree of uncertainty.

With respect to leak rate, I would have to take into account the additional factor of whether, and for how long, water is present in the basin. This introduces yet another uncertainty into the calculation. As a consequence of these uncertainties, it is my judgement that any quantitative assessments of these values would have little or no meaning, and in fact could be very misleading.

Q24. Please explain the structure and contents of the lined basins referred to in Basis B of EC-1.

A24. The Treated Effluent Evaporative Basin ("TEEB") would contain uranium-bearing effluent from the Liquid Effluent Collection and Treatment System. From the bottom up, this lined basin will consist of (1) a minimum of 2 feet of compacted clay soils; (2) lower geosynthetic liner; (3) leak collection piping, sump, and pumping system; (4) geomembrane drainage mat with imbedded leak collection piping; (5) upper geosynthetic liner; and (6) a minimum of 1 foot of compacted clay. Essentially, the TEEB is a double-lined basin with a leak-detection system between the liners.

The lined "stormwater detention basin" referred to in Basis B is the Uranium Byproduct Cylinder ("UBC") Storage Pad Storm Water Retention Basin ("USPSRB"). From the bottom up, this lined basin will consist of (1) a minimum of 2 feet of compacted clay; (2) geosynthetic liner; and (3) a minimum of 1 foot of compacted clay. This basin would contain stormwater runoff from the UBC Storage Pad and blowdown from the Cooling Tower and the Heating Boiler. Blowdown water is released from these systems as a part of routine operations. Blowdown in the USPSRB contains a buildup of total dissolved solids ("TDS") caused by the evaporation of water that leaves the solids behind, and additives to the system. The solids are normal components of drinking water, such as, calcium, chloride, magnesium, sodium and sulfate. (DEIS, at p. 3-41). Blowdown TDS would range from three to five times the potable water supply obtained from the City of Hobbs. (LES Groundwater Discharge Permit Application, September 2003, at p.8, LES Exhibit 4). Based on the water supply TDS concentration as given on page 3-41 of the DEIS, the blowdown water would have a TDS concentration in the range of approximately 1200-2100 milligrams per liter. TDS is not a health regulated drinking water pollutant and only affects taste, odor and color (rather than health). The additives, oxidizing biocide, corrosion inhibitor and dispersant chemical constituents, are used to assure efficient cooling tower operation, and

would be released in the USPSRB in concentrations of approximately 5-10 ppm. (LES Groundwater Discharge Permit Application, September 2003, at p. 5).

Q25. What is the primary cause of leakage of lined basins?

A25. The primary cause of leaks in geomembrane-lined impoundments is improper installation due to inadequate field seaming. Field seaming is the process by which adjacent portions of liner material are joined in order to form a continuous barrier. Seaming is chiefly done by permanent welding of overlapping pieces of liner using heat and pressure. Seaming around patches and small details, such as pipes and sumps, is typically performed with extrusion welding which forms a welded bead at the seam. Leaks in the parent material generally can be attributed to accidental damage from equipment or tools, e.g., equipment being dropped and gouges. (Laine, D. & Miklas Jr., M., *Detection and Location of Leaks in Geomembrane Liners Using an Electrical Method: Case Histories*, Southwest Research Institute, San Antonio, Texas, November 1989, ("Laine and Miklas"), LES Exhibit 72).

Q26. Is it possible to minimize leakage of lined basins?

A26. Yes. Proper installation and adherence to industry standards can minimize the possibility of lined basins leaking.

Q27. Has LES committed to assuring proper installation of liners for the Treated Effluent Evaporative Basin or the UBC Storage Pad Storm Water Retention Basin?

A27. Yes. LES has committed to selecting and installing the liners for the TEEB and the USPSRB in accordance with New Mexico Environment Department ("NMED") Guidelines for Liner Material and Site Preparation for Synthetically-Lined Lagoons. Liner installation would be performed by manufacturer-certified installers, who would install and test the liners according to project specifications. (LES Groundwater Discharge Permit Application, September 2003, at pp. 11-12, LES Exhibit 4).

Q28. Despite proper selection and installation of the liners for the TEEB and USPSRB, is there still a possibility of leakage?

A28. Yes. Despite all due care, there is a possibility of leakage. The possibility of leakage is the reason that leak collection and detection systems are installed when there is a potential exposure from hazardous basin contents.

Q29. In the event of a failure in the leak detection system and bottom synthetic liner of the TEEB or the synthetic liner of the USPSRB, what is the fate of the water and contaminants in these basins?

A29. Depending on the size of the leak, the water in the basin could eventually saturate the clay underlying the basin. The permeability of the clay, however, would be very low since compacted clay would be used. This water could eventually make its way down to the alluvium/Chinle interface where it would either mix with the water from the stormwater detention basin and septic systems, or would evapotranspire.

Q30. Should the contents of the water in the TEEB and USPSRB be considered in assessing the overall environmental impacts in the event of a leak in the liners and failure in the leak detection systems?

A30. Yes. The contents of the water in the TEEB and USPSRB should be considered in assessing the overall environmental impacts.

Q31. In your professional judgment, would the contaminants in the TEEB and USPSRB water, if such water leaked through the liners, be of significant environmental concern?

A31. No. In my professional judgment, the contaminants of any TEEB or USPSRB water which may leak from the liners are not of significant environmental concern.

The TEEB is a double-lined basin with a leak detection system which minimizes the possibility of leaks. A water balance of the TEEB, including consideration of effluent and precipitation inflows and evaporation outflows, indicates that this basin would be mostly dry

for 1 to 8 months of the year depending on annual precipitation rates. (DEIS, at p. 4-12). Furthermore, the clay layer underlying the lower synthetic liner in the TEEB would adsorb and hold any small amount of uranium that might be released, thereby preventing the escape of uranium beyond this layer. (Yu, at p. 110). A water balance of the USPSRB indicates that this basin would be mostly dry for 2 to 12 months of the year depending on precipitation rates. (LES Response to Request for Additional Information Regarding the National Enrichment Facility Environmental Report, May 20, 2004, Table ER RAI 4-2A.2a, LES Exhibit 3; LES Revision to Applications for a Material License Under 10 CFR 70 "Domestic licensing of special nuclear material," 10 CFR 40 "Domestic licensing of source material," & 10 CFR 30 "Rules of general applicability to domestic licensing of byproduct material," NEF#04-029, July 30, 2004, at p. 3, attached as Staff Exhibit 13). Similarly to the TEEB, the nature of the clay underlying the USPSRB liner would tend to adsorb and hold any contaminants that may leak. Moreover, as indicated in A27, LES has committed to take measures to ensure proper installation of the basin liners.

Basis (C) – Moisture in Boring

Q32. Are you familiar with Basis (C) for NIRS/PC EC-1?

A32. Yes. I understand that Basis (C) of NIRS/PC EC-1states that:

> (C) According to the DEIS, "... no precipitation recharge (i.e., rainfall seeping deeply into the ground) occurs in thick, desert vadose zones with desert vegetation (Walvoord et al., 2002)" (DEIS at 3-35). However, cuttings from one of the borings drilled in September 2003 were "slightly moist" (ER Rev. 2 at 3.4-2). In addition, the clay at the bottom of boring B-2 was "moist" (SAR at Fig. 3.2-11). The DEIS should explain the presence of this moisture, which conflicts with its statements about lack of recharge.

Q33. Please explain what the term "precipitation recharge" means and its use in assessing environmental impacts on ground and surface water resulting from the construction, operation, and decommissioning of the proposed NEF site.

A33. Precipitation recharge occurs when rainwater seeps into the ground and replenishes or recharges the groundwater, especially an aquifer. Precipitation recharge is a factor used to assess movement of water and any potential contaminants in that water.

Q34. What measurements would indicate precipitation recharge at the proposed NEF site?

A34 Precipitation recharge would be indicated by drilling multiple borings across the proposed site and examining cuttings from the borings to determine the presence of moisture. Precipitation recharge is a phenomenon that would be noted over a wide area at multiple borings. Given the relatively small size of the proposed site and the general consistency of the alluvial soil, one would expect evidence of precipitation recharge to be present consistently throughout the proposed site. Therefore, if precipitation recharge existed at the proposed site, one would expect multiple borings across the proposed site to produce cuttings that were moist.

Q35. How many borings were drilled at the proposed NEF site?

A35. As documented in a Cook-Joyce Hydrogeologic Report and the Mactec Preliminary Subsurface Exploration Report, 14 borings were drilled to the top of the Chinle Formation. (*Hydrogeological Investigation, Section 32; Township 21 Range 38, Eunice, New Mexico*, Cook-Joyce, Inc., November 19, 2004, at p.4 ("Cook-Joyce Hydrogeological Investigation") LES Exhibit 3; *Report of Preliminary Subsurface Exploration, Proposed National Enrichment Facility, Lea County, New Mexico*, Mactec Engineering and Consulting, Inc., October 2003, at p. 7 ("Mactec") attached as Staff Exhibit 8).

Q36. In your professional judgment, are these 14 borings adequate to assess the presence of precipitation recharge at the proposed NEF site?

A36. Yes. The breadth and spacing of these borings (set forth in DEIS Figure 3-21) are such that precipitation recharge would be detected through the presence of moisture at multiple borings.

Q37. How many borings from the proposed site produced cuttings that were "slightly moist" or "moist"?

A37. Multiple (approximately 5) soil layers were logged at each of the 14 borings. Only one layer of one boring was logged as "slightly moist" and only one layer in another boring was logged as "moist."

Q38. Are the two separate occurrences of moisture in the two borings consistent with the remainder of the borings drilled at the proposed site?

A38. No.

Q39. Do you believe that the finding of moisture in the two borings indicates that the statement in the DEIS regarding lack of precipitation recharge is incorrect?

A39. No. I do not agree that these notations of moisture conflict with the statement in the DEIS. The Cook-Joyce log of Boring No. B-9 indicates slight moisture from a depth of 6 to 14 feet below ground. (Cook-Joyce Hydrogeologic Investigation, at Appendix A, LES Exhibit 3). Both above and below this layer in the Antlers Formation, the soils are noted as very dry. The lack of any indication that this moisture is seeping further downward is consistent with the conclusion that precipitation does not seep deeply into the ground beneath the proposed NEF site. Instead, precipitation can infiltrate into shallow portions of the subsurface where it is subject to upward hydraulic gradients caused by vaporization and evaoptranspiration, drawing water upwards. (DEIS, at p. 3-35).

The indication of moist clay in the top of the Chinle Formation (Mactec Boring Number B-2) is an isolated observation. Except as noted above, all other soil layer notations from the nine Cook-Joyce and five Mactec borings, including those in the Chinle clay, are noted as being dry. Notwithstanding these two indications of moisture, the totality of the evidence demonstrates a lack of precipitation recharge at the proposed NEF site. This evidence includes: (1) the multiple layers at the 12 totally dry borings and the

associated dry layers at the two borings discussed above, (2) computer modeling and confirming measurements taken in the high plains of Texas presented on page 3-35 of the DEIS, and (3) the lack of groundwater in any of the nine Cook-Joyce boreholes after they were allowed to remain open for a minimum of 24 hours. This evidence supports the statement in the DEIS regarding the lack of precipitation recharge.

Basis (D) – Fracture Zones

Q40. Are you familiar with Basis (D) for NIRS/PC EC-1?

A40. Yes. I understand that Basis (D) of NIRS/PC EC-1states that:

> (D) The DEIS states: "Although the presence of fracture zones that can significantly increase vertical water transport through the Chinle Formation has not been precluded, the low measured permeabilities indicate the absence of such zones." (DEIS at 3-35). Two permeability measurements have been made on the Chinle Formation at or near the site: laboratory measurement of core samples (ER Rev. 2 Table 3.3-2) and a slug test performed in MW-2 (Cook-Joyce, Hydrogeologic Investigation, Sec. 32, T. 21 R. 38, Nov. 19, 2003). Such extremely limited measurements, where faults are present, cannot describe the permeability of the entire site, and NRC should explain its reliance on such restricted data.

Q41. The DEIS statement quoted above is from Section 3.8 of the DEIS. Are you the author of that Section?

A41. Yes.

Q42. You use the term "fracture zones" in the DEIS. Please explain what these zones are, and how they relate to water transport through rock.

A42. Fracture zones within a rock formation are caused by mechanical forces on the rock, such as shear stress and thermal compaction. Fractures can also result from human activities such as drilling and core handling. Open fractures are ones which have not been filled with cementing materials. When open, such fractures may provide conduits (i.e., fast flow paths) for the comparatively rapid movement of ground water through an otherwise relatively impermeable rock mass. (Schmelling, S. & Ross, R., *Contaminant Transport in Fractured*

Media: Models for Decision Makers, EPA/540/4-89/004, U.S. Environmental Protection Agency, April 1989 ("Schmelling and Ross"), attached as Staff Exhibit 9).

Q43. Do the presence of fracture zones in rock necessarily indicate the presence of fast flow paths?

A43. No. As explained in Schmelling and Ross, the presence of fracture zones does not necessarily indicate that fast flow paths are present. In order to transmit water, fractures have to form an interconnected system which can transmit water through the formation thickness. Fracture orientation is an important characteristic; fractures have to be aligned parallel to the direction in which water would flow in order to provide effective pathways for water flow. The fractures have to remain open and not be filled with cementing materials, such as clay or carbonate minerals. The lack of interconnectivity, the lack of proper orientation, or the filling of fracture apertures with minerals can result in the absence of fast flow paths.

Q44. In which direction would water flow within the Chinle and the overlying Antlers Formations?

A44. In the Chinle, water generally flows vertically downwards, albeit very slowly. In the Antlers Formation, which overlies the Chinle, flow is vertically downward until contact with the relatively impermeable Chinle is made. At the alluvium/Chinle interface, the water would then flow horizontally to the south-southwest, along the direction of the slope of the contact.

Q45. Basis D references the concept of "permeability." Please discuss permeability and explain how permeability measurements are taken.

A45. Permeability pertains to the ability of a soil or rock mass to transmit fluids. When discussing hydrogeology, the terms permeability and hydraulic conductivity are often used interchangeably. Permeability can be measured in the laboratory or in the field. In the laboratory, permeability is typically determined by measuring the flow transmitted by field samples of the geologic medium being investigated under conditions of known hydraulic

head (i.e., the pressure from a column of water). Slug tests are a common method of in-situ field testing used for measuring permeability; the test consists of suddenly changing the static water level in a well by, for example, adding or removing water. As the water level returns back to its static level, it is tracked and the water level over time is compared with theoretical models.

Q46. Were such measurements taken at or near the proposed NEF site?

A46. Yes. LES performed a slug test at a well in the siltstone bed, located approximately 220 feet beneath the proposed NEF site, within the Chinle Formation. (DEIS, at p. 3-35; Cook-Joyce Hydrogeologic Investigation, at p. 8, LES Exhibit 3). In addition, a total of 36 tests of vertical permeabilities and 6 horizontal permeabilities were performed in the laboratory on samples taken from the Chinle Formation under the Waste Control Specialists ("WCS") facility, located in Andrews, Texas. (*Geotechnical Investigation and Engineering Analysis for Waste Control Specialists Inc*, Jack H. Holt Ph.D. and Associates Inc., File No. 10-25792, March 12, 1993, LES Exhibit 3).

Q47. Are the permeability findings in this WCS study applicable to the proposed NEF site?

A47. Yes. The WCS site is located only one mile to the east of the proposed NEF site. Both sites lie within the Central Basin Platform of the Permian Basin (as shown in DEIS Figure 3-15), and would thus have similar underlying geologic structures, including the Chinle Formation.

Q48. What are the units by which permeability is measured?

A48. Permeability is related to groundwater velocity through Darcy's Law (discussed in A15). Permeability is measured in units of length per unit time, e.g., cm/sec. The value of permeability is related to the ability of the geologic unit to transmit water.

Q49. What did the permeability measurements you described in A49 show?

A49. Laboratory tests of Chinle Formation clay and imbedded siltstones and sandstones taken

near the proposed NEF site showed that all of these materials are of low permeability. A permeability of 3.7×10^{-6} cm/sec was measured with the slug test performed for the 220-foot elevation siltstone bed within the Chinle Formation in Monitoring Well 2 at the proposed NEF site. Permeabilities determined by the lab tests at WCS ranged from less than 10^{-9} to 1.76×10^{-8} cm/sec for the clay taken from the Chinle Formation. Lab tests on the sandstone and siltstone beds determined a range of permeabilities from 2.58×10^{-8} to 1.93×10^{-6} cm/sec.

Q50. In your opinion, does the sampling which has been conducted at the proposed NEF site and other nearby locations within the Chinle formation provide an adequate assessment of the permeability of the entire NEF site?

A50. Yes. The large number of samples taken within the Chinle formation in close proximity to and at the proposed NEF site (as discussed in A46) represent a reliable indicator of the permeability of this geologic unit.

Q51. Are you aware of recent data relevant to the presence of potential fracture zones and fast flow paths that exist below the proposed NEF site?

A51. Yes. As indicated in A46, the Chinle Formation has been studied in detail at the nearby WCS site. A recent example of such a study is a geology report which contains an evaluation of the relationship between faulting in the Triassic Red Beds and the overlying Antlers Formation. The analysis was performed to evaluate the fault recently discovered beneath the WCS site (referenced in DEIS, at p. 3-26). This report notes that there are no indications that the overlying Antlers Formation was affected by the faulting in the Triassic Red Beds. Therefore, the faults would have been inactive for at least the past 135 million years, the age of the Antlers Formation. This evaluation found no evidence of a fast flow path resulting from the faulting at the WCS site. This was attributed to the presence of swelling clays in the fractures and closure or healing of the fracture joints. (*Section VI*

Geology Report Prepared For: Waste Control Specialists, LLC, Andrews, Texas, Cook-Joyce, Inc. & Intera, Inc., August 2004, at pp. 4-9 to 4-11, LES Exhibit 73).

Q52. Given your knowledge of the geology of the site, and the history of faults in the site vicinity, what is your conclusion regarding the likelihood that fracture zones exist that can significantly increase the vertical transport of water through the Chinle formation beneath and surrounding the proposed NEF site.

A52. The results of investigations near the proposed NEF site indicate that it is unlikely that there are fracture zones which lead to increased vertical water transport. This is based on the fact that any active faulting in the immediate area occurred over 135 million years ago, and any resulting fractures would have had time to close, as demonstrated in the study at the WCS site. These conclusions are confirmed by the low permeability findings in the Chinle formation beneath and in close proximity to the proposed NEF site, as evidenced by over 40 permeability measurements taken within the last 13 years.

Basis (E) – Stormwater Runoff

Q53. Are you familiar with Basis (E) for NIRS/PC EC-1?

A53. Yes. I understand that Basis (E) of NIRS/PC EC-1states that:

> (E) The stormwater basin will discharge runoff containing numerous contaminants, which are not adequately identified in the DEIS, nor is their monitoring explained. LES has stated that the runoff will contain small amounts of oil and grease typically found in runoff from paved roadways and parking areas (RAI Response, May 20, 2004, at 33). However, other contaminants may be present, such as PAHs (USGS, Concentrations of PAHs and Major and Trace Elements in Simulated Rainfall Runoff from parking lots, 2003, Open File Report 2004-1208), other organics such as aliphatic hydrocarbons and alcohols (Barrett, M.E, et al., Review and Evaluation of Literature Pertaining to the Quality and Control of Pollution from Highway Runoff and Construction, Tech. Report CRWR 239, April 1993), and other contaminants from spills and accidents. Their presence should be disclosed. Further, stormwater should be monitored for such contaminants.

Q54. Describe the stormwater basin referenced in Basis E, and state the purpose of this basin.

A54. The unlined Site Stormwater Detention Basin ("SSDB") will collect and contain stormwater from the developed areas of the site (other than the UBC Storage Pad), thereby reducing the potential for flooding caused by storms. The drainage area of the SSDB is 39 hectares (96 acres). (LES ER, at p. 3.4-6, LES Exhibit 1). The SSDB would have approximately 123,350 cubic meters (100 acre-ft) of storage capacity. The SSDB would have two feet of clearance between the water surface and the top of the basin. The surface area of the SSDB at high water elevation would be 19 acres, and the SSDB would be sized to contain the volume equal to that for the 24-hour, 100-year return period storm. (LES Groundwater Discharge Permit Application September 2003, at p. 11, LES Exhibit 4). The main purpose of a detention basin is to minimize increases in stormwater runoff from developed areas, so that pre-development runoff volumes to the surrounding land will not be exceeded. A detention basin also can have positive impacts on local surface water quality resulting from settling of suspended solids within the basin.

Q55. Would you expect some contamination of stormwater runoff at the proposed NEF site?

A55. Yes. I would expect the stormwater runoff to contain contaminants typical of industrial facilities that one would expect to find from activities such as vehicle maintenance and fueling, filling storage tanks, and painting operations during construction and operation. (DEIS, at pp. 4-10 & 4-11). While all of these potential contaminants are not specifically listed in the DEIS, the general chemical categories that would encompass them are listed as the parameters that will be evaluated as part of the stormwater monitoring program. (DEIS Table 6-9).

Q56. Is it possible that stormwater runoff could be contaminated by spills and accidents?

A56. Yes. However, the DEIS at page 4-10 discusses LES's planned implementation of the Spill Prevention Control and Countermeasures Plan during construction and operation. These

mitigation measures are designed to minimize releases from spills and accidents to site soils. By doing so, the impact of spills and releases into stormwater runoff, which transports contamination in soil by dissolution of contaminants or suspension of contaminated soil particles, would also be reduced. The potential contaminants one would expect to be involved in an industrial accident are included in the list of all process chemicals and gases which would be used at the proposed NEF at Table 4-21 of the DEIS. Additionally, DEIS page 4-15 describes how under its Stormwater Pollution Prevention Plan, LES would establish staging areas to manage waste materials. Such materials would be segregated, and generation of such materials would be minimized. As shown in DEIS Tables 5-1 and 5-2, the Stormwater Pollution Prevention Plan is part of the mitigation measures that LES has committed to implement during both construction and any later operation of its proposed facility.

Q57. Please describe the polycyclic aromatic hydrocarbons ("PAHs") and the other "organics such as aliphatic hydrocarbons and alcohols" referenced in Basis E.

A57. As indicated in Basis E, PAHs, aliphatic hydrocarbons and alcohols may all generally be described as organics. On a molecular level, PAHs consist of rings of carbon and hydrogen. One type of sealer applied to asphalt parking lots and driveways is based on coal tar emulsions; coal tar consists of at least 50 percent PAHs by weight. Aliphatic hydrocarbons, on the other hand, are straight chain hydrocarbons. Examples of aliphatic hydrocarbons are methane, propane and kerosene. Alcohols are chain hydrocarbons, the most common examples of which are methanol and ethanol.

Q58. How are these types of contaminants typically introduced into the environment at an industrial facility such as the proposed NEF?

A58. PAHs are found in most petroleum products. PAHs can enter the environment, for example, from emissions from generators or motor vehicles. PAHs also can result from runoff from

surface sealed parking lots. Aliphatic hydrocarbons are also a petroleum product, and are a component of motor oil and gasoline. Alcohol is a component of gasoline as it is presently formulated to reduce ozone and toxic air pollutants from auto exhausts. All of these contaminants would be expected near highways, major roadways, and parking lots in the vicinity of industrial facilities.

Q59. Will PAHs, aliphatic hydrocarbons and alcohols likely be present in any stormwater runoff from the proposed NEF site?

A59. As stated above in A58, these organics can be present in normal highway and parking lot runoff. However, there is no reason to expect that their presence at the proposed NEF would be any greater than at any other facility that is located near highways and has parking lots.

Q60. Basis E references the need to monitor stormwater for contaminants. Will contaminants in stormwater be monitored ?

A60. Yes. As discussed in DEIS Section 6.2.2, monitoring will be governed through the National Pollutant Discharge Elimination System ("NPDES") process and State regulations. Implementation of a Stormwater Monitoring Program would begin during construction of the proposed LES facility. Data collected from this program would show whether contamination of stormwater is being effectively prevented. Monitoring would continue during any operation of the proposed NEF. (DEIS, at p. 6-17). LES has proposed that its Stormwater Monitoring Program, regulated by NMED through the Groundwater Discharge Permit, would include quarterly monitoring of stormwater in the SSDB. (DEIS, at p. 6-18). The parameters to be monitored there are oil and grease, total suspended solids, Biological Oxygen Demand ("BOD"), Chemical Oxygen Demand ("COD"), phosphorus, nitrogen, pH, nitrates, and metals. (DEIS Table 6-9, at p. 6-18).

Q61. This list of parameters to be monitored does not specifically include PAHs, aliphatic hydrocarbons and alcohols. Why not?

A61. As stated above, these organics are typically found in stormwater releases where there are highways and parking lots. Monitoring of two of the parameters listed in the DEIS, BOD and COD, would detect the presence of these contaminants.

Q62. Does this conclude your testimony on NIRS/PC EC-1?

A62. Yes.

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EDUCATION: M.S., Chemical Engineering, University of Maryland, 1970
B.E., Chemical Engineering, Cooper Union, 1968
Course work and qualifying exam completed for PhD in Chemical Engineering, University of Maryland, 1970-72

EXPERIENCE SUMMARY:

Mr. Toblin has 32+ years of professional experience as a Principal Investigator and Technical Manager for analyses of contaminant (chemical, radionuclide, thermal) transport in groundwater, surface water and air environments. He has performed such analyses for numerous major industrial sites and government agencies, including all major DOE sites, in support of construction, operations, and clean-up activities. He has defended such analyses as an expert witness in state and federal hearing processes. Mr. Toblin also performs probabilistic risk assessments in support of licensing and operations of power plants and other facilities.

PROJECT EXPERIENCE:

Analyst; Determine Water Resources Impacts for the Proposed National Enrichment Facility; NRC (ATL Inc.); Lea County, New Mexico; Evaluated potential impacts to ground and surface water and water supplies due to construction, operation and decommissioning of that proposed facility. Prepared corresponding sections of the Draft Environmental Impact Statement.

Analyst; Determine Water Quality Impacts and Human Health Risks for Decontamination and Decommissioning of Sequoyah Fuels Corp; NRC (ATL Inc.); Gore, Ok.; Reviewed site analyses of water quality (chiefly groundwater) and human health impacts (ingestion, inhalation, external radiation) for site decommissioning. Performed independent analyses of future groundwater impacts on the site, at the site boundary and offsite. (Draft) Environmental impact statement written.

Analyst; Hazardous Waste Cap Performance for Operating Unit 3; Portsmouth Naval Yard; Portsmouth, N.H.; Evaluated water budget for the hazardous waste site for no action, and with various cap options. Determined flow through the cap to the groundwater using HELP3 model.

Analyst; Hydrologic Transport from Saltstone Disposition; DOE; Savannah River; Evaluated groundwater and subsequent surface water transport of contaminants from the proposed saltstone vaults. Transport included unsaturated flow, saturated flow, and impacts on local creeks.

Analyst; High Level Waste Tank Closure in F and H Areas; U.S. DOE; Savannah River Site; Performed groundwater modeling in support of closure of high level waste tanks in F and H areas at Savannah River Site. Performed for tank farm and specific tank closure plans and EIS.

Analysis includes concentration profiles at hypothetical 1-meter and 100-meter wells plus groundwater discharge points.

Analyst; River Water System EIS; U.S. DOE; Savannah River Site;. Performed groundwater quality and quantity modeling of the impacts of changing flows through Savannah River Site, including draining of L-Lake.

Task Leader; Sandia Sitewide EIS; U.S. DOE; Albuquerque, NM; Performed groundwater and surface water modeling of the water quality and quantity impacts of Sandia (Albuquerque) Sitewide operations.

Analyst; Yucca Mountain EIS; U.S. DOE; Las Vegas, NV; Performed radiological dose analyses for the no action alternative to the proposed disposal of material at Yucca Mountain. Atmospheric, surface water, and groundwater modeling analyses of the effects of leaving high level waste and spent fuel in place at each of the U.S. nuclear power plants and at DOE sites.

Analyst; Interim Management of Nuclear Materials EIS; F-Canyon Plutonium Solutions EIS; U.S. DOE; Savannah River; Performed analyses of radiological and chemical releases to hydrosphere for various source materials and processing options. Calculated doses to public from releases. Authored water resources sections of EIS.

Task Leader; Waste Management EIS; U.S. DOE; Savannah River; Determined radiological and chemical concentrations and drinking water doses as a result of releases from below grade vaults and slit trenches. Applied and modified the results from the Radiological Performance Assessment so that they were appropriate for the specific EIS options.

Task Leader; Critical Review of RESRAD Computer Code; Argonne National Laboratory; Argonne, Ill; Performed in-depth review of regulations, theory, coding, and results of code to implement DOE policy for reducing Residual Radioactive (RESRAD) material to levels as low as reasonably achievable (ALARA) on a site-specific basis. Emphasized environmental transport (air, groundwater, surface run-off). Suggestions to improve code's applications and fix errors found were implemented by code's authors.

Technical Manager; Waste Management Activities For Groundwater Protection at the Savannah River Plant EIS; U.S. DOE; Savannah River; Technical Manager for analyzing the contaminant transport and human health effects from the burial of low-level waste at DOE sites. Determined allowable disposal concentrations such that all DOE/NRC/EPA/State regulations regarding radiation exposure would be met at the time of emplacement and in the future. Authored EIS sections.

Technical Manager; Groundwater Contamination Remediation; Sherwin Williams; Directed three dimensional finite element groundwater modeling analysis which simulated the past release to and subsequent movement of material in a multi-aquifer system. A conceptual model was formulated and the flow (3D-FEMWATER) and transport (3D-LEWASTE) models used to deduce the release scenario from the present state of the plumes. Predictions of the temporal and spatial fate of the plumes, assuming no interdiction, lead to use of the model to develop a strategy for remediating the groundwater contamination.

Technical Manager; Resource Conservation and Recovery Act, Subpart X permitting at U.S. Army Open Burning and Open Detonation units; Martin Marietta; Directed technical group which performed multimedia hazardous material environmental transport modeling in air, groundwater, and surface water in support of RCRA Subpart X.

Analyst; Accelerator Production of Tritium EIS; U.S. DOE; Performed surface and groundwater impact analyses for Accelerator Production of Tritium.

Analyst; Remedial Investigation and Feasibility Study of Dahlgren Naval Base; U.S Department of Defense; Portsmouth, Virginia; Computer modeling of the impacts of remediation alternatives on groundwater and surface water quality and quantity for sites 9, 10, 17, 19, 25 and 29.

Analyst: Accident Environment for Proposed Pluto Space Shot: Determined accident environments (fragment velocity, position, pressure from explosions, etc.) for space shot from 2 proposed rocket systems.

Analyst: Modern Pit Facility Environmental Impact Statement: Performed accident analyses of proposed facility at 5 sites. Determined dose to non-involved worker, MEI and population. Produced isodose maps for each site.

Analyst; Site-wide Environmental Impact Statement for Lawrence Livermore National Laboratory; Performed accident analyses for non-involved and involved workers, MEI and population for all site facilities existing and proposed. Performed dose and health impact analyses from normal radioactive releases (ground water, atmospheric) to MEI and population from existing and proposed facilities.

Analyst; Level 3 Probabilistic Risk Assessment of Joseph M. Farley Nuclear Plant, Southern Nuclear Company; Performed PRA including source term derivation, analysis of meteorology/climatology data, local economic and agricultural production, evacuation simulation. Radiological dose, economic costs and risk calculated for hypothetical risk-important accidents.

Analyst; Level 3 Probabilistic Risk Assessment of V.C. Summer Nuclear Station, South Carolina Electric & Gas; H.B. Robinson Nuclear Station, Carolina Power & Light; Performed PRA including source term derivation, analysis of meteorology/climatology data,

local economic and agricultural production, evacuation simulation. Radiological dose, economic costs and risk calculated for hypothetical risk-important accidents.

Analyst; Temperature Distribution in Atlantic Ocean from Uprated Brunswick Steam Electric Plant; Carolina Power and Light Company; Southport, NC; Statistical analysis of muti-year thermal monitoring data to determine isotherm areas and extents. Operations data scaled to account for increased heat load of proposed uprate. Scaling included heat load and buoyancy effects.

Task Leader; Develop Radiological Accident Response Code; Mallinckrodt; St.Louis, Mo.; Developed atmospheric transport and dose calculation computational model, based on Rascal kernel, directly applicable to client's site. Model is simple to use, contains all of the site-specific parameters, and calculates doses in the event of various accident scenarios at specific special receptors.

Task Leader; Review of Ultimate Heat Sink Technical Specification Change; NRC (Scientech Corp.); Hartsville, S.C.; Evaluated utility's application with regard to changing their method of operating their ultimate heat sink (cooling pond). Reviewed supporting material and suggested revisions to the application.

Task Leader; Level 3 Probabilistic Risk Assessment of Hatch NPP; Southern Nuclear Operating Company; Baxley, Georgia; Performed PRA including source term derivation, analysis of meteorology/climatology data, local economic and agricultural production, evacuation simulation. Radiological dose, economic costs and risk calculated for hypothetical risk-important accidents.

Task Leader; Review of Hazard and Operability Study of Ross Incineration Services; U.S. Environmental Protection Agency; Cleveland, Ohio; Reviewed Failure Mode and Effects Analysis. Comments regarding hazards analyzed and actions taken supplied to EPA.

Task Leader; Modeling of the thermal response of the service water pond at V.C. Summer Station NPP to upgrades in station operation; South Carolina Electric and Gas Corp; Columbia, S.C.; Modeled 30 years of sequential 3D pond temperatures for comparison with technical specification limits on temperature rise through the pond. The transient response of the pond to varying pond elevation, plant operation and meteorology was performed. A 30 day period of measured pond temperatures were simulated with the model and found to be an excellent match.

Task Leader; Accident Consequence Analysis (Level 3 PRA); Scientech Corp (U.S. NRC); Rockville, MD; Co-instructor of course presented to USNRC personnel. Course covered source terms, dispersion, health effects and health models, protective measures, and economic consequences.

Analyst; Reconfiguration (Stockpile Stewardship and Management, Highly Enriched Uranium, Fissile Material Development, Storage and Disposition, Tritium Supply and Recycling EISs); U.S. DOE; Washington, D.C.; Performed accident risk analyses (radiological

and chemical) in support of DOE reconfiguration.

Task Manager; Programmatic Spent Nuclear Fuel Management EIS; U.S. DOE; Idaho Falls, Id; Technical direction of group performing Occupational and Public Health and Safety sections dealing with use of the Oak Ridge Reservation and Nevada Test Site as alternative Spent Nuclear Fuel Management sites. Responded to comments of public and governmental agencies.

Analyst; Programmatic Tritium Supply and Recovery EIS; U.S. DOE; Washington, D.C.; Performed 10 CFR 100 dose limit analysis to determine the suitability of locating various tritium supply source designs and sizes at Oak Ridge Reservation, Pantex, and Nevada Test Site. Determined site capacity in accordance with regulation.

Analyst; Nonnuclear Consolidation EA, Nuclear Weapons Complex Reconfiguration Program; U.S. DOE; Kansas City, MO; Gathered data for chemical accident exposure analysis via site visit, interview with site personnel, personal inspection of facilities. Performed chemical accident analyses of existing and proposed chemical storage and operations facilities using CHEMS-PLUS (Chemical Hazard Evaluation Methodologies software package). Wrote environmental background sections.

Analyst; Estimated Frequency of Loss of Off-Site Power Due to Extremely Severe Weather and Severe Weather for Salem and Hope Creek Generating Stations; Public Service Electric & Gas; Salem, NJ; Determined frequency of occurrence of severe and extremely severe weather (snowfall, tornadoes, storms, hurricanes) and resulting frequency of off-site power loss to generating stations. A report which reported the results was produced and used by power company to successfully demonstrate to NRC, in accordance with Regulatory Guide 1.155, that special design and operating conditions limitations previously required by the commission were not necessary.

Analyst; Control Room x/Q Values for the Beaver Valley Power Station; Duquesne Light Co.; Pittsburgh, Pa; Performed theoretically advanced simulation of atmospheric dispersion in the presence of building wake turbulence for a 5 year sequential meteorological record. The results were included in a report which was used to successfully demonstrate to the Nuclear Regulatory Commission that special design implementations (filter systems) for station control room occupants, the necessity of which were indicated by previous analyses, were not required.

Analyst; Cooling Water Discharge Modeling; U.S. DOE; Savannah River; Developed thermal model of site streams between reactors (L, K, C, and power plant) and Savannah River (including swamp). Model used to predict downstream temperatures from cooling water discharges from various (combinations of) reactors, reactor operating levels, and discharge options. Model results were compared with subsequent operating data and demonstrated to be accurate. Developed associated models of cooling tower and cooling pond thermal performance (as a function of reactor operating condition and meteorology). Analyses used in various projects including design of alternative reactor cooling water systems, 316a demonstrations, L-Reactor restart, K-Reactor restart, and New Production Reactor cooling system design. Cooling pond model (L-Lake) used to study response of thermal discharge from lake to changing meteorological and reactor

operating conditions; also to study vertical thermal structure of lake and possible destratification in response to major changes in reactor operating levels. Various reports and EIS sections (and technical appendices) produced.

Analyst; Evaluation of Proposed 40 CFR 193, Subpart C; U.S. DOE, Office of Environmental Guidance; Washington, D.C.; Reviewed performance assessments and other supporting technical documents to proposed EPA rule on groundwater dose limits from low level radioactive waste disposal. Presented technical arguments showing that generic studies which formed the basis of the proposed rules were not appropriate for DOE sites. Report generated.

Analyst; V.C. Summer Station - Cooling Lake Thermal Performance; South Carolina Electric & Gas; Columbia, SC; Performed computer mathematical study of horizontal and vertical temperature distribution in a cooling lake to determine the likelihood of exceeding regulatory discharge limitations. The model simulated the cooling lake response to 30 years of historical meteorology, power plant (at various power levels) and pumped storage operation. The pumped storage reservoir's thermal response was also modeled. The results of the model were accepted by the state and an NPDES permit granted. An associated study to quantify the incremental (from power plant operation) evaporation from the cooling lake was used by the pumped storage operator to assess the power plant owners for the cost of makeup water and lost pumped storage energy caused by the plant's thermal discharge.,

Analyst; Internal Dose Reconstruction Model; Defense Nuclear Agency, Washington, DC; Developed a calculational model and associated computer code reconstructs internal doses resulting from inhalation and ingestion of radioactivity in a space and time varying contaminant field. The model was applied to participants at atmospheric tests of nuclear devices. These participants were moved through the radioactive field in accordance with the historical record; contamination from previous detonations were included.

Technical Manager; Environmental Survey Prioritization; U.S. DOE - Office of Environmental Audit; Washington, DC; Responsible for direction of multidisciplinary group which prioritized environmental problems at all U.S. DOE sites. Rankings used a health-based assessment of environmental transport of contaminants, including evaluation of source terms, environmental transport mechanisms, and human health effects and consideration of all environmental media (air, surface water and groundwater, soil, direct radiation). "Debugged," revised, and refined associated computer program, MEPAS. Developed technical guidance for developing conceptual models of environmental problems, applying the computer model, and interpreting results. Developed Risk Information System (RIS) which integrated various quantitative measures of environmental impact. Presented results to 5-Year Planning group for their use; critiqued their use of information. Presented results and responded to questions from congressional staff.

Analyst; Hazard Ranking System; U.S. EPA - Superfund Office; Washington, DC; Evaluated risk assessment methodologies in support of congressionally mandated revision to Hazard

Ranking System. Performed theoretical study and practical applications of models for use in comparative studies of mathematical models. Results of study used in selecting a more mechanistic methodology (modified HRS) for ranking the risk of hazardous waste sites.

Hydrologist; Various Projects; Industrial/Governmental Clients. Is responsible for analysis of physical effects due to transport of effluents into surface and groundwater environments. Responsibilities have included evaluation of effects from existing and proposed discharges at Milliken, Bell, Cayuga, and Somerset (New York State Electric and Gas Co.); Perry (Cleveland Electric and Illuminating Co.); Belvedere, Carrols Pond, Douglas Point, and Chalk Point (Potomac Electric Power Co.); Greenwood and Fermi (Detroit Edison Co.); Tyrone and Sherburne (Northern States Power Co.); Davis-Besse (Toledo Edison Co.); South Texas Project (Houston Lighting and Power Co.); Dresden, Powerton, La Salle, Braidwood, Byron, and Collins (Commonwealth Edison Co.); San Onofre (Southern California Edison Co.); Ginna, Russell, Beebee, and Sterling (Rochester Gas and Electric Co.); Palo Verde (Arizona Public Service Co.); Schuylkill Refinery (Gulf Oil Co.); Great Bend (Columbus and Southern Ohio Co.); Big Bend (Tampa Electric Co.); Rio Haina (Dominican Republic); Skagit-Hanford (Northwest Environmental Services Co.); Savannah River Plant (U.S. Department of Energy); Limerick (Philadelphia Electric Co.); V.C. Summer (South Carolina Electric and Gas Co.); uranium mill tailings sites (U.S. Department of Energy); deep geologic nuclear waste repositories (Office of Nuclear Waste Isolation); hazardous waste sites (U.S. Environmental Protection Agency); all of the defense production and support facilities of U.S. Department of Energy; Mallinkcrodt.

CHRONOLOGICAL WORK HISTORY:

Consultant; April 2004 to Present.

Engineer; Tetra Tech NUS, Inc.; Gaithersburg, Maryland; October 1971 to March 2004.

Teaching Assistant; University of Maryland; College Park, Maryland; September 1968 to June 1971. Taught both graduate and undergraduate courses, concerned with computer applications to chemical engineering. Conducted mathematical research on dynamics of nonlinear control systems.

Analyst; Kennedy Van Saun Corp.; New York, New York; June 1968 to September 1968. Conducted engineering analysis of solids separation systems.

PUBLICATIONS:

"An Example of the Public Risk Arising from the Accidental Contamination of Drinking Water by the Deposition of Airborne Radionuclides" (coauthor), Proceedings of International ANS/ENS Topical Meeting on Probabilistic Safety Methods and Applications, 1985.

"Higher Order Approximations to Unit Impulse Response," Master's Research Paper, University of Maryland, College Park, MD., January 1970.

1 CHAIR BOLLWERK: And the rebuttal?

2 MS. CLARK: I would like to admit the

3 rebuttal testimony into this proceeding as well.

4 CHAIR BOLLWERK: All right. No

5 corrections?

6 MS. CLARK: No corrections. Any

7 objections?

8 MR. LOVEJOY: No.

9 CHAIR BOLLWERK: No, all right. Then the

10 NRC Staff rebuttal testimony of Alan Toblin,

11 concerning Nuclear Information and Resource Service

12 and Public Citizen Environmental Contention 1, NIRS/PC

13 EC-1 Impacts Upon Ground and Surface Water should be

14 admitted into the record as if read.

15 (Whereupon, the pre-filed rebuttal

16 testimony of Alan Toblin was inserted into the record

17 as if having been read.)

February 3, 2005

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
LOUISIANA ENERGY SERVICES, L.P.	)	Docket No. 70-3103
	)	
(National Enrichment Facility)	)	ASLBP No. 04-826-01-ML

NRC STAFF REBUTTAL TESTIMONY OF ALAN TOBLIN
CONCERNING NUCLEAR INFORMATION AND RESOURCE SERVICE AND PUBLIC CITIZEN ENVIRONMENTAL CONTENTION 1 ("NIRS/PC EC-1")
(IMPACTS UPON GROUND AND SURFACE WATER)

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

A1. My name is Alan Toblin. I am employed as a consultant with Advanced Technologies and Laboratories International, Inc. I am providing this testimony under a technical assistance contract with the Nuclear Regulatory Commission ("NRC").

Q2. Have you previously submitted testimony in this proceeding?

A2. Yes. I provided testimony in this proceeding on January 7, 2005, on behalf of the NRC. In that testimony, I described my current responsibilities. I also attached a copy of my professional qualifications.

Q3. What was the purpose of your previous testimony?

A3. I provided my views concerning Nuclear Information and Resource Service and Public Citizen ("NIRS/PC") Environmental Contention 1 ("EC-1").

Q4. What is the purpose of this testimony?

A4. To provide my views on NIRS/PC's pre-filed testimony of Mr. George Rice regarding contention NIRS/PC EC-1.

Q5. What have you done to prepare this testimony?

A5. I have reviewed all of the pre-filed testimony, including supporting documentation and related NEPA analysis.

Q6. George Rice states that groundwater is known to exist in the alluvium at three places near the proposed NEF site: (1) about one-half mile north at the Wallach sand and gravel quarry, (2) about one-half mile northeast at Baker Spring, and (3) about two-thirds mile east at the Waste Control Specialists ("WCS") site. Does this indicate that groundwater exists beneath the proposed NEF site?

A6. No. The existence of alluvial groundwater at the three locations noted is the result of conditions specific to those locations which are not found at the proposed NEF. The specific site conditions which explain the existence of groundwater at those locations are as follows. Groundwater is present at the base of an excavation wall at the Wallach sand and gravel quarry (a photo of which is shown in the *National Enrichment Facility Environmental Report*, Revision 2, Louisiana Energy Services, July 2004 ("LES ER") at Figure 3.4-4, LES Exhibit 1). This groundwater is due to a seep, an area in which groundwater slowly discharges to the surface, in this case a shallow surface depression. The groundwater is a result of rainfall rapidly infiltrating through surface and near-surface fractured caliche caprock, a cemented carbonate layer capping the alluvial soil at the Wallach site. Water that penetrates the caliche caprock through cracks becomes trapped and remains underneath the caprock because it will not evapotranspire. In contrast, when water enters silty sand soils, evapotranspiration prevents it from remaining trapped in the soil. Rainfall infiltrating through fractured caliche caprock does not occur at the proposed NEF site because the caprock, present at the Wallach site, is not present at the proposed NEF site. (LES ER, at p. 3.4-2, LES Exhibit 1). Furthermore, the Wallach site surface soil is sand and gravel; the surface soil at the proposed NEF site is a finer grained silty sand,

which tends to inhibit infiltration more-so than the soil at the Wallach site.

Groundwater is also intermittently present at a depression known as Baker Spring. Baker Spring, which is man-made, is a result of the excavation of gravel and caprock above the redbed clay. Due to this excavation, Baker Spring is lower than the surrounding area. This lower surrounding area and the low permeability of the underlying clay produce ponding on the excavation during rainfall events. Shading caused by the 20 to 30 foot high excavation walls, and by trees along these walls, retard the natural evaporation rates. During periods of ponding, standing pond water infiltrates into the sands at the base of the excavation wall, and is retained as bank storage. (LES ER Figure 3.4-5 contains a photo of Baker Spring, LES Exhibit 1). As the surface water declines to levels below the water stored in the base of the excavation, this bank storage is discharged back to the excavation floor. These conditions do not exist at the proposed NEF site.

At the WCS site, groundwater is found, to a limited extent, in discontinuous perched water bodies on the surface of the Chinle Formation. These areas of perched water are likely a result of playas (buffalo wallows). Playas are surface depressions that collect runoff, which can then infiltrate into the alluvium due to this ponding of water. There is no evidence that playas are present at the proposed NEF site.

Q7. Mr. Rice has drawn a schematic (Figure 1) to show a cross section of the geology in the vicinity of the proposed NEF site. In your opinion, does that schematic reflect conditions at the proposed NEF site?

A7. No, I believe that Figure 1 is misleading. Because he notes vertical dimensions but not horizontal ones, Mr. Rice's depiction implies that playas (buffalo wallows) and groundwater from seepage beneath the playas are located on the proposed NEF site. No playas, nor any saturated alluvial groundwater, have been identified at the proposed NEF site. Furthermore, although possible locations for fractures which could result in fast vertical flow

through the Chinle Formation are indicated in Figure 1, there is no evidence to support the presence of such fractures at the proposed NEF site. In fact, the existing evidence supports the conclusion that no such fractures are present at the proposed NEF site. More than 40 permeability measurements taken of the Chinle Formation in the site vicinity and a detailed evaluation of the fracture characteristics in the Chinle weigh against the theory that fractures are present beneath the proposed NEF site which could act as fast flow paths. (*Section VI Geology Report for Waste Control Specialists LLC, Andrews, Texas,* Cook-Joyce, Inc. & Intera, Inc., August 2004 ("Cook-Joyce Geology Report"), LES Exhibit 73, at p. 4-11; NRC Staff Testimony of Alan Toblin Testimony, January 7, 2004 ("Toblin Testimony"), at Q&A 45-52).

Q8. Mr. Rice states that groundwater in the Dockum Group (including the Chinle Formation and the Santa Rosa Aquifer) has been used in the vicinity of the site. Can one reasonably infer from this that groundwater in the Chinle beneath the proposed NEF site may be used sometime in the future?

A8. No. Discussing the Chinle and Santa Rosa formations together when discussing water use is misleading because they are two distinct geologic formations. The Chinle forms a very thick impermeable barrier between the soils at the top of the proposed site and the deeper Santa Rosa Formation, where an aquifer is located. Water from the Santa Rosa Aquifer is used in the vicinity of the site; however, as I discuss in my direct testimony, groundwater is not likely to travel through the Chinle and reach the Santa Rosa Aquifer. According to page 6-12 of the *Lea County Regional Water Plan* (LES Exhibit 26), referenced to support Mr. Rice's testimony, "[t]he development that has occurred [in the Dockum Group] is limited specifically to the Santa Rosa sandstone unit."

Q9. What is your response to Mr. Rice's testimony regarding the town of Oil Center, located about 12 miles northwest of the proposed NEF site, which obtains water from the Dockum

Group?

A9. The town of Oil Center gets its water from a specific part of the Dockum Group that contains an aquifer; the Santa Rosa Formation. This is the only local community that currently pumps even part of its water from the Santa Rosa. (*Lea County Regional Water Plan,* December 2000, at p. 6-12, LES Exhibit 26).

Q10. Mr. Rice states that the site has not been adequately characterized in order to predict how the proposed facility will affect groundwater. He cites a number of reasons for this conclusion, the first of which is that the hydraulic properties of the shallow materials underlying the site have not been measured. Did you in fact determine appropriate values for the hydraulic properties of those materials?

A10. Yes. In doing so, I relied on well-established literature values (e.g., *Groundwater* by Freeze and Cherry) of hydraulic properties (hydraulic conductivity, porosity) to describe the range of conditions encountered at the site. These literature values are based on numerous measurements of materials similar to those at the proposed site and therefore constitute a reliable indicator of these properties.

Q11. In addition, Mr. Rice claims that the site has not been properly characterized because the presence of moisture found in the shallow alluvium underlying the site has not been explained. He then concludes that the moisture is probably an indication of recent recharge. Do you agree?

A11. No. In my professional opinion, the moisture that was found was not due to recent recharge. Of 14 borings and multiple layers logged, only one shallow alluvium layer at one boring indicated "slight moisture" from a depth of 6 to 14 feet below ground. (*Hydrogeologic Investigation, Section 32; Township 21 Range 38, Eunice, New Mexico,* Cook-Joyce, Inc., November 2003, "Cook-Joyce Hydrogeologic Investigation," at Appendix A, LES Exhibit 3). In the alluvium both above and below this layer, the soils are

noted as very dry. The lack of any indication that this moisture is seeping further downward is consistent with the conclusion that precipitation does not seep deeply into the ground beneath the proposed NEF site. Were there recent recharge, one would expect to see moisture in the borings that were taken throughout the proposed NEF site. (Toblin Testimony, at Q&A 34-36).

Q12. Mr. Rice continues to state that NEF site characterization was not sufficient because of the failure to investigate the possibility that fractures may exist at the proposed site since fractures may act as preferential pathways. Has there been any such investigation near the proposed NEF site?

A12. Yes. The possibility that fractures may act as preferential pathways has been investigated at the WCS site, located approximately one mile to the east of the proposed NEF site. The geological investigation of faults and fractures in the Chinle Formation beneath the WCS site did not detect any evidence of fast flow paths. (Cook-Joyce Geology Report, at pp. 4-9 to 4-11).

Q13. Mr. Rice notes that moist clay has been found in most of the borings at the WCS site. Does this indicate that the same phenomenon occurs at the proposed NEF site?

A13. No. I would expect to find moist clay at the WCS site. There are known lenses (discontinuous limited extent perched water) sitting on the Chinle Formation at the WCS site. These lenses are known and of limited extent, as witnessed by those borings not indicating clay moisture. In contrast, there is no evidence that such lenses exist at the proposed NEF site as indicated by boring logs taken throughout the site. (Cook-Joyce Hydrogeologic Investigation, LES Exhibit 3).

Q14. Mr. Rice states that the question of whether recent recharge has occurred could be answered by using radioisotopes to date the moisture in the vadose zone. Do you believe such an investigation is called for?

A14. No. To begin, the vadose zone (the unsaturated zone) is the subsurface zone in which the pore spaces are partially filled with water and partially filled with air. At the proposed NEF site, this zone would include the alluvium and the Chinle. Presumably, Mr. Rice is concluding that a radioisotope investigation is necessary because moist clay was found at the bottom of one of the site borings. However, as I have discussed, I do not believe that the presence of moisture in this one boring casts any doubt on my conclusion that no recent recharge is present. Furthermore, as Mr. Rice concedes, radioisotope testing would not definitively determine the age of the water, nor would such tests indicate the water's flow path from the surface (i.e., its surface origin).

Q15. In discussing the measurements of permeability of the Chinle Formation, Mr. Rice concludes that laboratory measurements often underestimate bulk permeability. In support of this conclusion he refers to data shown in his Figure 2, which is based on a 1981 publication by Olson and Daniel. Do the data in Figure 2 apply to the laboratory measurements of the Chinle?

A15. No. Olson and Daniel's 1981 paper describes the relationship between laboratory and field measurements of fine-grained soils, as stated in the note to Figure 2. Field-measured conductivities are often greater than those measured in the laboratory for such material because the soil which is brought to the laboratory has been subject to compaction during drilling and handling. However, consolidated (rock like) formations, such as the Chinle, show different behavior, in that such material is subject to fracturing (caused by drilling and handling), rather than compaction. (Toblin Testimony, at A42; Schmelling, S. & Ross, R., *Contaminant Transport in Fractured Media: Models for Decision Makers*, EPA/540/4-89-004, U.S. Environmental Protection Agency, April 1989, Staff Exhibit 9, at p. 3). Accordingly, permeabilities of material taken from the Chinle Formation and measured in the lab tend to be greater than those obtained in the field. I note that the Davis

and DeWiest reference cited in footnote 54 of Mr. Rice's testimony talks of lab samples being disturbed but does not conclude whether such samples would result in greater or lesser measurements of permeability than would field measurements.

Q16. Mr. Rice states that stormwater runoff from the proposed NEF site (other than from the UBC storage pad) would be directed to an unlined basin which will be able to hold approximately 23,350 m^3 of runoff. Is this number correct?

A16. No. This number was a typographical error in the LES ER and was corrected in the DEIS at p. 2-10. The correct basin volume is 123,350 m^3 (100 acre-feet).

Q17. Included with Mr. Rice's testimony is a schematic cross-section depicting subsurface discharge from the Site Stormwater Detention Basin and septic field, designated as Figure 3. Does this figure accurately depict flow of water at the proposed NEF?

A17. No. Figure 3 indicates the presence of "fracture flow" under the proposed NEF site, which is not supported by site investigations. Instead, investigations of faults and fractures in the Chinle Formation at the WCS site and more than 40 permeability measurements indicate that there are no fast flow paths along fractures at the proposed NEF site. (A7, above).

Q18. With regard to leakage from the Site Stormwater Detention Basin, Mr. Rice states that the NRC did not perform an adequate estimate because it was assumed that all the water entering the basin would infiltrate underlying materials. Is it true that you assumed that all of the water entering the basin would infiltrate?

A18. Yes. I did not perform a calculation of the fraction of water that would discharge to the vadose zone from the basin because I made the most conservative assumption that all of the water entering the basin would infiltrate beneath it.

Q19. Mr. Rice notes that although you observed that transport of water which infiltrates the soil underlying the Stormwater Detention Basin and the septic leach field would be limited by the storage capacity of the soils and the upward flux to the root zone, you did not quantify

either of those limiting factors. Is that correct?

A19. Yes. These factors were not quantified because I did not rely on them in performing the calculations. I conservatively assumed that all of the water which infiltrates from the basins would be transported downgradient. For each of these factors that was not quantified, additional conservatism was added to my calculation.

Q20. Mr. Rice notes that your evaluation of potential discharge areas is based on a review of the literature rather than field investigation. Is reliance on literature for this purpose appropriate?

A20. Yes. The use of literature is appropriate. Information was available to determine the downgradient direction (the slope of the Chine surface as determined from a local map of the same). (LES ER, at Figure 3.4-6, LES Exhibit 1). A nearby downgradient surface feature (Monument Draw), in which alluvial groundwater could discharge, was also clearly referenced (LES ER, at p. 3.4-4 and Figure 3.4-2, LES Exhibit 1).

Q21. Mr. Rice states that the DEIS does not explain why water will discharge at the locations given, and why potential discharge areas (e.g., Monument Draw) closer to the proposed NEF site were not considered. Can you explain this?

A21. Yes. I considered whether there were any groundwater discharges (e.g., springs) identified downgradient from the proposed NEF site (south-southwest as determined from the slope of the Chinle surface) and upgradient of any surface water body; none were found. I then identified the closest water body which would cut through the alluvium as the nearest discharge point. Following this method, I identified Monument Draw, approximately 3 miles south-southwest of the site, as the likely discharge location should any perched water be transported there. This was incorrectly identified as "Custer Mountain or in the excavation 3.2 kilometers (2 miles) southeast of Monument Draw where the Chinle Formation is exposed" in the DEIS at p. 4-13. The statement beginning on line 43 of page 4-13 of the

DEIS should be corrected to read, "Portions of the plume not evapotranspired and traveling downgradient could result in a minor seep at Monument Draw, approximately 3 miles south-southwest of the site." Another correction to the DEIS should be made in line 34 of page 3-35: it should state "the town of Monument" instead of "Monument Draw."

Q22. Does this conclude your rebuttal testimony?

A22. Yes.

1 MS. CLARK: At this time I'd like to go
2 through and identify the Staff exhibits associated
3 with this testimony.
4 Staff exhibit number 1-A is the unredacted
5 version of the Draft Environmental Impact Statement
6 for the proposed National Enrichment Facility.
7 (Whereupon, the above-
8 referenced to document was
9 marked as Staff Exhibit No. 1-A
10 for identification.)
11 MS. CLARK: Staff exhibit 1-B is the
12 redacted version of the Draft Environmental Impact
13 Statement for the proposed National Enrichment
14 Facility.
15 CHAIR BOLLWERK: Right, and that has
16 already been admitted, so we don't have to go over
17 that one.
18 MS. CLARK: That is correct. Staff
19 exhibit number 2 is an article by De Wiest, Flow
20 Through Porous Media.
21 (Whereupon, the above-
22 referenced to document was
23 marked as Staff Exhibit No. 2
24 for identification.)
25 MS. CLARK: Staff exhibit 6 is data

1 collection handbook to support modeling impacts of
2 radioactive material in soil, prepared by Argon
3 National Laboratory in April 1993.
4 (Whereupon, the above-
5 referenced to document was
6 marked as Staff Exhibit No. 6
7 for identification.)
8 MS. CLARK: Staff exhibit number 8 is the
9 draft report of preliminary subsurface exploration
10 proposed National Enrichment Facility, prepared by the
11 Mactec Engineering and Consulting Company.
12 (Whereupon, the above-
13 referenced to document was
14 marked as Staff Exhibit No. 8
15 for identification.)
16 MS. CLARK: Staff exhibit number 9 is
17 contaminate transport in fractured media models for
18 decisionmakers, prepared by Schmelling & Ross, which
19 is an EPA document dated April 1989.
20 (Whereupon, the above-
21 referenced to document was
22 marked as Staff Exhibit No. 9
23 for identification.)
24 MS. CLARK: Staff exhibit number 13 is the
25 LES revision to applications for material license.

1 (Whereupon, the above-
2 referenced to document was
3 marked as Staff Exhibit No. 13
4 for identification.)
5 MS. CLARK: Staff exhibit number 18 is the
6 Engineering analysis -- oh, I'm sorry, and that is it,
7 that completes our documents. So at this time --
8 CHAIR BOLLWERK: I have a number 21, do
9 you want to just check to make sure that is --
10 MS. CLARK: That is for EC-2.
11 CHAIR BOLLWERK: Okay, EC-2, good.
12 MS. CLARK: So at this time I would like
13 to move these exhibits into the record supporting EC-
14 1.
15 CHAIR BOLLWERK: Let's indicate, first,
16 that Staff exhibits 1-A, 2, 6, 8, 9 and 13 should be
17 identified for the record as described, and marked for
18 identification.
19 And then you want to admit the exhibits
20 into evidence. Does anyone have any objection to
21 that?
22 MR. REPKA: No objection.
23 MR. LOVEJOY: No objection.
24 CHAIR BOLLWERK: All right, then Staff
25 exhibits 1-A, 2, 6, 8, 9, and 13 are admitted into

1 evidence.

2 (The document referred to,
3 having been previously marked
4 for identification as Staff
5 Exhibit Nos. 1-A, 2, 6, 8, 9
6 and 13 are admitted into
7 evidence.)

8 CHAIR BOLLWERK: Anything further from the
9 Staff, at this point, with respect to the witness?

10 MS. CLARK: No. The Staff offers this
11 witness for cross examination.

12 CHAIR BOLLWERK: Thank you very much.

13 MR. REPKA: No questions at this time.

14 CHAIR BOLLWERK: No questions from LES.
15 I turn to you, Mr. Lovejoy.

16 MR. LOVEJOY: Thank you, Your Honor.

17 EXAMINATION BY MR. LOVEJOY OF
18 ALAN TOBLIN

19 MR. LOVEJOY: Mr. Toblin, you stated in
20 your direct testimony that you determined discharge
21 areas for potential leakage from the NEF site by
22 identifying the nearest down-gradient water body into
23 which the plume might discharge.

24 Can you explain how you did that?

25 WITNESS TOBLIN: Yes, well, I looked at

1 the, all the reports that were available to me, and
2 most especially the environmental report identified
3 the Monument Draw as the surface water that was in the
4 -- maybe we are getting into something else.
5 But that was down-gradient to the site, it
6 was near to the site.
7 MR. LOVEJOY: So you referred to the text
8 of the environmental report, is that right?
9 WITNESS TOBLIN: Yes.
10 MR. LOVEJOY: You didn't look at maps, or
11 any --
12 WITNESS TOBLIN: Well, they are on the
13 maps as well.
14 MR. LOVEJOY: But you didn't do any
15 calculations to --
16 WITNESS TOBLIN: One doesn't do a
17 calculation to determine a discharge area.
18 MR. LOVEJOY: And in the calculations
19 which you did do, involving the description of plumes,
20 you know what I'm referring to?
21 WITNESS TOBLIN: Yes.
22 MR. LOVEJOY: You used some porosity
23 values and hydrolic conductivity values which you
24 obtained from literature references, is that right?
25 WITNESS TOBLIN: That is correct.

1 MR. LOVEJOY: And it is true, isn't it,
2 that there are gravels beneath the site, the proposed
3 site?
4 WITNESS TOBLIN: There is, and I quote
5 from the Cook-Joyce report, there are minimal amounts
6 of gravel in certain areas.
7 MR. LOVEJOY: Which Cook-Joyce report are
8 you referring to?
9 WITNESS TOBLIN: I believe it is called
10 Hydrogeologic Investigation, I don't recall the entire
11 title. But Hydrogeologic Investigation I believe is
12 the title.
13 MR. LOVEJOY: Do you have the LES exhibits
14 with you?
15 WITNESS TOBLIN: Not at the table, I
16 don't.
17 CHAIR BOLLWERK: Is that exhibit 73?
18 MR. LOVEJOY: I think it is exhibit 3 tab
19 L.
20 WITNESS TOBLIN: Yes, I have that in front
21 of me now.
22 MR. LOVEJOY: Can you look at the appendix
23 A?
24 (Witness reviews document.)
25 WITNESS TOBLIN: Yes, I have that.

1 MR. LOVEJOY: Did you review these well
2 logs that show up in appendix A?
3 WITNESS TOBLIN: Yes.
4 MR. LOVEJOY: To identify gravel. How
5 many of them had gravel?
6 WITNESS TOBLIN: Well, I didn't make a
7 count of how many had gravel in it, but I relied on
8 the people who took those measurements, and were
9 familiar with all those measurements, and their
10 characterization of them.
11 MR. LOVEJOY: So you didn't refer to the
12 primary source?
13 WITNESS TOBLIN: I looked at the primary
14 source, but when they mentioned gravel in a boring,
15 there is no mention of how much gravel there is in
16 that boring.
17 MR. LOVEJOY: Would you look at well log
18 B-1 and see if you find gravel mentioned in the
19 stratum descriptions?
20 WITNESS TOBLIN: Yes, I see it.
21 MR. LOVEJOY: How about B-2, does that
22 mention gravel?
23 WITNESS TOBLIN: Yes.
24 MR. LOVEJOY: It does?
25 WITNESS TOBLIN: There is graVel listed

1 there, yes.

2 MR. LOVEJOY: I see. How about B-3, does

3 that mention gravel?

4 WITNESS TOBLIN: The words gravel are

5 mentioned. I note that they are mentioned last on the

6 list, behind sand and silt and gravel, for example, in

7 B-3.

8 MR. LOVEJOY: And in B-4 is gravel

9 mentioned?

10 WITNESS TOBLIN: Yes, it is.

11 MR. LOVEJOY: And in B-5 is gravel

12 mentioned?

13 WITNESS TOBLIN: Yes.

14 WITNESS TOBLIN: Actually there it says

15 six inch gravel layer, from 32 feet to 35 feet, and

16 three inch gravel layer a little below that, doesn't

17 it?

18 WITNESS TOBLIN: Yes, it does.

19 MR. LOVEJOY: And in B-6 gravel is

20 mentioned a couple of times, isn't it?

21 MS. CLARK: Your Honor, I think I have to

22 interrupt at this point. I'm not sure exactly where

23 this cross examination is going, but it appears to be,

24 once again, challenging the values that were used by

25 Mr. Toblin in his calculation based on this theory

1 that we should have used gravel.

2 And if that is the case then this line of

3 questioning is objectionable.

4 JUDGE ABRAMSON: Well, frankly, counsel I

5 would like to hear this information about how much

6 gravel there is. And, in particular, I would like to

7 hear Mr. Toblin take a look at B-1 and tell me how he

8 interprets the statement that 40 feet, which says fine

9 sand with silt and abundant gravel, what does it tell

10 you?

11 WITNESS TOBLIN: Well, it tells me that

12 there is abundant gravel at that boring.

13 JUDGE ABRAMSON: At that boring?

14 WITNESS TOBLIN: At that boring.

15 JUDGE ABRAMSON: And you implied, from

16 your earlier statement, that these other statements in

17 the boring logs that say fine sand with silt and

18 gravel, by virtue of the fact that gravel is listed

19 last, you implied that meant there was not much

20 gravel, is that --

21 WITNESS TOBLIN: Well that, in connection

22 with the report's conclusion, yes on page 9 of the

23 report Cooke-Joy says there are minimal amounts of

24 gravel in certain zones, but gravel is not

25 consistently present throughout the site.

1 JUDGE ABRAMSON: Okay, that is very
2 helpful, thank you. So where is that, page 9?
3 WITNESS TOBLIN: Page 9, first bullet.
4 JUDGE ABRAMSON: Thank you.
5 MR. LOVEJOY: So where did we leave off,
6 was it B-6? There is silt and gravel mentioned a
7 couple of times in log B-6, is that right?
8 WITNESS TOBLIN: That is correct.
9 MR. LOVEJOY: And in B-7, silt and gravel
10 show up, again?
11 WITNESS TOBLIN: In limited layers, yes.
12 Again, you know, in certain areas, yes.
13 MR. LOVEJOY: Yes, and in B-8 silt and
14 gravel show up, also?
15 WITNESS TOBLIN: Uh hum.
16 MR. LOVEJOY: In B-9 silt and gravel show
17 up also, is that right?
18 WITNESS TOBLIN: Yes.
19 MR. LOVEJOY: And that is the same place
20 where it says slightly moist, is that right?
21 WITNESS TOBLIN: Yes, I see that.
22 MR. LOVEJOY: So it showed up in every
23 log, right?
24 WITNESS TOBLIN: In certain areas of each
25 log, yes. Again, I refer to the characterization as

1 minimal amounts.

2 MR. LOVEJOY: Well, how much does it take

3 to make a fast flow path?

4 WITNESS TOBLIN: We take a continuous

5 gravel layer to make a fast flow path.

6 MR. LOVEJOY: Well, it shoes up in every

7 log.

8 WITNESS TOBLIN: Well, that's not a

9 continuous -- no, showing up in every log is not a

10 continuous layer.

11 MR. LOVEJOY: You don't know that.

12 WITNESS TOBLIN: I know that the different

13 -- as I was glancing through, as we were talking, I

14 saw that the gravel was listed at different depths in

15 each of them.

16 And it was mixed with sand and silts. So,

17 therefore it wouldn't be a continuous gravel layer.

18 MR. LOVEJOY: So you're able to decide

19 that you cannot correlate any of these gravels in one

20 well with another one? You can tell that?

21 WITNESS TOBLIN: I'm, again, relying on

22 the Cooke-Joyce characterization of those logs. They

23 were the ones that took the logs. They were the ones

24 who saw what was in them.

25 MR. LOVEJOY: So, it's not your judgment?

1 WITNESS TOBLIN: It's not my judgment.
2 MR. LOVEJOY: I see.
3 JUDGE ABRAMSON: Mr. Toblin, when you see
4 in the log that it says fine sand with silt and
5 gravel, can you just give me a description of what
6 that tells you in your mind it looks like in that
7 area? I mean, is this a gravel layer that's --
8 WITNESS TOBLIN: No. Because, if it was
9 gravel, it would say gravel with some silt and sand.
10 JUDGE ABRAMSON: So, what does this tell
11 you it looks like? It says fine sand with silt and
12 gravel.
13 WITNESS TOBLIN: Yes. So, it's mostly
14 sand, mostly fine sand, some silt and, again, if
15 gravel is third I would say --
16 JUDGE ABRAMSON: Stones mixed in my
17 sandbox? Some gravel mixed in my sandbox, is that an
18 accurate description?
19 WITNESS TOBLIN: Perhaps, yes. Something
20 of that order. I mean, I --
21 JUDGE ABRAMSON: I'm trying to understand
22 what --
23 WITNESS TOBLIN: Yes.
24 JUDGE ABRAMSON: -- what that would say to
25 you as --

1 WITNESS TOBLIN: Well, I say, again, you
2 know, in connection with their characterization, is
3 the way I would look at that.
4 MR. LOVEJOY: Are you through?
5 JUDGE ABRAMSON: I am. Thank you.
6 JUDGE KELBER: Going back to this question
7 of characterization, you say that the quote, grave,
8 quote whatever it's mixed with, occurs at different
9 depths in different logs.
10 Is the variation in depth such that you
11 wouldn't expect to see a continuous bed? Or are they
12 such that normal variations in soil conditions could
13 explain the variations?
14 WITNESS TOBLIN: Again, if you needed a --
15 if you were interested in a continuous gravel layer,
16 you would be interested in the same depth at each of
17 those.
18 JUDGE KELBER: Well, excuse me, but could
19 the depth vary by perhaps a foot or two?
20 WITNESS TOBLIN: Sure.
21 JUDGE KELBER: From place to place.
22 WITNESS TOBLIN: Sure.
23 JUDGE KELBER: Ten feet?
24 WITNESS TOBLIN: That would be quite a bit
25 in a 20 foot layer.

1 JUDGE KELBER: So, one to three feet
2 perhaps might be continuous. Ten to 20 feet would not
3 be.
4 WITNESS TOBLIN: That is correct.
5 JUDGE KELBER: And, are some of these logs
6 show gravel that spaces more or less than three feet
7 from their neighbors?
8 WITNESS TOBLIN: Well, there's -- you
9 know, some logs show them in the middle of the layer,
10 for example, in B-2, we're looking at a gravel layer
11 from 15.5 feet to 16.5 feet.
12 And there's some that's showing -- there's
13 a six foot gravel layer from 32 feet to 32.5 feet.
14 JUDGE ABRAMSON: Six inch.
15 WITNESS TOBLIN: Six inch, excuse me, six
16 inch. Thank you.
17 CHAIR BOLLWERK: Back to Mr. Lovejoy.
18 MR. LOVEJOY: Well, Mr. Toblin, these
19 gravel deposits are stream bed deposits, aren't they?
20 WITNESS TOBLIN: Yes.
21 MR. LOVEJOY: So, you wouldn't expect a
22 continuous layer of gravel extending for thousands of
23 feet in all directions, would you?
24 WITNESS TOBLIN: No, typically not.
25 MR. LOVEJOY: You would expect kind of

1 linear or curving deposit representing where an
2 ancient stream was, wouldn't you?
3 WITNESS TOBLIN: Perhaps.
4 MR. LOVEJOY: And, characteristically that
5 would be continuous along the bed of the stream?
6 WITNESS TOBLIN: Speculating that such a
7 thing were to occur, yes. But I don't believe that's
8 the case here. And, again, I relied on the
9 characterization of Cooke-Joyce.
10 MR. LOVEJOY: Well, gravels are stream bed
11 deposits, aren't they?
12 WITNESS TOBLIN: Yes.
13 JUDGE ABRAMSON: If we had such a stream
14 bed that might provide a path for flow, if that stream
15 bed were made up of sand with some silt mixed in,
16 which I assume would fill the intergranular spaces
17 between the sand, and some gravel, which would occupy
18 places where grains of sand might otherwise have been,
19 what would you expect the permeability of such a
20 medium to be, and how would it compare to the
21 permeability of a gravel layer, and how would it
22 compare to the permeability of a sand layer or a silt
23 layer?
24 WITNESS TOBLIN: A gravel layer would be
25 -- is the most permeable of that spectrum that you

1 just mentioned, typically, of course. And, sand would
2 be less permeable than gravel. And silt would be less
3 permeable than sand.
4 JUDGE ABRAMSON: Is it possible to have in
5 natural formations a gravel layer that doesn't --
6 where the inter -- where the spaces between chunks of
7 gravel don't get filled in by sand?
8 Is that physically possible? I have some
9 gardening experience. If I put down a gravel layer,
10 I don't wrap it in some sort of cloth to prevent stuff
11 from filling it. It fills in. Is it possible to --
12 WITNESS TOBLIN: Well, again, we're
13 talking about a mostly gravel layer. I think there
14 would be some -- you would never have 100 percent
15 gravel.
16 JUDGE ABRAMSON: So, in the way this is
17 described, it sounds to me as if it's sand with some
18 gravel mixed in and some silt mixed in. How much --
19 what would be the order of magnitude difference in
20 permeability between a sand layer and a mostly gravel
21 layer and a mostly sand layer?
22 WITNESS TOBLIN: You'd be talking about an
23 order of magnitude or two, something on that order.
24 JUDGE ABRAMSON: And, a silt layer?
25 WITNESS TOBLIN: Again, you know, you'd be

1 talking -- the other direction, of course, but that
2 would be -- mostly you'd be talking about --
3 JUDGE ABRAMSON: Silt or a less permeable
4 one --
5 WITNESS TOBLIN: Less permeable.
6 JUDGE ABRAMSON: So, if I had sand and
7 some other filled in with silt, it would be less
8 permeable than sand?
9 WITNESS TOBLIN: That is correct.
10 JUDGE ABRAMSON: And, if I had gravel and
11 it filled in with sand it would be --
12 WITNESS TOBLIN: Yes.
13 JUDGE ABRAMSON: Okay. Thank you.
14 MR. LOVEJOY: Typically, Mr. Toblin, don't
15 stream bed deposits kind of sort themselves out to the
16 hydrodynamics of the water so that in one particular
17 place you find gravel and in another place you find
18 finer stones and sand, and then in another place you
19 find silt. Isn't that how it works?
20 WITNESS TOBLIN: I am not aware of that,
21 no.
22 MR. LOVEJOY: You're not?
23 WITNESS TOBLIN: No.
24 (Pause.)
25 MR. LOVEJOY: Okay, let's move onto the

1 issue of the liner. There are lines planned to be
2 placed under the TEEB, that basin, the treated
3 ethylene basin, and also the uranium byproduct
4 cylinder storm water --
5 WITNESS TOBLIN: I know.
6 MR. LOVEJOY: Those two guys. And you
7 said that you have no way to assign any probability to
8 leakage --
9 WITNESS TOBLIN: That is correct.
10 MR. LOVEJOY: -- of these man-made water
11 bodies. And you've said things like that you would
12 need to assign a value to the number of penetrations
13 per unit area and per unit of time.
14 And you just can't do that. Aren't there
15 data available with which to make those calculations?
16 WITNESS TOBLIN: Well, no. There's no
17 data available. In fact, the basins haven't even been
18 -- don't even have a final design yet. So, there
19 certainly is no data for that.
20 MR. LOVEJOY: Well, when they finish the
21 design then you can assign a probability?
22 WITNESS TOBLIN: No.
23 JUDGE ABRAMSON: Can you gather such data
24 from information on the material proposed to be used
25 for liners?

1 WITNESS TOBLIN: There is some information
2 out there. I haven't seen an information document
3 that's -- let's say -- would separate them by liner
4 type and thickness of liner and the design of the
5 liner.
6 JUDGE ABRAMSON: So we couldn't make an
7 engineering analysis of any particular liner even if
8 we knew what was being proposed specifically. Is that
9 correct? Because there isn't data on the --
10 WITNESS TOBLIN: That is correct. You
11 know, one would have to pre-suppose some leaks.
12 JUDGE ABRAMSON: I understand. That's
13 kind of like doing a very conservative analysis.
14 WITNESS TOBLIN: I suppose.
15 MR. LOVEJOY: I'm going to ask Mr. Rice to
16 bring you the NIRS/PC exhibits relating to EC-1 so
17 that you can look at Exhibit 10, which is, I'll
18 identify it, NIRS/PC Exhibit 10, the hydrologic
19 evaluation of landfill performance HELP model, users
20 guide for version three.
21 This is an EPA publication. I'm going to
22 ask you to take a look at page 34.
23 CHAIR BOLLWERK: Let the record reflect
24 that NIRS/PC Exhibit 10 has been marked for
25 identification.

1 (Whereupon, the above-
2 referenced to document was
3 marked as NIRS/PC Exhibit No.
4 10 for identification.)
5 MR. LOVEJOY: Thank you. Have you looked
6 at this document, Mr. Toblin, before?
7 WITNESS TOBLIN: I have not looked at this
8 document for quite a while. But I have run the help
9 model, yes.
10 MR. LOVEJOY: Okay. Well, on this
11 particular page, 34, there's discussion of
12 representative installation defect densities. And the
13 statement appears -- I'm looking at the middle
14 paragraph on 34.
15 It says typical geo-membranes may have
16 about 05. to 1 pinholes per acre and one to pinholes
17 per hectare for manufacturing defects. Then it goes
18 on about the density of installation defects.
19 Is the kind of data that you could use in
20 order to estimate the probability of leakage?
21 WITNESS TOBLIN: Well, I would have to see
22 what was behind this information.
23 MR. LOVEJOY: Have you inquired?
24 WITNESS TOBLIN: Excuse me?
25 MR. LOVEJOY: Have you tried to find out?

1 WITNESS TOBLIN: Have I -- no I have not?

2 MR. LOVEJOY: Okay, would you --

3 WITNESS TOBLIN: You know, there are a lot

4 of different, again, there are a lot of different

5 designs, liner designs and a lot of different -- you

6 can have landfills, you have impoundments.

7 And those things aren't -- don't always

8 behave the same.

9 MR. LOVEJOY: Do you have the -- you do

10 have the LES exhibits there I believe. Would you look

11 at number 72?

12 WITNESS TOBLIN: LES 72?

13 MR. LOVEJOY: Yes.

14 WITNESS TOBLIN: The Southwest Research

15 Institute?

16 MR. LOVEJOY: On numbered page 36, the

17 second page of this paper, the right-hand column,

18 there's a heading caption, discussion of leaks

19 detected and located.

20 It says leak statistics. 61 sites with an

21 approximate total area of 4,368,785 square feet of

22 liner material have been commercially surveyed. Tables

23 one, two, and three present a summary of all the

24 commercial leak surveys conducted to date using the

25 electrical method developed at Southwest Research

1 Institute.

2 A total 1,409 leaks were located at the 61

3 sites surveyed, which equates to an average of 3.2

4 leaks per 10,000 square feet of liner material

5 inspected.

6 Is that the kind of data you could use

7 with which to project the probability of leakage?

8 WITNESS TOBLIN: If there were -- if the

9 frequency distributions were broken down by liner

10 type, how old the liner was, how much head there was

11 on the liner, there's a number of different parameters

12 that determine what kind leaks you might get through

13 a liner.

14 MR. LOVEJOY: Have you tried to find out

15 whether it --

16 WITNESS TOBLIN: I haven't seen such

17 information.

18 MR. LOVEJOY: Have you inquired about the

19 data underlying this report?

20 WITNESS TOBLIN: Other than Table 1, no I

21 haven't.

22 MR. LOVEJOY: And, is it possible to

23 estimate the frequency and amount of water present in

24 the TEEB or the UVC basin?

25 WITNESS TOBLIN: I can estimate the amount

1 of water in those basins, yes.

2 MR. LOVEJOY: You can estimate a fixed

3 quantity?

4 WITNESS TOBLIN: Excuse me?

5 MR. LOVEJOY: You can estimate a fixed

6 quantity. You mean the total capacity? Is that what

7 you're talking about?

8 WITNESS TOBLIN: I know -- I can estimate

9 the distribution of the water as a function of time

10 that was given in LES's REI responses.

11 MR. LOVEJOY: Okay. So, you have the

12 information, don't you, to project a probability and

13 amount of leakage?

14 WITNESS TOBLIN: No, I don't. I just told

15 you that I have information to estimate the amount of

16 water in the ponds.

17 MR. LOVEJOY: Oh, you're going back to the

18 fact that you don't have history on liners?

19 WITNESS TOBLIN: Yes.

20 MR. LOVEJOY: But you haven't investigated

21 the data behind the Linga Nicholas report?

22 WITNESS TOBLIN: No, I haven't gone past

23 what was in this document.

24 MR. LOVEJOY: You also said in your

25 testimony that you think the contaminants in the TEEB

1 and the storm water retention basin are not of
2 significant environmental concern.
3 And you state that the clay liner under
4 the TEEB and the USP basin would absorb any amount of
5 uranium that would be released in a --
6 JUDGE ABRAMSON: Can you give us a
7 reference for that, please?
8 MR. LOVEJOY: Pages 16 and 17 of the
9 direct testimony.
10 JUDGE ABRAMSON: Thank you.
11 MR. LOVEJOY: Sorry. And the citation you
12 give is the paper by Y-U, which is Exhibit six. And
13 I looked at Exhibit six and --
14 JUDGE ABRAMSON: I'm sorry, I'm having
15 difficulty finding this material. Give me the
16 question and answer again, please.
17 MR. LOVEJOY: Okay. Answer 31 on page 16,
18 and continue over on 17.
19 JUDGE ABRAMSON: Thank you.
20 MR. LOVEJOY: And what's the data in
21 Exhibit six that you're relying on?
22 WITNESS TOBLIN: Page 110, table 32.1.
23 MR. LOVEJOY: Specifically which data?
24 WITNESS TOBLIN: Kd, that's a distribution
25 coefficient for uranium in pond clay.

1 MR. LOVEJOY: It lists a Kd of 1,600,
2 right?
3 WITNESS TOBLIN: Yes, that is correct.
4 MR. LOVEJOY: And you think that would
5 apply to any uranium that somehow got into the TEEB or
6 the other container basin?
7 WITNESS TOBLIN: In general, yes. I think
8 it --
9 MR. LOVEJOY: This is not a value you've
10 determined experimentally at all. It's just out of
11 this document.
12 WITNESS TOBLIN: That is correct.
13 MR. LOVEJOY: And, doesn't the Kd for a
14 constituent depend upon the specific form the uranium
15 is in, say an oxidation state, but it's complex.
16 WITNESS TOBLIN: Yes.
17 MR. LOVEJOY: So, you can apply that Kd to
18 anything, any uranium that enters one of these basins,
19 can you?
20 WITNESS TOBLIN: The uranium tends to
21 absorb onto clay in, I think, just about all of its
22 oxidation states. Now, the value of 1,600 may not be
23 strictly applicable to the clay over here.
24 MR. LOVEJOY: So, you just happen to know
25 that uranium absorbs on clay?

1 WITNESS TOBLIN: Yes.

2 MR. LOVEJOY: In any oxidation state?

3 WITNESS TOBLIN: For the most part, yes.

4 MR. LOVEJOY: Does --

5 WITNESS TOBLIN: I mean, off the top of my

6 head, yes that's true.

7 MR. LOVEJOY: Is uranium ever transported

8 by colloids?

9 WITNESS TOBLIN: Colloidal transport has

10 been -- you know, a small portion of the uranium has

11 been known to be transported by colloidals, yes.

12 MR. LOVEJOY: And, for that kind of

13 transport, the usual Kd values would apply, is that

14 right?

15 WITNESS TOBLIN: That's a whole different

16 thing. You know, colloidal transport is more of a

17 suspended, solid-type transport. We have very small

18 particles that are moving along with the groundwater

19 that are carrying the uranium with it.

20 MR. LOVEJOY: Can those particles actually

21 move at the very speed of the groundwater or even

22 faster?

23 WITNESS TOBLIN: they typically move with

24 the groundwater, yes.

25 JUDGE ABRAMSON: How would clay -- how

1 would a colloidal suspension move through clay?

2 WITNESS TOBLIN: It would be very

3 difficult. It would be -- you would have a very, very

4 small particle. And I do not know of any cases of

5 colloids moving through clay.

6 But there are discussions of colloids and

7 colloidal transport in the literature.

8 JUDGE ABRAMSON: I mean, I can understand

9 the issue of something being carried in a colloidal

10 suspension through a relatively porous medium.

11 WITNESS TOBLIN: Right.

12 JUDGE ABRAMSON: But I'm having difficulty

13 comprehending how clay in a compacted form would

14 permit colloidal -- permit transport of something

15 suspended in a colloidal manner.

16 WITNESS TOBLIN: I'm not aware of any

17 situation. I've never read of any such happenstance.

18 And it would be unlikely.

19 JUDGE ABRAMSON: Counsel, do you intend to

20 present some evidence to that effect? That clay will

21 permit the transport of uranium in colloidal

22 suspension?

23 MR. LOVEJOY: Your Honor, I cannot say

24 that I am.

25 JUDGE ABRAMSON: Okay. Thank you.

1 (Pause.)

2 MR. LOVEJOY: You've testified in your

3 direct testimony in pages 17 and 18, and on, about a

4 recharge and what one would expect to see if there

5 were precipitation recharge.

6 And, you do acknowledge that, in the

7 drilling at the NEF site, moisture was found at two

8 bore holes.

9 WITNESS TOBLIN: Correct.

10 MR. LOVEJOY: And these were reported by

11 Cooke-Joyce?

12 WITNESS TOBLIN: Yes.

13 MR. LOVEJOY: Okay. One of them, B-9,

14 identified moisture at the six to 14 foot zone. And

15 you state that there's no indication that this

16 moisture is seeping downwards.

17 But, you don't really know at present

18 which way it's going?

19 WITNESS TOBLIN: Yes. Well, I would say,

20 based on the information contained in the Walvoord

21 report that I would expect it was going upwards. But

22 it is true that there is, you know, if I remember off

23 the top of my head, there's an 8 foot layer of

24 slightly moist alluvium.

25 And, both above and below that layer it

1 was noted as being dry.

2 MR. LOVEJOY: But, without the Walvoord

3 paper you wouldn't know which way that water is going?

4 WITNESS TOBLIN: Well, again, the concepts

5 of the Walvoord paper would still apply. You know, it

6 could be moving down by gravity. Or it could be

7 moving up because of the transpiration.

8 JUDGE ABRAMSON: Mr. Toblin, we've been

9 having a lot of discussion today about the Walvoord as

10 if it's the only authoritative source for the concept

11 that water would evaporotranspirate. Is that the

12 case?

13 WITNESS TOBLIN: Well, no. I mean,

14 evaporotranspiration is a well-known phenomenon. And

15 is this just one of many sources? Or is this the

16 authoritative statement, or what's the situation?

17 WITNESS TOBLIN: Well, no. That was the

18 paper presented by LES that, you know, described

19 conditions, most especially in a desert environment,

20 in an arid environment with a thick Vadose zone.

21 JUDGE ABRAMSON: That is -- in your view

22 is that the authoritative paper for this particular

23 application? And, are there -- let me ask a couple of

24 things.

25 A, is that the authoritative paper for

1 this or --

2 WITNESS TOBLIN: I'm not aware of, in that

3 particular -- again, for deep Vadose zones and an arid

4 environment, I'm not aware of any papers that

5 specifically address that.

6 JUDGE ABRAMSON: Okay. And is there --

7 you say that this is a well-accepted principle. Is

8 there any doubt among experts that this principle is

9 -- that this principle of evaporotranspiration is not

10 just a hypo --

11 WITNESS TOBLIN: Oh, no. I mean, it's

12 standard. You'll find that in any textbook.

13 JUDGE ABRAMSON: Oh, okay.

14 MR. LOVEJOY: Have you looked for any

15 other papers on the question of the Vadose zone in

16 arid places and the equilibrium states and response

17 times in thick desert Vadose zones as the Walvoord

18 paper --

19 WITNESS TOBLIN: I haven't specifically

20 looked for any papers like that.

21 MR. LOVEJOY: Okay. Now, as for the water

22 in B-9, in that eight foot zone, you don't know how

23 long it took to get to that place, do you?

24 WITNESS TOBLIN: No, I don't.

25 MR. LOVEJOY: You call the moist clay in

1 bore hole B-2, which showed up as well as a 35 to 40
2 feet depth, is that correct?
3 WITNESS TOBLIN: Something on that order,
4 yes.
5 MR. LOVEJOY: You call that an isolated
6 observation?
7 WITNESS TOBLIN: Yes, sir.
8 MR. LOVEJOY: And that was probably right
9 at the top of the alluvium wasn't it?
10 WITNESS TOBLIN: Yes. Or at the top of
11 the clay, not at the top of the --
12 MR. LOVEJOY: Excuse me, at the top --
13 where the alluvium hits the clay.
14 WITNESS TOBLIN: Yes.
15 MR. LOVEJOY: Thank you. Sorry. Does
16 this indicate what we might call ponding on top of an
17 impermeable body?
18 WITNESS TOBLIN: No, not at all. We're
19 talking, again, about a moist sample in one location.
20 I wouldn't interpret that to talk about ponding on top
21 of an impermeable body.
22 JUDGE ABRAMSON: But, could we say that if
23 one had kept boring down into the clay one would not
24 have found moisture very far down, that the clay in
25 fact prevented the moisture from penetrating very much

1 farther below that interface?

2 WITNESS TOBLIN: I think that that's what

3 our evidence shows us.

4 JUDGE ABRAMSON: So, even if it's not

5 ponding, at least it sort of traps the moisture above

6 the interface?

7 WITNESS TOBLIN: Right. And, again,

8 ponding is a --

9 JUDGE ABRAMSON: I understand --

10 WITNESS TOBLIN: -- concept of --

11 JUDGE ABRAMSON: -- the density of

12 moisture there.

13 MR. LOVEJOY: Maybe I used the wrong word.

14 The water is present in any case right above the

15 impermeable layer, is that right?

16 WITNESS TOBLIN: There is some moisture.

17 MR. LOVEJOY: Isn't that inconsistent with

18 the model that Walvoord and her colleagues have

19 published?

20 WITNESS TOBLIN: Well, no. Again, that is

21 part of the Vadose zone. This is not saturated water

22 over there. This is residual water. I wouldn't even

23 -- I wouldn't speculate exactly where it's from. This

24 is unsaturated.

25 MR. LOVEJOY: So, is the Walvoord paper

1 just about saturated water bodies?

2 WITNESS TOBLIN: The contention was that

3 there is precipitation recharge. And precipitation

4 recharge we're talking about water -- precipitation

5 infiltrating into the ground and reaching a saturated

6 water body, especially an aquifer.

7 So, you know, a little bit of moisture at

8 one location does not indicate precipitation recharge

9 to me.

10 MR. LOVEJOY: Oh, so you're saying that

11 recharge only occurs if there's a saturated --

12 WITNESS TOBLIN: Yes.

13 MR. LOVEJOY: -- in which water -- oh,

14 okay.

15 JUDGE ABRAMSON: Is it accurate to say

16 that these two competing forces, as Dr. Kelber

17 described it, gravity pulling it down and

18 evaporotranspiration tending to provide an upward

19 force on the water, could permit moisture to penetrate

20 to any depth, assuming we had a similar permeability,

21 depending on the coefficience of the permeability and

22 the --

23 WITNESS TOBLIN: Yes. Well, if the water

24 could move fast enough vertically, you know, before it

25 could evaporotranspire, sure.

1 JUDGE ABRAMSON: Okay. So, this is a
2 question of what the material properties are that this
3 process is going on here. Do you think we have a
4 pretty good handle on what the material properties are
5 in this alluvium layer?
6 WITNESS TOBLIN: Yes.
7 JUDGE ABRAMSON: And, from that you're not
8 -- are you surprised or not surprised to find moisture
9 to some level, unmeasured level, at any level, any
10 particular depth?
11 WITNESS TOBLIN: I would be surprised to
12 see it very deep. But, you know, at the levels we're
13 talking about here in the Vadose zone, I wouldn't say
14 I would necessarily expect to see, but I'm not shocked
15 that it's there.
16 MR. LOVEJOY: You said that if the water
17 could move fast enough it could go very deep. Is this
18 consistent with the Walvoord model?
19 WITNESS TOBLIN: Well, again, we're
20 talking fast enough, now we're fasting than moving in
21 the sands.
22 MR. LOVEJOY: Do you mean that it would
23 require, say, a fast flow path if it were to behave
24 that way?
25 WITNESS TOBLIN: Yes.

1 MR. LOVEJOY: And the Walvoord model is a
2 one dimensional model. We've been through this.
3 WITNESS TOBLIN: right.
4 MR. LOVEJOY: It doesn't account for fast
5 flow paths or preferential flow paths. They're just
6 not part of that model?
7 WITNESS TOBLIN: Well, again, in the sense
8 that it's a one dimensional model, it doesn't account
9 for variations in conductivity, let's say, in the
10 lateral directions.
11 JUDGE ABRAMSON: Let me ask you this,
12 we've used a lot of one dimensional modeling and
13 computations that Dr. Kelber and I have done over the
14 years.
15 You can build parallel paths with one
16 dimensional models, have an interconnection at the
17 bottom and at the top, and have different conductivity
18 in the two paths and probably generate circulation,
19 could you?
20 WITNESS TOBLIN: Yes. Well, you would not
21 have a one dimensional model there. But, yes.
22 JUDGE ABRAMSON: You have used a one
23 dimensional model to build a model that does more than
24 one dimensional computations.
25 WITNESS TOBLIN: Yes.

1 JUDGE ABRAMSON: So, it's not the
2 limitation of the Walvoord -- am I getting that name
3 right?
4 WITNESS TOBLIN: Walvoord.
5 JUDGE ABRAMSON: It's not a limitation of
6 that. It's a question of how you apply that physical
7 model to what you're trying to compute. Is that
8 right?
9 WITNESS TOBLIN: Yes, I think that's --
10 JUDGE ABRAMSON: And, is the Walvoord
11 model specifically hard wired to compute only for
12 transport through sand or --
13 WITNESS TOBLIN: Oh, no, no, no.
14 JUDGE ABRAMSON: Can you input the --
15 WITNESS TOBLIN: Yes, you can input the --
16 JUDGE ABRAMSON: So you could input
17 permeability of gravel if you wanted?
18 WITNESS TOBLIN: Yes.
19 JUDGE ABRAMSON: It's not a model
20 limitation?
21 WITNESS TOBLIN: Right.
22 JUDGE ABRAMSON: Thank you.
23 JUDGE KELBER: You could in fact put in a
24 very high conductivity representing a so-called
25 fracture zone or --

1 WITNESS TOBLIN: You could, yes.

2 MR. LOVEJOY: But, Mr. Toblin, that's not

3 what Ms. Walvoord and her colleagues did, is it?

4 WITNESS TOBLIN: No.

5 MR. LOVEJOY: Was that --

6 WITNESS TOBLIN: No.

7 MR. LOVEJOY: They used the FEHM or the

8 finite element heating mass transfer model, right?

9 WITNESS TOBLIN: Yes.

10 MR. LOVEJOY: And they applied values,

11 parameters, in that model which omitted any fractures,

12 macropores, or other preferential flow paths.

13 Those are the stipulated parameters for

14 their exercise, true?

15 WITNESS TOBLIN: I agree.

16 JUDGE KELBER: I think, Counsel --

17 CHAIR BOLLWERK: Why don't we stop here

18 and take a break? How's that? A two minute break?

19 Well, we'll take five. All right.

20

21 (Whereupon, the above-entitled matter

22 went off the record at 4:10 p.m. and

23 went back on the record at 4:20 p.m.)

24 CHAIR BOLLWERK: Back on the record. I

25 think Judge Kelber before we proceed --

1 JUDGE KELBER: Yes, Mr. Lovejoy, I think
2 we understand your point that there can exist local
3 zones either with fractures or other porous material
4 that present, at least locally, fast flow paths.
5 Do you or your expert believe in
6 contradiction to what we heard earlier that if such
7 zones extended from the alluvium to the Santa Rosa
8 aquifer, the Santa Rosa aquifer would still be
9 confined, or do you agree with their answer that if
10 that were the case the water in the Santa Rosa aquifer
11 would be distributed much more widely and not
12 confined?
13 MR. LOVEJOY: I can give you my amateur
14 answer, and I --
15 JUDGE KELBER: Please confer with your
16 expert.
17 MR. LOVEJOY: I've seen conditions like
18 that at Los Alamos.
19 JUDGE KELBER: You have seen conditions
20 like that --
21 MR. LOVEJOY: Where there's a perched
22 zone --
23 JUDGE KELBER: Excuse me, not a perched
24 zone. I'm talking about a zone with fast flow paths
25 continuous from the alluvium to the Santa Rosa

1 aquifer. Let me be quite specific.

2 MR. LOVEJOY: At Los Alamos there's a

3 regional aquifer, and there are -- which has its own

4 conditions of confinement. There are perched zones on

5 the pathway from the, yes, alluvial zones there down

6 through those perched zones, down to the confined

7 regional aquifer.

8 JUDGE KELBER: There is a continuous

9 pathway?

10 MR. LOVEJOY: If the water gets down, yes.

11 JUDGE KELBER: And they -- the zone at Los

12 Alamos is confined?

13 JUDGE ABRAMSON: We will ask the expert.

14 MR. LOVEJOY: I think the expert's the guy

15 on this one.

16 JUDGE ABRAMSON: Thank you.

17 CHAIR BOLLWERK: Thank you. All right

18 WITNESS TOBLIN I think -- I'm sorry, Mr. Lovejoy it's

19 your question. I'm sorry.

20 MR. LOVEJOY: Do you remember the exchange

21 that Mr. Peery and I had this morning concerning

22 instances or logs -- next to the report by Holt where

23 there was a moist zone or moisture found immediately

24 above the Chinle in numerous logs?

25 WITNESS TOBLIN: Yes.

1 MR. LOVEJOY: I don't need to go through
2 those again, there were maybe a dozen logs showing
3 that. And do you think that those situations are
4 similar, those came about in similar fashion to the
5 moisture in B-2?
6 WITNESS TOBLIN: I couldn't speculate on
7 that.
8 MR. LOVEJOY: Anyway, those dozen or so --
9 perhaps I should count them but say a dozen instances
10 in the report, they make up more than an isolated
11 instance don't they?
12 WITNESS TOBLIN: Well, there is now, in
13 the WCS site there is known areas of moisture and in
14 fact, saturated water.
15 MR. LOVEJOY: In saturated --
16 WITNESS TOBLIN: There are instances of
17 saturated water on the WCS site.
18 MR. LOVEJOY: At the bottom of the
19 alluvium, right?
20 WITNESS TOBLIN: Yes.
21 MR. LOVEJOY: And do you recall whether
22 those are associated with depressions interest the
23 surface?
24 WITNESS TOBLIN: Yes, they are.
25 MR. LOVEJOY: And those depressions

1 constitute recharge points, yes?

2 WITNESS TOBLIN: Yes.

3 JUDGE ABRAMSON: What's being recharged?

4 I'm sorry to -- I'm trying to understand what it means

5 to -- what's the significance of your comment that

6 they constitute recharged --

7 MR. LOVEJOY: Well, what is being

8 recharged is a zone that this witness, I think is

9 saying cannot be recharged because it's not

10 sufficiently saturated, but --

11 JUDGE ABRAMSON: The zone is the --

12 MR. LOVEJOY: The bottom of the alluvium,

13 the top of the Chinle.

14 WITNESS TOBLIN: At the WCS site you have

15 recharge due to depressions and water ponding in the

16 depressions and moving down to that interface.

17 MR. LOVEJOY: Do you recall if some of

18 those ponds are manmade?

19 WITNESS TOBLIN: I don't recall that any

20 were.

21 JUDGE ABRAMSON: Can you tell me, WITNESS

22 TOBLIN, on those ponds on the WCS site, what does the

23 soil look like under them, between them and the bottom

24 of the alluvium?

25 Is there a clay layer? Is there something

1 that would be less permeable than the rest of the
2 alluvium or is it relatively permeable?
3 WITNESS TOBLIN: Well, no. There are
4 depressions formed based on -- at that site there is
5 near surface caliche.
6 JUDGE ABRAMSON: Caliche --
7 WITNESS TOBLIN: Caliche is cemented soil.
8 JUDGE ABRAMSON: Okay.
9 WITNESS TOBLIN: And apparently there --
10 some of that has dissolved over the years and settled
11 and formed little basins that fill up with water.
12 JUDGE ABRAMSON: But they're permeable
13 enough to let water --
14 WITNESS TOBLIN: If there's fractures in
15 the caliche, yes.
16 JUDGE ABRAMSON: -- seep through.
17 WITNESS TOBLIN: Fractures in caliche will
18 allow water to go through readily.
19 JUDGE ABRAMSON: And is that what we think
20 is the reason that that water penetrates down into the
21 alluvium?
22 WITNESS TOBLIN: Yes.
23 JUDGE ABRAMSON: So it's like a basin, a
24 sink with a bunch of cracks in it.
25 WITNESS TOBLIN: Yes.

1 JUDGE ABRAMSON: The water runs through.
2 WITNESS TOBLIN: Yes.
3 JUDGE ABRAMSON: And is there anything
4 there that would prevent that water from running on
5 down to the interface?
6 WITNESS TOBLIN: No.
7 JUDGE ABRAMSON: It's just the balance of
8 forces --
9 WITNESS TOBLIN: Yes, yes.
10 JUDGE ABRAMSON: -- between that and what
11 we've been speaking of earlier. So we would
12 distinguish -- you would distinguish that from what
13 happens on the NEF site because there were no similar
14 depressions --
15 WITNESS TOBLIN: That's correct.
16 JUDGE ABRAMSON: In the NEF --
17 WITNESS TOBLIN: That's right. There's no
18 --
19 MR. LOVEJOY: But isn't it true, WITNESS
20 TOBLIN, that there are -- there's water occurring over
21 on the WCS site even where there's no caliche present
22 in the subsurface?
23 WITNESS TOBLIN: well, I think most of
24 that subsurface water is related to where the
25 depressions are.

1 MR. LOVEJOY: Related to what?

2 WITNESS TOBLIN: Where the -- the location

3 of the depressions.

4 MR. LOVEJOY: Are you talking about

5 depressions in the caliche?

6 WITNESS TOBLIN: Surface depressions on

7 the land.

8 MR. LOVEJOY: Okay, forgive me. I thought

9 you said that there could only be water in the

10 subsurface where there had been caliche that had been

11 broken through. So that's not what you're saying?

12 WITNESS TOBLIN: Those two things are

13 connected. There are depressions caused by caliche

14 that was either dissolved or -- that's one

15 explanation, and settled and caused these depressions.

16 MR. LOVEJOY: Now one of the reports about

17 that area is the Lehman and Rainwater report which is

18 LES Exhibit 3, tab I. Would you look at that? I'm

19 going to ask you to look at page 30.

20 WITNESS TOBLIN: Okay. I'm sorry, did you

21 give a page number?

22 MR. LOVEJOY: Page 30, figure 10. Does

23 this show the saturated thicknesses?

24 WITNESS TOBLIN: Yes.

25 MR. LOVEJOY: Okay, having in mind those

1 zones, would you take a look at page, I think it's 22.
2 And does 22 show, among other things, the presence of
3 the caprock caliche at or near the land surface?
4 WITNESS TOBLIN: Yes, in general, yes.
5 MR. LOVEJOY: Okay. Back on page 30
6 there's, for example, saturated thickness in Section
7 16, up in the north of this area, isn't there?
8 WITNESS TOBLIN: Yes.
9 MR. LOVEJOY: Over on page 22, there's no
10 caliche in Section 16, is there?
11 WITNESS TOBLIN: I believe there is, yes.
12 MR. LOVEJOY: There is?
13 WITNESS TOBLIN: Yes.
14 MR. LOVEJOY: And how do you infer that?
15 WITNESS TOBLIN: I see in the left quarter
16 of the section --
17 MR. LOVEJOY: Oh, I beg your pardon. I'm
18 misreading the number. Take a look at Section 18 on
19 figure 2.
20 WITNESS TOBLIN: Section -- which?
21 MR. LOVEJOY: Is there any caliche
22 represented there?
23 WITNESS TOBLIN: Section which? I'm
24 sorry.
25 MR. LOVEJOY: Eighteen.

1 WITNESS TOBLIN: Eighteen, okay. Yes.
2 MR. LOVEJOY: Yes, there is?
3 WITNESS TOBLIN: I'm sorry, what's the
4 question?
5 MR. LOVEJOY: Is there caliche?
6 WITNESS TOBLIN: Not indicated on this
7 map, no.
8 MR. LOVEJOY: And on figure 10, do we see
9 water in the subsurface?
10 WITNESS TOBLIN: Yes, there is.
11 MR. LOVEJOY: Okay. In Section 17, is
12 there any caliche?
13 WITNESS TOBLIN: No, there is not.
14 MR. LOVEJOY: And is there water in the
15 subsurface over on the east side of that?
16 WITNESS TOBLIN: A little bit, not much.
17 JUDGE ABRAMSON: I'm sorry, help me
18 understand what on figure 9 is advising you that there
19 is water. Where are you reading?
20 MR. LOVEJOY: I'm at page 30, figure 10.
21 JUDGE ABRAMSON: Thirty, figure 10.
22 MR. LOVEJOY: Showing saturated
23 thicknesses.
24 JUDGE ABRAMSON: I see. The solid line is
25 saturated thickness.

1 WITNESS TOBLIN: I call these isopacks.
2 They're attempts to show the thickness and the
3 presence of water bodies.
4 JUDGE ABRAMSON: I see, okay. Thank you.
5 MR. LOVEJOY: Now turning our attention
6 again to the Chinle, you -- and the questions that the
7 Board had about a possible path down to the aquifers
8 present in the Chinle, you say that the slug tests
9 showed that there was very little permeability in the
10 Chinle. And are you relying on in situ tests?
11 WITNESS TOBLIN: For that -- there was a
12 slug test at NEF that showed low permeability in that.
13 MR. LOVEJOY: So is that the basis for
14 your judgment about the permeability of the Chinle --
15 the in situ test?
16 WITNESS TOBLIN: Oh, no. There's 40 --
17 over 40 permeability tests done in the Chinle near to
18 the NEF.
19 MR. LOVEJOY: And are you talking about in
20 situ tests, or are you talking about lab tests?
21 WITNESS TOBLIN: Both, but most of them
22 are lab tests. But there are some in situ tests.
23 MR. LOVEJOY: Is it your view that a lab
24 test of permeability gives you a value as reliable as
25 an in situ test?

1 WITNESS TOBLIN: it depends on how it was
2 taken, but you know, in general, probably not.
3 MR. LOVEJOY: And when you take a core and
4 you test it in the labs you only get any fractures
5 that are right in the piece of core that you withdraw.
6 Is that true?
7 WITNESS TOBLIN: Right.
8 MR. LOVEJOY: So if there were fractures
9 to the left or to the right you just miss them?
10 WITNESS TOBLIN: Yes, if that were so.
11 MR. LOVEJOY: Now there's something you
12 said I wanted to ask about. On page 24 in answer 52,
13 you say the results of investigations near the
14 proposed NEF site indicate that it's unlikely that
15 there are fracture zones which lead to increased
16 vertical water transport.
17 This is based on the fact that any active
18 faulting in the immediate area occurred over 135
19 million years ago, and any resulting fractures would
20 have had time to close, as demonstrated in the stuffy
21 of the WCS site.
22 Are you saying that there's been no
23 fracturing of any rocks in the area for 135 million
24 years?
25 WITNESS TOBLIN: What I'm saying is that

1 there was a study done at the WCS site based on some
2 faults that were identified there. And that study
3 indicated that -- and it was a very detailed study.
4 They opened a wall in the chimney which
5 was 400 feet long and about 40 feet deep, and studied
6 the faults or fractures in the chimney and determined
7 that there was no fast flow paths due to the fractures
8 in the formation.
9 MR. LOVEJOY: And at that point, what was
10 the thickness of the alluvium?
11 WITNESS TOBLIN: On the order of 20 feet.
12 MR. LOVEJOY: And the excavation was 40
13 feet?
14 WITNESS TOBLIN: Actually it was 60. I
15 think it was 40 feet of Chinle I believe, if I recall
16 correctly.
17 JUDGE ABRAMSON: Was the Chinle largely
18 clay, all clay?
19 WITNESS TOBLIN: Yes, it's largely clay.
20 There are layers of silt stone, sandstone imbedded
21 within the Chinle, mostly clay layer, yes.
22 JUDGE ABRAMSON: So the kinds of fractures
23 we're talking about would be caused by what? We're
24 talking -- we're looking for fracture zones. What
25 would cause those fracture zones?

1 WITNESS TOBLIN: An earthquake.

2 MR. LOVEJOY: Are there other things other

3 than -- excuse me, were you --

4 WITNESS TOBLIN: Yes. I mean, yes. I

5 mean there -- yes.

6 JUDGE ABRAMSON: Earthquake was just an

7 example.

8 WITNESS TOBLIN: An example, yes.

9 JUDGE ABRAMSON: Drying out and cracking.

10 WITNESS TOBLIN: drying, stress

11 deformations, yes.

12 MR. LOVEJOY: And those are processed that

13 can occur or could have occurred at any time in the

14 past 135 million years. Is that true?

15 WITNESS TOBLIN: Those are processes that

16 did not occur at this location in the last 20, 35

17 million years, yes.

18 MR. LOVEJOY: And you say fractures would

19 have had time to close? How long does it take to

20 close?

21 WITNESS TOBLIN: It was demonstrated in

22 the -- I don't know the answer to how long it would

23 take to close, but it was demonstrated in the studies

24 that the fractures did, in fact, close in their study.

25 MR. LOVEJOY: Let me ask you where you got

1 the information that nothing occurred in the past 135
2 million years. Is there come carbon dating, or what
3 made us believe that was --
4 WITNESS TOBLIN: Yes.
5 MR. LOVEJOY: -- as opposed to ten million
6 years.
7 WITNESS TOBLIN: Based on the age of the
8 formations and when they were laid down, and there was
9 faulting in the Chinle, which is an old formation.
10 MR. LOVEJOY: So you had some geological
11 information that was given to you?
12 WITNESS TOBLIN: Yes.
13 MR. LOVEJOY: You're not a geological
14 expert?
15 WITNESS TOBLIN: No.
16 MR. LOVEJOY: Well, I'm just trying to get
17 a handle on how we know it's 135 million instead of
18 ten. Did you look at the logs for the company in the
19 Holt report?
20 WITNESS TOBLIN: Yes.
21 MR. LOVEJOY: You did? Did you notice
22 that Mr. Holt and his associates found fractures in
23 the wells that they dug, that they bored?
24 WITNESS TOBLIN: They noted some fractures
25 on the logs, yes.

1 MR. LOVEJOY: Can you tell from the
2 reports that these were closed fractures and that --
3 when it doesn't specifically say closed?
4 WITNESS TOBLIN: What I could tell from
5 the report is that the borings were dry.
6 MR. LOVEJOY: So you couldn't tell if the
7 fracture was closed or not?
8 WITNESS TOBLIN: Other than all the
9 supporting evidence of all the permeability
10 measurements, and the studies, and the dryness -- I
11 would expect that they were closed.
12 MR. LOVEJOY: Can we bore in on this for
13 a second? I think we may be dealing with lawyers and
14 technical people speaking different languages. You
15 said, I'm quoting from answer 52, any resulting
16 fractures would have had time to close.
17 Did you mean by that that every resulting
18 fracture would have closed, or just that --
19 WITNESS TOBLIN: Those that occurred over
20 -- under 35 million years ago.
21 MR. LOVEJOY: Everything that occurred 135
22 million years ago would have closed?
23 WITNESS TOBLIN: No. There might --
24 MR. LOVEJOY: Even if it was one of
25 these --

1 WITNESS TOBLIN: Slickenside?

2 MR. LOVEJOY: -- or what we call block

3 fractures in the --

4 WITNESS TOBLIN: I mean, you know, there

5 may be fractures that are not connected that haven't

6 closed, but for the most part, they've closed so that

7 you don't have interconnected pathways.

8 JUDGE ABRAMSON: Could we have lots of

9 little fractures? Could we have something that looked

10 like a bunch of clay blocks that slipped on each

11 other?

12 WITNESS TOBLIN: Yes, sure.

13 JUDGE ABRAMSON: -- and are still sitting

14 there but they've got hairline gaps between them, and

15 they're not -- that it's now fractured into clay

16 blocks but they're -- so we have fractures, but --

17 WITNESS TOBLIN: We have fractures but

18 they're not contributing to flow paths.

19 JUDGE ABRAMSON: Okay, so when you said

20 any resulting fractures would have had time to close,

21 did you mean there won't be any fractures, or did you

22 --

23 WITNESS TOBLIN: No, no, no.

24 JUDGE ABRAMSON: -- mean there won't be

25 any big fractures that would let flow? I don't know.

1 WITNESS TOBLIN: That -- yes.

2 JUDGE ABRAMSON: I'm not trying to put

3 words in your mouth but --

4 WITNESS TOBLIN: No, no that's the latter.

5 No, this is all in relation to fast flow paths. There

6 would not be any fractures that would be open to fast

7 flow.

8 JUDGE ABRAMSON: The difference between

9 lawyers and engineers again. I'm sorry, Counsel.

10 Carry on.

11 MR. LOVEJOY: Well, you couldn't tell

12 whether there were fractures that were interconnected

13 from Mr. Holt's bore hole reports, could you?

14 WITNESS TOBLIN: No.

15 JUDGE ABRAMSON: Could you tell from the

16 bore hole reports, or boring logs whether the

17 fractures had gaps so that water could get through, or

18 could you not tell that either?

19 WITNESS TOBLIN: I mean, again, if you saw

20 moisture at those locations or, you know, water, then

21 you'd know that.

22 MR. LOVEJOY: There's something getting

23 in.

24 WITNESS TOBLIN: Yes, then something would

25 be getting in.

1 MR. LOVEJOY: If there was a report of
2 secondary mineralization, that would indicate flow of
3 water, wouldn't it?
4 WITNESS TOBLIN: That would indicate flow
5 of water at sometime in the past that perhaps left
6 behind the mineralization which in turn closes the
7 fractures.
8 MR. LOVEJOY: Does mineralization always
9 close a fracture?
10 WITNESS TOBLIN: If there's enough of it,
11 yes.
12 MR. LOVEJOY: And if there's not enough of
13 it, it doesn't, right?
14 WITNESS TOBLIN: That's true.
15 JUDGE KELBER: Let me ask, I think it's
16 question 52, centers -- does it center around the
17 events that happened roughly 135 million years ago
18 when there may have been a major upheaval in the
19 antlers?
20 WITNESS TOBLIN: Yes.
21 JUDGE KELBER: And at that time there may
22 have been a major fracture in the Chinle. Is that
23 correct?
24 WITNESS TOBLIN: That's correct.
25 JUDGE KELBER: And what you're saying --

1 is what you're saying that the plastic properties of
2 clay, and the stress on the clay due to gravity, would
3 cause over that period of time such fractures to
4 close?
5 WITNESS TOBLIN: Among -- yes. That would
6 be among the mechanisms.
7 JUDGE ABRAMSON: They key being, Dr.
8 Kelber, these would be major fractures that resulted
9 from --
10 JUDGE KELBER: It says stress, strain,
11 plastic deformation. It's a standard problem. Just
12 happens slowly.
13 MR. LOVEJOY: May I?
14 JUDGE ABRAMSON: Please.
15 MR. LOVEJOY: Mr. Toblin, look just once,
16 please, at one of Mr. Holt's reports. The boring --
17 well log for B-18.
18 WITNESS TOBLIN: Could you tell me again
19 what exhibit we're at?
20 MR. LOVEJOY: The Exhibit is LES Exhibit
21 3, tab G, grid number 8-D. I'll tell you what it
22 says. Slightly silty clay, heavily modeled, dusky,
23 red, maroon, purple, yellow, and gray. Hard blocky
24 fracture, dry with occasional zones of dense moist
25 clay.

1 Would that indicate moisture associated
2 with fractures, Mr. Toblin?
3 WITNESS TOBLIN: Perhaps. In that
4 location, again, moist rather than water and
5 saturated, so I would hazard a guess that based on
6 that being moist, that was probably in the matrix.
7 MR. LOVEJOY: In the what?
8 WITNESS TOBLIN: The soil matrix.
9 JUDGE ABRAMSON: You're on B-18. Is that
10 correct, Counsel?
11 MR. LOVEJOY: I'm on B-18.
12 JUDGE ABRAMSON: At what depth?
13 MR. LOVEJOY: Forty-five to 71 feet.
14 JUDGE ABRAMSON: Thank you.
15 MR. LOVEJOY: Let me ask you just about
16 one other subject. We went into it some this morning,
17 and this is the monitoring of storm water. But we're
18 on groundwater so let's talk about that.
19 There are certainly going to be
20 contaminants like PAHs, alcohols, aliphatic
21 hydrocarbons occurring near roadways, and other
22 industrial elements in this proposed plan.
23 And you said that I think monitoring of
24 chemical oxygen demand, and biological -- BOD would
25 detect the presence of any of these contaminants. Is

1 that so?

2 WITNESS TOBLIN: BOD and COD are -- will

3 generally detect the presence of organics. They wont

4 detect PAHs per say.

5 MR. LOVEJOY: They don't detect any

6 particular constituents?

7 WITNESS TOBLIN: Right, they're indicators

8 of the presence of organics.

9 MR. LOVEJOY: And there are certainly

10 organic hazardous constituents whose detection limits

11 would not be satisfied by the testing for BOD and COD

12 that is the plan for this site, true?

13 WITNESS TOBLIN: I'm sorry?

14 MR. LOVEJOY: There are certain -- well,

15 my expert advisor gives me the example of benzoate

16 pyrine. And let me just ask you, would the detection

17 limits for that constituent be satisfied by the

18 testing for BOD and COD that's proposed at two parts

19 per million and one part per million --

20 WITNESS TOBLIN: That's doesn't make

21 sense. You're asking if the detection limits for

22 benzoate pyrine --

23 MR. LOVEJOY: Rather the health based --

24 I'm sorry, I'm talking about apples and oranges and

25 probably shouldn't be. The sampling for BOD and COD

1 are specified at limits of two parts per million and
2 one part per million in the table of the environment
3 impact statement that we looked at this morning. Do
4 you remember that?
5 WITNESS TOBLIN: Yes.
6 MR. LOVEJOY: Now a health based standard
7 for the constituent and the example that I was given
8 and I was giving you was benzoate pyrine, with a
9 health based standard of something like 0.0007 parts
10 per million.
11 WITNESS TOBLIN: Okay.
12 MR. LOVEJOY: Now would that standard be
13 identified, something at that minimum level, by the
14 BOD and COD monitoring that's proposed?
15 WITNESS TOBLIN: Well, you know, that
16 standard is not applicable in the -- I assume we're
17 talking about the storm water detention basin here.
18 I'll make that leap of faith. That's one location.
19 And also groundwater.
20 JUDGE ABRAMSON: Counsel, would you please
21 relate the question to what's at issue here which is
22 whether they've taken a hard look? We talked earlier
23 about monitoring standards and how it relates to hard
24 look.
25 You've heard their side. I don't want to

1 belabor this, but I understand your question about
2 monitoring and your concern about monitoring.
3 WITNESS TOBLIN: Yes.
4 JUDGE ABRAMSON: Can we just make the
5 point and move on?
6 WITNESS TOBLIN: Well, it really is this,
7 that there are constituents, hazardous constituents
8 that are not to be identified by the monitoring that's
9 proposed.
10 JUDGE ABRAMSON: Okay. And we think we
11 understand that. Is there a need to belabor this?
12 WITNESS TOBLIN: No, there's no need.
13 MR. LOVEJOY: Thank you, that's all I
14 have.
15 CHAIR BOLLWERK: All right. At this
16 point, is there any redirect?
17 MS. CLARK: Could I request maybe a ten
18 minute break?
19 CHAIR BOLLWERK: I'm sorry?
20 MS. CLARK: Could I request a ten minute
21 break before I --
22 CHAIR BOLLWERK: Okay.
23 MS. CLARK: -- redirect.
24 JUDGE ABRAMSON: Let's make it five. The
25 question is it's not ten minutes of five. The

1 question is, what are we going to do next? Are we
2 going to try to put on Dr. Rice, and are you going to
3 stay around for awhile and help us out?
4 Are you going to be available tomorrow if
5 we have to rollover into tomorrow?
6 MR. RICE: Either way.
7 CHAIR BOLLWERK: And then one of the
8 questions I'll be looking to the both of you is what
9 is your schedule for tomorrow? Will we be done with
10 Dr. Rice by noon if we stop now, or should we go --
11 I'd like to have him done by midday tomorrow, by the
12 lunch break.
13 MR. CURTISS: From our perspective, Mr.
14 Chairman, I think in view of the very thorough
15 presentation this morning that our cross examination
16 of Mr. Rice can be completed in about 30 minutes.
17 We want to allow time for the Board to ask
18 questions, and --
19 JUDGE ABRAMSON: Mine might not be done in
20 30 minutes.
21 MR. CURTISS: Well, if your cross
22 examination exceeds ours, you're welcome to do that,
23 but --
24 JUDGE ABRAMSON: I don't mean cross, but
25 my questions --

1 MR. CURTISS: I think from our perspective
2 we would like to proceed while there's some continuity
3 here on these issues --
4 JUDGE ABRAMSON: All right.
5 MR. CURTISS: And if the Board's willing
6 --
7 JUDGE ABRAMSON: That might be Mr. Rice's
8 benefit too, because I understand there was something
9 you wanted to do tomorrow if that were possible. I
10 don't know if that's still the case, but --
11 MR. RICE: No, either way would be okay
12 with me.
13 JUDGE ABRAMSON: Well, let's give the
14 Staff then five minutes to talk with their witness and
15 then we'll come back.
16 (Whereupon, the above-entitled matter
17 went off the record at 4:50 p.m. and
18 went back on the record at 5:00 p.m.)
19 CHAIR BOLLWERK: All right, let's go ahead
20 and come to order. And we will go back on the record.
21 And I guess the question for the Staff is, do you have
22 any redirect?
23 MS. CLARK: Yes, thank you.
24 EXAMINATION BY MS. CLARK OF
25 ALAN TOBLIN

1 MS. CLARK: Mr. Toblin, I would like to
2 direct you back to NIRS exhibit 10, which is the Hope
3 model for the EPA hydrologic evaluation of landfill
4 performance.
5 And I would like to direct you to page 34.
6 Now, I believe earlier Mr. Lovejoy questioned you
7 about the information on that page. At this point I
8 would like --
9 JUDGE ABRAMSON: Speak up, please.
10 MS. CLARK: I'm sorry.
11 JUDGE ABRAMSON: Both of you.
12 WITNESS TOBLIN: Okay, yes.
13 MS. CLARK: At this point I would like to
14 direct you to the first full paragraph on that page.
15 And if you would, could you please read the first
16 sentence?
17 WITNESS TOBLIN: The density of pin holes
18 and installation defects is a subject of speculation.
19 MS. CLARK: Moving down to the second
20 paragraph, line 4, beginning with the words the
21 density, would you please read that?
22 WITNESS TOBLIN: The density of
23 installation defects is a function of the quality of
24 installation, testing, materials, surface preparation,
25 equipment, and QA/QC programs.

1 MS. CLARK: Given, I believe you
2 testified, as I recall, that the final design has not
3 yet been made for these lined basins, is that
4 correct??
5 WITNESS TOBLIN: Yes, that is correct.
6 MS. CLARK: Given that fact would you be
7 able to know the materials that would be used for
8 this?
9 WITNESS TOBLIN: No, I don't.
10 JUDGE ABRAMSON: Your answer was no?
11 WITNESS TOBLIN: No, that is correct.
12 MS. CLARK: And, finally, I would like you
13 to please read the last sentence of that paragraph.
14 WITNESS TOBLIN: The estimates are based
15 on limited data, but are characteristic of the
16 recommendations provided in the literature.
17 MS. CLARK: Thank you. Now I would like
18 to direct your attention to LES exhibit 72. Would you
19 please identify this exhibit?
20 WITNESS TOBLIN: Detection and -- it is a
21 paper, detection and location of leaks in geomembrane
22 liners using an electrical method case histories by
23 Laine & Miklas.
24 MS. CLARK: Now, earlier, when Mr. Lovejoy
25 was asking you about this document, I believe he asked

1 you whether you looked at any of the evidence which it
2 was premised on and you answered that you had not, is
3 that correct?
4 WITNESS TOBLIN: Something like that, yes.
5 MS. CLARK: I would like to direct you to
6 page 36. Under the caption where it says types of
7 facilities and materials surveyed --
8 WITNESS TOBLIN: All right.
9 MS. CLARK: Mr. Toblin, does that tell you
10 what types of facilities were used in the surveys?
11 WITNESS TOBLIN: Yes, it does.
12 MS. CLARK: Does it tell you what types of
13 materials were in those?
14 WITNESS TOBLIN: The following paragraph
15 does, yes.
16 MS. CLARK: Does it tell you how many
17 sites were surveyed? And I can direct you to the --
18 WITNESS TOBLIN: Well, the number of sites
19 surveyed is on the table on the next page, yes.
20 MS. CLARK: And does it give all the
21 results of those surveys?
22 WITNESS TOBLIN: Yes.
23 MS. CLARK: Thank you. Now I would like
24 to direct your attention to page 39. Under the
25 caption which is entitled Leaks Associated with

1 Material Types, could you please read the sentence
2 under that caption?
3 WITNESS TOBLIN: Because of the limited
4 use of materials other than HDPE, in the facilities
5 tested by the Southwest Research Institute electrical
6 method, it is not possible to formulate any valid
7 conclusions on the relationship of material type to
8 numbers and types of leaks.
9 MS. CLARK: And now I'd like to direct
10 your attention to the next caption entitled leaks
11 beneath soil covers and sludge. And would you please
12 read the last sentence of that paragraph?
13 WITNESS TOBLIN: No significant numerical
14 relationships between leaks, leak occurrence, and
15 types of leaks can be developed on leaks discovered
16 beneath soil covers because of the limited field
17 testing experience in such environments.
18 MS. CLARK: Thank you. At another part of
19 Mr. Lovejoy's questioning, he asked you whether you
20 believed that lab tests were as reliable as field
21 tests.
22 And I believe you said you thought that
23 field tests were more reliable than lab tests?
24 WITNESS TOBLIN: That is correct.
25 MS. CLARK: Does that mean that lab tests

1 are not reliable?

2 WITNESS TOBLIN: I think lab tests are

3 reliable, not as reliable as field tests but give

4 reasonable results that one can base decisions on.

5 MS. CLARK: Later on in his questioning he

6 directed you to LES exhibit 3, tab G. And I know he

7 directed your attention to one of the bore hole logs.

8 I don't recall which one, but I believe that it showed

9 that there was moisture and a fracture in one area of

10 the bore hole?

11 WITNESS TOBLIN: Correct.

12 MS. CLARK: Now, can I ask you, does that

13 necessarily mean that the fact that there is a

14 fracture and moisture, that that fracture is acting as

15 a fast flow path?

16 WITNESS TOBLIN: No, it doesn't mean that

17 at all. The -- it was moist, it was noted as being

18 moist, as opposed to being saturated. So you wouldn't

19 be expecting flow in any case. And, no, that doesn't

20 indicate fast flow.

21 MS. CLARK: Could it just mean that the

22 clay in the area of this fracture happened to be moist

23 for other reasons?

24 WITNESS TOBLIN: Yes, I mean, the clay was

25 moist. Yes, the clay could have been moist.

1 MS. CLARK: Thank you, that is all I have.

2 CHAIR BOLLWERK: All right, Mr. Lovejoy,

3 any further questions?

4 MR. LOVEJOY: No.

5 CHAIR BOLLWERK: Thank you. All right,

6 then sir I believe we are done with your testimony at

7 this point, we thank you for your appearance and your

8 service to the Board.

9 WITNESS TOBLIN: You are welcome.

10 (Witness is excused.)

11 CHAIR BOLLWERK: I believe we are ready

12 for the NIRS/PC witness, Mr. Rice.

13 MR. LOVEJOY: We call George Rice. And,

14 if I may, if the NIRS/PC exhibits are up there, it

15 would be best to leave them there.

16 CHAIR BOLLWERK: Let's take care of one

17 piece of business here. I believe we have one

18 exhibit NIRS/PC 10 that was identified with respect to

19 Mr. Toblin?

20 MR. LOVEJOY: Yes.

21 CHAIR BOLLWERK: Let me just check and see

22 if there is any objections. I believe we have the

23 number of copies we need. So are there any objections

24 to the admission of NIRS/PC 10?

25 (No response.)

1 CHAIR BOLLWERK: Anything from any one?
2 MS. CLARK: No objection.
3 MR. REPKA: None.
4 CHAIR BOLLWERK: Let the record reflect
5 exhibit NIRS/PC 10 has been admitted into evidence.
6 (The document referred to,
7 having been previously marked
8 for identification as NIRS/PC
9 Exhibit No. 10 was admitted in
10 evidence.)
11 MR. LOVEJOY: Your Honor, as I think we
12 may have said before, pursuant to the orders of the
13 Board we revised the rebuttal testimony, and we have
14 copies of that here for everyone, and for the witness.
15 And we have the two copies called for of
16 the direct testimony.
17 CHAIR BOLLWERK: All right.
18 MR. LOVEJOY: When we revised the rebuttal
19 testimony we didn't change the numbers of the
20 questions and answers, the renumbering was getting
21 complicated.
22 CHAIR BOLLWERK: That is fine.
23 MR. LOVEJOY: We also, we have a new
24 exhibit list, which is the same, except that there are
25 two exhibits removed. I didn't make certificates of

1 service with this new material, because I'm not
2 mailing it.
3 CHAIR BOLLWERK: That is fine. As long as
4 everyone has a copy then we are in good shape.
5 JUDGE ABRAMSON: Do you have copies for
6 the other two parties?
7 MR. LOVEJOY: We do.
8 CHAIR BOLLWERK: And perhaps, to make it
9 a little bit easier, if Mr. Lovejoy could identify the
10 two exhibits removed, if this is not possible --
11 MR. LOVEJOY: They are identifiable from
12 the fact that the numbers skip.
13 CHAIR BOLLWERK: Okay, that is fine.
14 MR. LOVEJOY: Did you want to swear the
15 witness?
16 CHAIR BOLLWERK: I will do that. Anything
17 else with respect to the exhibits, we are all set, I
18 take it?
19 MR. LOVEJOY: I think we are set.
20 Whereupon,
21 GEORGE RICE,
22 was called as a witness by Counsel for NIRS/PC and,
23 having been duly sworn, assumed the witness stand, was
24 examined and testified as follows.
25 MR. LOVEJOY: Would you state your name,

1 please?

2 WITNESS RICE: George Rice.

3 MR. LOVEJOY: And do you have, in front of

4 you, two copies of your direct testimony, and two

5 copies of your rebuttal testimony?

6 WITNESS RICE: Yes.

7 MR. LOVEJOY: Do you have any changes to

8 make in either of those papers?

9 WITNESS RICE: Yes, in the direct

10 testimony. Several places on the direct testimony I

11 referred to the deposition of Mr. Harper and Mr.

12 Peery. And when I referred to that deposition I used

13 page numbers from the electronic copy.

14 However, the page numbers of the

15 electronic copy are different from the page numbers of

16 the paper copy. So I think that should be noted.

17 MR. LOVEJOY: Okay, thank you. With that

18 correction do these documents both represent to your

19 own sworn testimony?

20 WITNESS RICE: Yes.

21 MR. LOVEJOY: Thank you.

22 CHAIR BOLLWERK: Do we need to be any more

23 specific about what the page number changes, or is

24 that clear to everyone?

25 MR. LOVEJOY: Well, do you have a record

1 of the page numbers, or are you simply stating --

2 WITNESS RICE: I have prepared a corrected

3 copy that reflects the page numbers of the hard copy.

4 But that was done just a couple of days ago, and it

5 hasn't been given to anyone.

6 JUDGE ABRAMSON: Perhaps we can get an

7 update at your convenience to all the parties. And we

8 can just use it. In fact, if you want to do that,

9 just on page X of the direct I referred to, or in

10 question or answer X I referred to page such and such,

11 which is of the electronic, and it should be page, it

12 is also page Y of the hard copy. A little table that

13 everybody can see.

14 CHAIR BOLLWERK: Are there a lot of these?

15 WITNESS RICE: Maybe 10.

16 CHAIR BOLLWERK: The only concern I have

17 is when we bind this into the record it is not going

18 to reflect those changes unless we --

19 JUDGE ABRAMSON: Do you want to put in a

20 corrected copy?

21 CHAIR BOLLWERK: But the corrected copy is

22 going to be out of sync with the rest of the

23 transcript. We can't go back and -- I mean, they are

24 going to do overnight transcripts, so that is not

25 going -- what I'm saying is, that if we haven't got it

1 now, it is not going to be in the one that you see
2 tomorrow morning, and it isn't going to be -- unless
3 it will be a separate sheet of paper floating around
4 some place, I can live with that, if you all can.
5 MR. REPKA: That is acceptable to us.
6 CHAIR BOLLWERK: All right. Because in a
7 sense we are talking about a transcript correction,
8 which the Office of the Secretary makes, and writes on
9 things, and we don't want to go there.
10 All right, then you will provide us with
11 a list?
12 MR. LOVEJOY: I think we can make a list,
13 we can probably even get it in an electronic copy.
14 CHAIR BOLLWERK: And we should have that
15 how soon?
16 MR. LOVEJOY: Tomorrow?
17 CHAIR BOLLWERK: That will work, all
18 right. Okay, and that was the only correction, I take
19 it, right?
20 WITNESS RICE: Yes, sir.
21 JUDGE ABRAMSON: Are we ready, then, to go
22 ahead and admit it?
23 MR. LOVEJOY: I think we are proposing to
24 admit the direct written testimony.
25 CHAIR BOLLWERK: Then any objections, from

1 any of the parties?

2 MR. REPKA: No.

3 MS. CLARK: No objection.

4 CHAIR BOLLWERK: All right, then the

5 record should reflect that the direct testimony of

6 George Rice on behalf of NIRS/PC, on NIRS Contention

7 EC-1, as revised January 28th, 2005, as well as the

8 rebuttal testimony of George Rice, on behalf of

9 NIRS/PC on Contention EC-1, revised February 7th,

10 2005, should be placed and adopted into the record as

11 if read.

12 (Whereupon, the pre-filed direct and

13 rebuttal testimony of Mr. George Rice was inserted

14 into the record as if having been read.)

January 28, 2005

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	Docket No. 70-3103
Louisiana Energy Services, L.P. National Enrichment Facility	ASLBP No. 04-826-01-ML

DIRECT TESTIMONY OF GEORGE RICE ON BEHALF OF NUCLEAR INFORMATION AND RESOURCE SERVICE AND PUBLIC CITIZEN NIRS/PC CONTENTION EC-1 REVISED JAN. 28, 2005

Q1: Please state your name and address.

A1. George Rice; 414 East French, San Antonio, Texas

Q2: What is your profession and educational background?

A2. I am a groundwater hydrologist; I have an MS from the University of Arizona. My resume has been filed in this case as an attachment to the Petition filed on April 6, 2004, and a copy is attached to this testimony.

Q3. What topics will be addressed in your testimony?

A3. I will discuss the questions of the environmental impacts of the proposed National Enrichment Facility (the "NEF") upon groundwater resources in the area. I am testifying in support of contention NIRS/PC EC-1, which states as follows:

NIRS/PC EC-1 -- IMPACTS UPON GROUND AND SURFACE WATER

CONTENTION: Petitioners contend that the Environmental Report contained in the application does not contain a complete or adequate assessment of the potential environmental impacts of the proposed project on ground and surface water, contrary to the requirements of 10 C.F.R. 51.45.

The Draft Environmental Impact Statement, NUREG-1790 (September 2004) ("DEIS") likewise does not contain a complete or adequate assessment of the potential environmental impacts of the proposed project on ground and surface water, contrary to the requirements of 10 C.F.R. Part 51 in that:

(A) The DEIS correctly notes that leakage from the stormwater detention basin and the septic leach fields will probably cause formation of perched bodies of groundwater at the alluvium/Chinle interface. (DEIS, 4-13, 4-14). The DEIS contains estimates of the dimensions of such water bodies, flow rates, and discharge areas. However, NRC provides no explanation of such calculations, and it is not possible to determine whether they are reasonable.

(B) The DEIS does not contain an estimate of the probability and frequency of leakage through the liners of the treated effluent basin or the stormwater detention basin. The basins are to be lined with geosynthetic materials (DEIS at 4-11, 4-12), such liners are known to leak (EPA, Hydrologic Evaluation of Landfill Performance (HELP) Model, User's Guide for Version 3, EPA/600/R-94/168a, Sept. 1994), and such information is necessary to demonstrate the impact of such leakage. The DEIS should contain an estimate of the leakage rate and should show the fate of water and contaminants that leak from the basins.

(C) According to the DEIS, "... no precipitation recharge (i.e., rainfall seeping deeply into the ground) occurs in thick, desert vadose zones with desert vegetation (Walvoord et al., 2002)" (DEIS at 3-35). However, cuttings from one of the borings drilled in September 2003 were "slightly moist" (ER Rev. 2 at 3.4-2). In addition, the clay at the bottom of boring B-2 was "moist" (SAR at Fig. 3.2-11). The DEIS should explain the presence of this moisture, which conflicts with its statements about lack of recharge.

(D) The DEIS states: "Although the presence of fracture zones that can significantly increase vertical water transport through the Chinle Formation has not been precluded, the low measured permeabilities indicate the absence of such zones." (DEIS at 3-35). Two permeability measurements have been made on the Chinle Formation at or near the site: laboratory measurement of core samples (ER Rev. 2 Table 3.3-2) and a slug test performed in MW-2 (Cook-Joyce, Hydrogeologic Investigation, Sec. 32, T. 21 R. 38, Nov. 19, 2003). Such extremely limited measurements, where faults are present, cannot describe the permeability of the entire site, and NRC should explain its reliance on such restricted data.

(E) The stormwater basin will discharge runoff containing numerous contaminants, which are not adequately identified in the DEIS, nor is their monitoring explained. LES has stated that the runoff will contain small amounts of oil and grease typically found in runoff from paved roadways and parking areas (RAI Response, May 20, 2004, at 33). However, other contaminants may be present, such as PAHs (USGS, Concentrations of PAHs and Major and Trace Elements in Simulated Rainfall Runoff from parking lots, 2003, Open File

Report 2004-1208), other organics such as aliphatic hydrocarbons and alcohols (Barrett, M.E, et al., Review and Evaluation of Literature Pertaining to the Quality and Control of Pollution from Highway Runoff and Construction, Tech. Report CRWR 239, April 1993), and other contaminants from spills and accidents. Their presence should be disclosed. Further, stormwater should be monitored for such contaminants.

Q4. Please summarize your conclusions.

A4. I conclude that the Draft Environmental Impact Statement (DEIS) (NIRS/PC Exhibit 41) and the Environmental Reports for the proposed National Enrichment Facility (NEF) are deficient. The Nuclear Regulatory Commission (NRC) and Louisiana Energy Services (LES) have not performed investigations necessary to properly characterize existing groundwater conditions. Nor have they performed investigations necessary to determine how the proposed facility will affect groundwater in the future.

Q5. What are your conclusions based on?

A5. My conclusions are primarily based upon a review of documents related to the proposed site, including reports produced by LES, and NRC's Draft Environmental Impact Statement (NIRS/PC Exhibit 41).

Q6. Briefly state how the proposed facility may affect groundwater.

A6. The NEF will generate wastewaters (treated effluent from the plant operations and sewage) and stormwater runoff. LES intends to discharge plant effluents and runoff to evaporation basins on the plant. Sewage will be discharged to a septic leach field. Leakage from the basins and sewage effluent may enter local groundwater systems.

Q7. Please describe the proposed site.

A7. The proposed National Enrichment Facility (NEF) site is in Lea County, southeastern New Mexico. It is approximately 20 miles south of Hobbs and one half mile from the Texas border[1].

[1] NRC, 2004a, page xix (NIRS/PC Exhibit 41).

The proposed site is less than a mile west of the Waste Control Specialists (WCS) site[2]. The WCS site is licensed to dispose RCRA hazardous wastes and has submitted an application to dispose low-level nuclear wastes[3].

The site is underlain by about 20 to 60 feet of soil, dune sand, and alluvium[4]. The alluvium is underlain by the Dockum Group. The Dockum Group is composed of two subunits: the Chinle Formation and the Santa Rosa Aquifer. The Chinle immediately underlies the alluvium[5]. The Santa Rosa is about 1100 feet below land surface[6].

Groundwater has not been found in the alluvium at the proposed site. However, groundwater is known to exist in the alluvium at three places near the site: 1) about ½ mile north at the Wallach sand and gravel quarry[7], 2) about ½ mile northeast at Baker Spring[8], and 3) about 2/3 mile east at the WCS site[9].

At the proposed site, water exists in the Chinle at a depth of about 220 feet[10]. Near the site, water has also been reported in a 100 foot-thick sandstone layer at a depth of about 600 feet[11]. Water also exists in the Santa Rosa Aquifer[12].

A schematic geologic cross-section is shown in NIRS/PC Exhibit 39.

Q8: What is known about groundwater use in the area of the NEF site?

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[2] Cook-Joyce Inc., 2003a, figure 5(NIRS/PC Exhibit 4).
[3] NRC, 2004a, page 2-32 (NIRS/PC Exhibit 41).
[4] NRC, 2004a, table 3-8 (NIRS/PC Exhibit 41); and Cook-Joyce Inc., 2003a, table 1 (NIRS/PC Exhibit 4). Alluvium is stream deposited clay, silt, sand, and gravel.
[5] NRC, 2004a, table 3-8 (NIRS/PC Exhibit 41).
[6] NRC, 2004a, page 3-36 (NIRS/PC Exhibit 41).
[7] Louisiana Energy Services, 2003a, page 3.4-2; Louisiana Energy Services, 2003c.
[8] Louisiana Energy Services, 2003a, pages 3.4-2 and 3.4-3; Louisiana Energy Services, 2003c.
[9] Louisiana Energy Services, 2003a, pages 3.4-3 and 3.4-4; Louisiana Energy Services, 2003c.
[10] NRC, 2004a, page 3-35 (NIRS/PC Exhibit 41).
[11] Louisiana Energy Services, 2004a, page 3.4-5; and NRC, 2004a, page 3-36 (NIRS/PC Exhibit 41). Neither document specifies the location of any wells that encountered this water bearing unit.
[12] NRC, 2004a, page 3-36 (NIRS/PC Exhibit 41).

A8. There are no downgradient groundwater users within two miles of the proposed site[13]. However, groundwater in the alluvium and the Dockum Group (Chinle Formation or the Santa Rosa Aquifer) has been used in the vicinity of the site[14].

Alluvial wells approximately three miles west of the proposed site have been used for domestic purposes[15]. The City of Eunice had an old public supply well in the Dockum. This well was about six miles west of the site[16]. The town of Oil Center, about 12 miles northwest of the site, obtains water from the Dockum Group[17]. According to the Lea County Water Plan, deeper aquifers such as the Dockum Group may be developed for future water supplies[18].

Q9. Why is it necessary to characterize existing groundwater conditions?

A9. Existing conditions must be characterized in order to predict how the proposed facility will affect groundwater in the future. In my opinion, LES and the NRC Staff have failed to characterize the site sufficiently to predict such impacts.

Q10. What have LES and NRC failed to do?

A10. Regarding existing conditions, LES and NRC have failed to perform several investigations. They have failed to:

1. Measure the hydraulic properties of the shallow materials underlying the site.
2. Explain the presence of moisture found in the shallow alluvium underlying the site. This moisture is probably an indication of recent recharge.
3. Investigate water-bearing units that may exist beneath the site.

[13] NRC, 2004a, page 4-13 (NIRS/PC Exhibit 41).
[14] The Santa Rosa Aquifer is used as a source of domestic and livestock water (Leedshill-Herkenhoff et al., 2000, page 6-12) (NIRS/PC Exhibit 24).
[15] Nicholson and Clebsch, 1961, page 80 and plate 2 (NIRS/PC Exhibit 37).
[16] Nicholson and Clebsch, 1961, page 80 and plate 2 (NIRS/PC Exhibit 37).
[17] Leedshill-Herkenhoff, 2000, page 6-12 (NIRS/PC Exhibit 24), and Nicholson and Clebsch, 1961, page 69 and plate 2 (NIRS/PC Exhibit 37).
[18] The plan recommends investigating areas where faulting may have fractured these aquifers (Leedshill-Herkenhoff, 2000, page 8-5) (NIRS/PC Exhibit 24).

4. Investigate the possibility that fractures may exist at the proposed site. Fractures may act as preferential flow paths.

Q11: What hydraulic properties should be measured in the shallow materials?

A11. LES and NRC have not performed any tests to determine the hydraulic properties of the alluvium or other shallow materials underlying the site[19]. At a minimum, the range of hydraulic conductivities should be determined. Hydraulic conductivities are required to estimate the flow rates of water that will leak from the proposed facility. Hydraulic conductivities could be measured by a number of techniques, including infiltrometer tests[20], and the reverse auger method[21].

Q12: What is the significance of the moisture found in the alluvium?

A12. LES and NRC claim that no groundwater recharge occurs at the proposed site[22]. In addition, LES appears to claim that no recharge has occurred for thousands of years[23], and that no recharge will occur after the facility is built[24]. However, moisture has been found in cuttings from two borings drilled at the site. This moisture was in the unsaturated (vadose) zone. At boring B-9, sand, silt, and gravel from depths of 6 – 14 feet were described as "slightly moist"[25]. At boring B-2, the clay at the alluvial/Chinle contact was described as "moist"[26].

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[19] Harper and Peery, 2004a, page 54 (NIRS/PC Exhibit 17); and Louisiana Energy Services, 2004e, page 9.
[20] Hillel, D., 1971, pages 131 – 133 (NIRS/PC Exhibit 18).
[21] Bouwer, 1978, page 129 (NIRS/PC Exhibit 3).
[22] Louisiana Energy Services, 2004a, page 3.4-4; NRC, 2004a, page 3-35 (NIRS/PC Exhibit 41); and Harper and Peery, 2004a, page 35 (NIRS/PC Exhibit 17). This claim is based in part on a paper by Walvoord (Walvoord et al., 2002 (NIRS/PC Exhibit 48); NRC, 2004a, page 3-35 (NIRS/PC Exhibit 41); and Louisiana Energy Services, 2004a, page 3.4-4).
[23] Recharge being defined as the infiltration of water beneath the base of the root zone (Louisiana Energy Services, 2004a, page 3.4-4).
[24] Harper and Peery, 2004a, pages 35 – 37 (NIRS/PC Exhibit 17); and Louisiana Energy Services, 2004e, pages 3 - 5.
[25] Louisiana Energy Services, 2004a, page 3.4-2; and Cook-Joyce Inc., 2003a, appendix A (NIRS/PC Exhibit 4).
[26] Louisiana Energy Services, 2003b, figure 3.2-11 (note, this figure is not included in the latest version of the Safety Analysis report, Louisiana Energy Services, 2004f). Moist clay at depth of about 35 feet. Note, there are two borings designated as B-2 at the site. The boring B-2 referred to here is the one drilled on September 9, 2003.

The only explanation LES and NRC have offered for the existence of this moisture is the following: *LES judged this moisture to be from water trapped in the vadose zone.*[27] This statement is vague. LES does not explain how the water came to be trapped, how long it has been trapped, or whether the moisture will dissipate (i.e., will it flow in response to hydraulic gradients?).

The most straightforward explanation for the presence of this moisture is that it represents residual water from episodic recharge events. That is, from time to time, rainwater or snowmelt will flow downward from the land surface to the interface of the alluvium and the Chinle. Such recharge may enter the subsurface along preferential flow paths that result from water ponding in depressions or beneath sand dunes. Preferential flow paths may also result from variations in the permeability of the shallow materials underlying the site[28].

The moist clay in boring B-2 is likely to be the result of recharge that ponded along the interface between the alluvial materials and the relatively impermeable Chinle. The clay retains water longer than the overlying alluvium.

Moist clay at the alluvial/Chinle contact also occurs at the WCS site. In a study conducted in the early 1990s, moist clay was found in most of the borings that penetrated the contact[29].

This moisture found in the borings probably indicates that some recharge currently occurs at the site. There is no reason to believe that this recharge will not occur in the future.

This question of recent recharge might be answered by using radioisotopes to date the moisture found in the vadose zone. The absence of tritium and chlorine-36 would indicate that

[27] Louisiana Energy Services, 2004e, page 8.
[28] Walvoord et al. state that their method of assessing flow in the vadose zone assumes that preferential flow paths do not affect the system (Walvoord et al., 2002, pages 44-4 and 44-5) (NIRS/PC Exhibit 48).
[29] Holt, 1993 (NIRS/PC Exhibit 19), moist clay at the alluvial/Chinle contact reported in 16 of 25 available borehole logs.

the moisture entered the subsurface before the atmospheric testing of nuclear weapons. Low carbon-14 concentrations would also indicate that the moisture was not recent. However, the presence of high concentrations of these radioisotopes would not necessarily indicate that the moisture was recent. This is because water in the vadose zone may exchange water vapor and other gases with the atmosphere.

Q13: Have fractures been investigated at the proposed site? That is, fractures that could act as preferential flow paths for groundwater.

A13. LES and NRC have not adequately investigated the possibility that fractures may act as preferential flow paths. Such fractures could allow water to rapidly flow from the alluvium to the saturated zones in the Chinle, or from the Chinle to the Santa Rosa Aquifer.

LES and NRC have advanced several arguments against the existence of fractures in the Chinle at the proposed site. These include:

1. Fractures were not detected as boreholes were advanced[30].
2. The Chinle sediments are dry[31].
3. The permeability of the Chinle is low[32].

However, these arguments do not show that fractures do not exist. Taking them in order as presented above:

1. No fractures in boreholes: The borings advanced into the Chinle were vertical. Fractures may be spaced at intervals of five feet, ten feet, or more. Thus, the chances that vertical borings would intercept vertical, or near vertical, fractures may not be great. In addition, the borehole materials do not appear to have been examined in a manner that would reveal the

[30] Harper and Peery, 2004a, page 21 (NIRS/PC Exhibit 17).
[31] Harper and Peery, 2004a, page 22 (NIRS/PC Exhibit 17).
[32] Harper and Peery, 2004a, pages 22 and 23 (NIRS/PC Exhibit 17); and NRC, 2004a, page 3-35 (NIRS/PC Exhibit 41).

presence of fractures. Although borings through the Chinle were cored at the WCS site, it is not clear whether any cores were taken at the proposed NEF site, or if any were, whether the cores were continuous[33]. No descriptions of cores from the proposed NEF site were found in the geology report[34] or in any other documents that were reviewed. LES's hydrologist does not appear to have examined any cores for the presence of fractures[35].

However, in the early 1990s Holt examined cores from the Chinle at the WCS site[36]. Fractures were found in most of the boreholes[37]. Fractures were found at various depths, from the alluvial/Chinle contact[38] to more than 200 feet below ground surface[39]. In some cases the fractures had 'healed'[40]. In other cases mineral deposits indicate that the fractures have acted as groundwater flow paths[41].

2. Chinle dry: In response to episodic recharge events, water may flow along fractures only a few times each year, or perhaps only every few years[42]. Such episodic flows would wet the area immediately adjacent to a fracture, but would not be expected to wet large volumes beyond the fracture. Thus, the generally dry conditions found in the Chinle do not mean that fracture flow does not occur. It should be noted that the Chinle may appear to be dry even though it actually contains water. An example of this is WCS boring/monitor well B-20 (11-D). According to the boring log and well construction diagram, no water was encountered within the

[33] Three test borings and three monitor wells were drilled at the proposed site (Cook-Joyce Inc., 2004a, appendix B, page 3) (NIRS/PC Exhibit 5). The test borings were not cored (Cook-Joyce Inc., 2004a, page 3) (NIRS/PC Exhibit 5).
[34] Cook-Joyce Inc., 2003a (NIRS/PC Exhibit 4).
[35] Harper and Peery, 2004a, pages 22 – 24 (NIRS/PC Exhibit 17).
[36] Holt, 1993 (NIRS/PC Exhibit 19).
[37] Holt, 1993 (NIRS/PC Exhibit 19), fractures reported in 21 of 28 available borehole logs.
[38] Holt, 1993 (NIRS/PC Exhibit 19), see log of borehole B-45 (11-E), for example.
[39] Holt, 1993 (NIRS/PC Exhibit 19), see log of borehole B-4 (7-G), for example.
[40] Holt, 1993 (NIRS/PC Exhibit 19), see log of borehole B-49 (8-B), for example.
[41] Holt, 1993 (NIRS/PC Exhibit 19), see log of borehole B-36 (10-C), for example.
[42] At Yucca Mountain, Nevada, significant flow through fractures is believed to occur only every few years (DOE, 2000a, pages 20 and 21) (NIRS/PC Exhibit 7).

screened interval[43]. Yet, this monitor well was later found to contain water more than 100 feet of standing water[44]. The moisture contents of materials like those that make up the Chinle can be difficult to judge in the field. In the absence of laboratory measurements of moisture content, one cannot assume that an interval of the Chinle is dry merely because it was logged as dry in the field.

3. Low permeability: NRC states: "Although the presence of fracture zones that can significantly increase vertical water transport through the Chinle Formation has not been precluded, the low measured permeabilities indicate the absence of such zones."[45] However, the limited permeability measurements that were performed at the proposed site and the nearby WCS site are not likely to reveal the presence of fractures that may be spaced at intervals of five feet, ten feet, or more. Two types of permeability measurements were performed on the Chinle Formation near the site. First, laboratory measurements of core samples from the WCS site[46]. Second, a slug test performed at the proposed site in MW-2[47]. Laboratory measurements often underestimate the bulk permeability of a unit, because they do not account for fractures and other features that may act as preferential flow paths[48]. This is illustrated by the data shown in NIRS/PC exhibit B[49]. Permeabilities measured in the field may be more than a thousand times greater than the corresponding laboratory measurement. Slug tests only measure hydraulic

[43] Holt, 1993 (NIRS/PC Exhibit 19), log of borehole B-20 (11-D). This is also the case for borehole B-21 (9-G(3)).
[44] Holt, 1993, page 11 (NIRS/PC Exhibit 19); and Rainwater, 1996, table A-1 (NIRS/PC Exhibit 44). Borehole B-21 (9-G(3)) contained approximately six feet of water (Rainwater, 1996, table A-1) (NIRS/PC Exhibit 44).
[45] NRC, 2004a, page 3-35 (NIRS/PC Exhibit 41).
[46] Louisiana Energy Services, 2004a, table 3.3-2; and Harper and Peery, 2004a, page 22 (NIRS/PC Exhibit 17).
[47] Cook-Joyce Inc., 2003a, page 8 (NIRS/PC Exhibit 4).
[48] Linsley, Kohler, and Paulhus, 1958, page 131 (NIRS/PC Exhibit 25); Davis and DeWiest, 1966, page 165 (NIRS/PC Exhibit 6); Olson and Daniel, 1981, page 20 (NIRS/PC Exhibit 43).
[49] Source of data: Olson and Daniel, 1981 (NIRS/PC Exhibit 43).

properties in the area immediately surrounding the well[50]. Thus, the relatively low permeability estimates derived from these tests do not indicate that fractures are absent.

Whether fractures that may act as preferential flow paths exist at the site could be determined by closely examining cores from the Dockum Group. To maximize the chances of intercepting near-vertical fractures, cores should be collected from angled borings. In addition, the ages of groundwater in the saturated units beneath the site should be estimated. Relatively young water would indicate that water reaches these units along preferential flow paths.

Q14. In general, can water flow between the Dockum Group and overlying units?

A14. Yes, that is the conclusion of investigators who have studied this issue. According to Dutton, in some portions of the Southern High Plains, the Dockum Formation receives recharge from overlying aquifers[51]. Investigators studying the Dockum Formation and the Ogallala Aquifer near Portales New Mexico concluded that groundwater is probably flowing upward from the Chinle into the overlying Ogallala[52]. The amount of flow between the Dockum Formation and overlying units depends on site-specific conditions. In the absence of site-specific information, it is not reasonable to assume that the Dockum constitutes an effective barrier to flow from overlying units[53]. LES and NRC have not collected the information necessary to determine whether water from the alluvium may flow into the Chinle or the Santa Rosa at the proposed site. This information could be obtained through studies of fractures, measurements of stable isotope ratios in groundwater, and the dating of groundwater.

Q15. What kinds of discharges would the proposed facility generate?

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[50] EPA, 1994b, page 1 (NIRS/PC Exhibit 11).
[51] Dutton and Simpkins, 1986, page 32 (NIRS/PC Exhibit 9); and Mehta et al., 2000, page 851 (NIRS/PC Exhibit 33).
[52] Langman et al., 2004. page 32 (NIRS/PC Exhibit 23).
[53] LES/NRC have stated that the Chinle Formation essentially "isolates the deep and shallow hydrologic systems." (Louisiana Energy Services, 2004a, page 3.4-15; and NRC, 2004a, page 3-35 (NIRS/PC Exhibit 41)).

A15. The NEF will generate wastewaters and stormwater runoff:

1. Treated effluent from the plant would be discharged to a double lined evaporation basin[54]. Approximately 2540 m^3 of effluent would be discharged to the basin each year[55].

2. Stormwater runoff from the uranium byproduct cylinder (UBC) storage pad and cooling tower blowdown would be directed to a single lined evaporation basin[56]. This basin would be able to hold approximately 77,700 m^3[(57)].

3. Stormwater runoff from the plant (except the UBC storage pad) would be directed to an unlined basin[58]. This basin will be able to hold approximately 23,350 m^3 of runoff[59]. Overflow from the basin would be discharged to ground surface[60].

4. Sewage would be discharged to six septic leach fields[61]. Approximately 7300 m^3 of sewage will be discharged annually[62].

Some of these discharges would seep into the shallow alluvial materials underlying the site.

Q16. Have LES and NRC performed the investigations necessary to determine how the discharges from the proposed facility will affect groundwater in the future?

A16. No. Moreover, LES appears to have made contradictory statements regarding the fate of the discharges.

Q17. What would happen to wastewaters and storm water runoff that enters the materials underlying the site?

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[54] NRC, 2004a, page 4-11 (NIRS/PC Exhibit 41).
[55] NRC, 2004a, page 4-12 (NIRS/PC Exhibit 41).
[56] NRC, 2004a, pages 4-11 and 4-12 (NIRS/PC Exhibit 41).
[57] Louisiana Energy Services, 2004b, page 5 of 36.
[58] NRC, 2004a, pages 4-12 and 4-13 (NIRS/PC Exhibit 41).
[59] Louisiana Energy Services, 2004b, page 4 of 36.
[60] NRC, 2004a, page 6-18 (NIRS/PC Exhibit 41).
[61] NRC, 2004a, figure 4-2 (NIRS/PC Exhibit 41).
[62] Louisiana Energy Services, 2004b, page 7 of 36.

A17. Some water from the basins and septic leach fields would infiltrate into the alluvium. A number of things may happen to the water after it enters the subsurface. It may:

1. be removed by evapotranspiration, or

2. pond on the surface of the Chinle Formation and flow along the alluvial/Chinle contact, or

3. flow through fractures to the water bearing units beneath the site, i.e., the saturated zone in the Chinle at about 220 feet, the 100 foot-thick sandstone layer at a depth of about 600 feet, or the Santa Rosa Aquifer.

NIRS/PC exhibit C is a schematic cross-section depicting subsurface discharge from the stormwater basin and a septic field.

Q18: Have NRC and LES evaluated the subsurface fate of wastewaters and runoff generated by the NEF?

A18. Not sufficiently. To determine where this water will go, they should answer the following questions:

1. How much water would infiltrate into the alluvium from:

   a. The treated effluent basin?

   b. The UBC storage pad and cooling tower blowdown basin?

   c. The stormwater basin?

   d. The septic leach fields?

2. Where would water flowing along the alluvial/Chinle contact be discharged?

3. How long would it take for water from the NEF to reach any discharge areas?

4. Could water flow to underlying water bearing units via fractures?

Q19: Have LES or NRC estimated the amount of water that would leak from the storm water detention basin?

A19. Yes, although the estimates are not adequate.

LES has made two estimates of leakage from storm water detention basin[63].

In one estimate, LES assumed that 50% of the water entering the stormwater basin would infiltrate into the underlying materials. No calculations or other analyses were provided to support this assumption[64].

In the other estimate, LES assumed that the minimum[65] leakage rate would be 1 mm/hr. The purpose of this estimate appears to be to determine whether the basin could handle expected inflows, not to determine the effects of leakage on groundwater[66].

NRC's estimate of leakage from storm water detention basin assumed that all water entering the stormwater basin would infiltrate into the underlying materials. No calculations or other analyses were provided to support the assumption[67].

Q20: Have LES or NRC addressed the fate of the water that would leak from the storm water detention basin and the septic leach fields?

A20. Yes. However, LES and NRC seem to disagree on the fate of the water that that would leak from the basin and the septic fields.

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[63] According to a statement by Lockwood Greene, no leakage would occur from the storm water basin because it would be lined (Areva, 2004a, pages 49 and 50 of 60, LES-05177 – LES-01578) (NIRS/PC Exhibit 1). It is not known whether this statement is an error, or whether LES once planned to line the stormwater basin.
[64] Louisiana Energy Services, 2004c, page 32; and Harper and Peery, 2004a, page 36 (NIRS/PC Exhibit 17).
[65] Areva, 2004a, pages 10 and 11 of 60 (NIRS/PC Exhibit 1). The use of a minimum leakage rate is conservative if the purpose of the estimate is to determine whether the basin could handle expected inflows. However, use of a minimum leakage rate is not appropriate for the purpose of estimating the effects of basin leakage on groundwater.
[66] Areva, 2004a, page 12 of 60 (NIRS/PC Exhibit 1). This estimate neglects factors that would control the amount of leakage from the basin. The neglected factors include: the hydraulic pressure (head) exerted by the water standing in the basin, and the hydraulic conductivity of the materials underlying the basin. In this case, the hydraulic conductivity of the materials would be a function of their degree of saturation.
[67] NRC, 2004b, page 8 (NIRS/PC Exhibit 42).

LES has stated that virtually all water that leaks from the stormwater basin will return to the surface via evapotranspiration[68].

In contrast to LES, NRC believes that leakage from the storm water detention basin and the septic leach fields is likely to result in the formation of perched bodies of groundwater at the alluvial/Chinle contact[69]. NRC also states that the downgradient transport of this water would be limited due to ... *the storage capacity of the soils and the upward flux to the root zone.*[70] However, NRC has not quantified either of these limiting factors.

I agree with NRC that leakage from the storm water detention basin and the septic leach fields is likely to result in the formation of perched bodies of groundwater at the alluvial/Chinle contact.

NRC has estimated the groundwater flow rate, and has identified potential discharge areas[71]. However, NRC's estimate of the flow rate is too low, and it has not adequately investigated potential discharge areas.

1. Groundwater flow rate: NRC estimated the groundwater flow rate along the alluvial/Chinle contact using Darcy's Law[72]:

$$q = K\,(\Delta H/\Delta L)/n$$

where:

K = hydraulic conductivity

$\Delta H/\Delta L$ = hydraulic gradient

n = effective porosity

[68] Louisiana Energy Services, 2004e, pages 3 - 5; and Harper and Peery, 2004a, pages 35 – 37 (NIRS/PC Exhibit 17).
[69] NRC, 2004a, pages 4-13 and 4-14 (NIRS/PC Exhibit 41).
[70] NRC, 2004a, pages 4-13 and 4-14 (NIRS/PC Exhibit 41).
[71] One of the potential discharge areas, Custer Mountain, is approximately 20 miles south of the site (Nicholson and Clebsch, 1961, plate 2) (NIRS/PC Exhibit 37).
[72] NRC, 2004b, page 7 (NIRS/PC Exhibit 42).

NRC used the following values[73]:

$K = 0.01$ cm/s

$\Delta H/\Delta L = 0.02$

$n = 0.25$

These values resulted in a groundwater flow rate of 252 m/yr (0.15 mi/yr). The hydraulic conductivity and porosity values used by NRC were not based on measurements performed at proposed site. They were based on values found in the literature[74]. The hydraulic gradient was based on the slope of the alluvial/Chinle contact[75].

2. Discharge areas and potential groundwater use: According to the NRC, bodies of groundwater that form beneath the site may be discharged ... *in a minor seep at Custer Mountain or in the excavation 3.2 kilometers (2 miles) southeast of Monument Draw* ... .[76]

NRC's evaluation of potential discharge areas appears to be based on a review of the literature rather than on a field investigation. NRC has not explained why it believes water from the site may discharge at the locations given. Nor has it explained why it did not consider potential discharge areas that are closer to the site (e.g., Monument Draw[77]), or discharge to wells that may be along the flow path of groundwater emanating from the site.

[73] NRC, 2004b, pages 9 and 12 (NIRS/PC Exhibit 42).
[74] NRC, 2004b, pages 7, 8, 10, and 11 (NIRS/PC Exhibit 42); Louisiana Energy Services, 2004a, pages 3.4-14 and 3.4-15; and Harper and Peery, 2004a, page 54 (NIRS/PC Exhibit 17).
[75] NRC, 2004b, pages 8 and 10 (NIRS/PC Exhibit 42).
[76] NRC, 2004a, pages 4-13 and 4-14 (NIRS/PC Exhibit 41). Custer Mountain is approximately 20 miles from the site (Nicholson and Clebsch, 1961, plate 2) (NIRS/PC Exhibit 37).
[77] NRC's reference to " ... *the excavation 3.2 kilometers (2 miles) southeast of Monument Draw* ... " appears to be an error. NRC cites Nicholson and Clebsch, 1961 as the source of this information. However, the excavation mentioned in Nicholson and Clebsch is two miles southeast of the town of Monument, not Monument Draw (Nicholson and Clebsch, 1961, page 35 and figure 3) (NIRS/PC Exhibit 37).

LES and NRC should conduct an investigation to locate potential discharge areas downgradient of the proposed site. They should also estimate the time required for water from the NEF to reach the discharge areas[78].

It should be noted that the New Mexico Environment Department (NMED) has expressed concern regarding the possibility that leakage from the NEF may transport contaminants off site and pose a threat of contamination to ephemeral drainages or aquifers[79].

Q21: Have LES and NRC addressed the possibility the lined basins may leak?

A21. No. Treated effluent from the plant will be discharged to a double lined evaporation basin[80]. Stormwater runoff from the UBC storage pad and cooling tower blowdown will be discharged to a single lined evaporation basin[81]. The basins will be lined with geosynthetic materials (e.g., HDPE)[82]. LES assumes that these basins will not leak[83]. That is not a good assumption. Lined basins often leak. They leak because the liners contain defects. These defects exist for a variety of reasons:

1. Manufacturing defects: typical geomembranes contain 0.5 to 1 pinholes per acre[84].

2. Installation defects: these include unsealed seams, punctures from sharp objects, and damage caused by the operation of heavy equipment[85]. The number of defects can be reduced by careful installation. However, even with the best quality control during installation, one can expect 1 to 2 defects per acre[86].

[78] Discharge areas may be natural features (e.g., springs or seeps) or wells.
[79] NMED, 2004a, pages 1, 2, and 4 (NIRS/PC Exhibit 35).
[80] NRC, 2004a, page 4-11 (NIRS/PC Exhibit 41).
[81] NRC, 2004a, page 4-12 (NIRS/PC Exhibit 41).
[82] Louisiana Energy Services, 2004b, pages 11 – 13 of 36.
[83] Louisiana Energy Services, 2004c, page 31; and Louisiana Energy Services, 2004e, pages 5 and 6.
[84] EPA, 1994a, page 34 (NIRS/PC Exhibit 10).
[85] Yazdani, 1997 (NIRS/PC Exhibit 49).
[86] Murphy and Garwell, 1998, page xii (NIRS/PC Exhibit 34).

3. Deterioration after installation: this includes rupture due to creep, stress cracking, and degradation due to exposure to chemicals and heat[87].

Laine and Miklas examined 61 geosynthetic-lined facilities[88]. The facilities included landfills and impoundments. Most of the geosynthetic liners were made of HDPE, but some were made of PVC (e.g., XR-5) or polyethylene. Leaks were detected in 58 of the 61 facilities. The average density of leaks at all facilities was about 13 per acre. The EPA recently released a report describing various methods for detecting leaks beneath lined landfills and impoundments[89].

Clearly, it is not reasonable to assume that the lined basins will not leak. NRC and LES should investigate this possibility and use the results to determine the fate of the water and contaminants (e.g., flow rates, discharge areas) that may leak from the basins. NRC and LES should also design monitoring systems to detect leakage from both lined basins[90]. The monitoring systems should include devices to detect leakage in the vadose zone, and along the alluvial/Chinle contact.

Q22: Has LES made contradictory statements regarding fate of water discharged to septic leach fields and basins?

A22. Yes. In its responses to interrogatories and questions during depositions, LES claimed that water which enters the subsurface from the septic leach fields and the stormwater runoff basin would be evapotranspired[91]. The responses did not mention the possibility that the water may recharge the underlying groundwater systems.

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[87] Reddy and Butul, 1999, pages 19, 25, and 108 (NIRS/PC Exhibit 45).
[88] Laine and Miklas, 1989 (NIRS/PC Exhibit 22).
[89] EPA, 2004a (NIRS/PC Exhibit 13).
[90] LES does not plan to install a leak detection system beneath the UBC storage pad basin.
[91] Louisiana Energy Services, 2004e, pages 3 – 5; and Harper and Peery, 2004a, pages 35 – 37 (NIRS/PC Exhibit 17).

However, in its Groundwater Discharge Permit Application, LES made the following statement regarding discharged sewage:

> *The infiltrated waters are expected to potentially recharge the limited ground water system at the 214 to 222 foot depth or return to the atmosphere via evapotranspiration.* [92]

LES made the same statement regarding stormwater runoff[93]. The statements in the Groundwater Discharge Permit Application appear to contradict LES's contention that all water which enters the subsurface will be evapotranspired. LES has not explained this apparent contradiction.

Also, in its responses to an NIRS/PC interrogatory regarding leakage from the lined basins, LES stated:

> *The basins will be designed to preclude water from infiltrating into the subsurface. Therefore, no estimates on how much water will infiltrate into the subsurface have been, or need be, made.* [94]

However, in its Groundwater Discharge Permit Application, LES makes the following statement regarding leakage from the UBC storage basin:

> *Any minor leakage past the liner will infiltrate into the ground under the basin. The infiltrated waters are potentially expected to recharge the limited ground water system at the 214 to 222 foot depth or return to the atmosphere via evapotranspiration.* [95]

This statement appears to contradict LES's contention that infiltration from the lined basins will be precluded. LES has not explained this apparent contradiction.

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[92] Louisiana Energy Services, 2004b, page 19 of 36 (NIRS/PC Exhibit 27).
[93] Louisiana Energy Services, 2004b, page 17 of 36 (NIRS/PC Exhibit 27).
[94] Louisiana Energy Services, 2004e, page 6 (NIRS/PC Exhibit 30).
[95] Louisiana Energy Services, 2004b, page 18 of 36 (NIRS/PC Exhibit 27).

Q23: Have LES and NRC presented a clear groundwater monitoring plan?

A23. No. LES and NRC have not clearly stated which groundwater zones will be monitored. The DEIS states that groundwater in the 220-foot zone will be monitored[96]. However, it does not state whether wells will be installed to monitor the perched bodies of groundwater that may form at the alluvial/Chinle interface[97]. All groundwater zones beneath the site, from the Santa Rosa Aquifer to land surface, should be monitored.

Q24: Have LES and NRC explained how they will distinguish groundwater contamination caused by the NEF from other potential sources of contamination?

A24. No. NRC and LES have not explained how they will distinguish between groundwater contamination caused by the NEF and contamination caused by other potential sources (e.g., Wallach Concrete, Sundance Services, WCS site, Lea County Landfill[98]).

NRC claims that contaminants from Wallach Concrete and Sundance Services would consist primarily of hydrocarbons[99]. NRC also claims that the proposed NEF would not emit hydrocarbons in detectable quantities[100]. However, NRC has not provided the basis for these claims. LES and NRC have not addressed potential contamination from WCS or the Lea County Landfill.

Q25: Is the planned Stormwater Monitoring Program adequate?

A25. No. The water discharged to the stormwater runoff basin may contain a wide variety of contaminants. According to LES, the discharge to the stormwater basin:

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[96] NRC, 2004a, page 6-13 (NIRS/PC Exhibit 41).

[97] The NMED has stated that it will probably require LES to install additional wells to monitor any leakage from the basins or septic systems that perches on the alluvial/Chinle contact (NMED 2004a, pages 4 and 5) (NIRS/PC Exhibit 35).

[98] The Lea County Landfill is less than 500 feet from the southeast corner of the proposed NEF site (NRC, 2004a, figure 3-2) (NIRS/PC Exhibit 41).

[99] NRC, 2004a, page 6-13 (NIRS/PC Exhibit 41).

[100] NRC, 2004a, page 6-13 (NIRS/PC Exhibit 41).

... will be typical of runoff from building roofs and paved areas from any industrial facility. [101]

The discharge will include:

... small amounts of oil and grease typically found in runoff from paved roadways and parking areas, ... [102]

The discharge may also contain pesticides and fertilizers that will be applied around the facility[103].

In addition to constituents identified by LES, the discharge may contain other contaminants associated with roads, parking lots and industrial facilities. These include: polycyclic aromatic hydrocarbons[104] (PAHs), other organic compounds (e.g., aliphatic hydrocarbons, alcohols)[105], and miscellaneous contaminants resulting from spills and accidents. However, the Stormwater Monitoring Program[106] does not include monitoring of PAHs, pesticides, or other organics. These potential contaminants should be included in the Stormwater Monitoring Program.

It should be noted that the Regional Environmental Officer of the United States Department of the Interior has expressed concern that wastewater in the UBC stormwater basin may contain nutrients, heavy metals, organic chemicals, petroleum, solvents, or pesticides; and that these contaminants may pose a risk to migratory birds and other wildlife[107].

Because the stormwater basin is expected to leak, groundwater should be monitored for all contaminants detected in the Stormwater Monitoring Program.

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[101] LES, 2004c, page 33 (NIRS/PC Exhibit 28).
[102] LES, 2004c, page 33 (NIRS/PC Exhibit 28).
[103] Lockwood Greene, 2004a, page 4 (NIRS/PC Exhibit 32).
[104] USGS, 2004a, table 3 (NIRS/PC Exhibit 47).
[105] Barrett et al., 1993, table 3.5 (NIRS/PC Exhibit 2).
[106] NRC, 2004a, page 6-18 (NIRS/PC Exhibit 41).
[107] USDOI, 2004a, page 2 (NIRS/PC Exhibit 46).

Q26: Please summarize your major points.

A26. The work performed by LES and NRC is deficient. They have not performed investigations necessary properly to characterize existing groundwater conditions. Nor have they performed investigations necessary to determine how the proposed facility will affect groundwater in the future.

LES and NRC should be required to:

1. Measure the hydraulic properties of the shallow materials.
2. Investigate and monitor all water-bearing units that may exist beneath the site - from the surface to the Santa Rosa Aquifer.
3. Investigate the possibility that fractures capable of acting as preferred flow paths may exist at the proposed site.
4. Estimate the amount of water that would leak from:
    a. The treated effluent basin.
    b. The UBC basin.
    c. The stormwater basin.
    d. The septic leach fields.
5. Determine where water that leaked from the NEF facility would go, i.e., identify discharge areas.
6. Estimate the time it would take for water from the NEF to reach discharge areas.
7. Develop a groundwater monitoring plan that clearly identifies all units to be monitored.
8. Monitor stormwater runoff for all contaminants that the proposed plant is expected to generate.

The work described above is necessary to determine whether:

1. The NEF can be built as planned.
2. Plans will have to be modified (e.g., additional environmental controls, additional monitoring).
3. The proposed site is not suitable.

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General

More than 20 years experience in hazardous waste investigations.

Education

M.S. Hydrology, University of Arizona, 1991
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Employment History

1993: Consultant
1988 - 1993: The MITRE Corporation, Brooks Air Force Base, Texas
1983 - 1988: SHB Geotechnical Engineers, Inc., Albuquerque, New Mexico
1980 - 1983: University of Arizona, Tucson, Arizona
1979 - 1980: U.S. Forest Service, Gifford Pinchot National Forest, Vancouver, Washington

Experience

- Design and install monitor well networks.
- Design, perform, and analyze aquifer tests.
- Design and install vadose zone monitor networks.
- Design and conduct groundwater sampling programs.
- Apply groundwater flow and contaminant transport models to predict the fate of groundwater contaminants (MODFLOW, MT3D, MOC3D).
- Participate in multidisciplinary teams to select and design hazardous waste disposal sites.
- Conduct third party reviews of environmental documents and field programs.
- Expert Witness.

Representative Projects

Site Characterization - Principal hydrologist responsible for the hydrologic characterization of low-level radioactive and hazardous waste sites throughout the western United States. The goals of these studies were to determine the extent and intensity of any metals or radionuclide contamination, estimate the rate and direction of contaminant movement, and predict future concentrations at receptor sites. Achievement of these goals required the installation of monitor well networks, installation of vadose zone monitoring instruments, groundwater sampling, the performance and analysis of aquifer tests, and the integration of data into a coherent conceptual model of each site.

Contaminant Transport Modeling - Used two and three-dimensional models to design pump and treat systems and estimate the effects of proposed remedial actions on future water quality. Conducted studies to estimate the time required for contaminants to reach potential receptors and estimate contaminant concentrations after plumes reached receptors.

Waste Repository Design - Principal hydrologist responsible for estimating the effects of remedial designs on future groundwater quality at low-level nuclear waste repositories in Arizona and Colorado. This required working closely with geotechnical and civil engineers to produce designs that incorporated the hydrologic characteristics required to meet water quality standards.

Field Methods Instructor - Member of a team that taught environmental field techniques to Air Force personnel. The four-day course consisted of lectures and field trips. It focused on monitor well design, monitor well construction, sampling program design, and groundwater sampling techniques.

Quality Assurance Manager - Manager of hydrology group responsible for evaluating environmental work performed at Air Force bases throughout the United States. Evaluated reports, hydrologic analyses, and field work related to Preliminary Assessments and Site Inspections (PA/SI), Remedial Investigations and Feasibility Studies (RI/FS), and Remedial Actions (RA). These evaluations usually resulted in recommendations for improving overall program design, analytical techniques, or field procedures.

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CERTIFICATE OF SERVICE

Pursuant to 10 CFR § 2.305 the undersigned attorney of record certifies that on January 28, 2005, the foregoing Direct Testimony of George Rice on behalf of Nuclear Information and Resource Service and Public Citizen, NIRS/PC Contention EC-1, Revised Jan. 28, 2005, was served by electronic mail and by first class mail upon the following:

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February 7, 2005

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	Docket No. 70-3103
Louisiana Energy Services, L.P. National Enrichment Facility	ASLBP No. 04-826-01-ML

REBUTTAL TESTIMONY OF GEORGE RICE
ON BEHALF OF NUCLEAR INFORMATION AND RESOURCE SERVICE
AND
PUBLIC CITIZEN
NIRS/PC CONTENTION EC-1
REVISED FEB. 7, 2005

Q1: Please state your name and address.

A1. George Rice; 414 East French, San Antonio, Texas

Q2: What is your profession and educational background?

A2. I am a groundwater hydrologist; I have an MS from the University of Arizona. My resume has been filed in this case as an attachment to the Petition filed on April 6, 2004.

Q3. Have you reviewed LES's testimony regarding EC-1?

A3. Yes.

Q4. Do you have a general opinion of the testimony?

A4. Yes. LES presents a series of assertions without the necessary analyses or site-specific data necessary to support them. I will address these assertions and, in some cases, make recommendations for confirming or refuting them. I will also address other issues regarding LES's testimony.

Much of the information that rebuts LES's testimony is contained in my prefiled testimony. In the interest of brevity I will reference most of this testimony rather than repeating it here.

Q5. On page 10 of its testimony, LES states that data obtained from the WCS site is applicable to the NEF site. Do you agree?

A5. I agree in part. For example, I would expect the lithology of the Chinle Formation to be similar at both sites. There are, however, significant differences with respect to the hydrology. At WCS, groundwater is present in the 230-foot Chinle zone across the entire portion of the site that has been investigated (NIRS/PC Exhibit 4, page 3, and NIRS/PC Exhibit 17, pages 72 – 73). In contrast, at the NEF site groundwater was found in only one of three wells completed in this zone (NIRS/PC Exhibit 4, table 2 and figure 5, and NIRS/PC Exhibit 17, page 54).

At WCS, the 230-foot zone in the Chinle is the uppermost water-bearing zone that extends across the entire site (NIRS/PC Exhibit , page 6-2). This is not true at the NEF site. Except for the northwestern portion of the site, LES has not identified the uppermost water-bearing zone (NIRS/PC Exhibit 4, table 2 and figure 5).

Q6. On page 51 of its testimony, LES claims that studies performed at the NEF and WCS do

not " ... *indicate that fractures and fast flow paths exist under the National Enrichment Facility site.*" Do you agree?

A6. No. Cores examined by Holt show that fractures in the Chinle are common at the WCS site. Fractures were encountered at various depths. Some were 'healed', while others showed signs that they had acted as groundwater flow paths, although the time the flow occurred is not known (NIRS/PC testimony, page 9).

LES does not appear to have thoroughly investigated the question of fractures at the proposed site (see NIRS/PC testimony, pages 8 and 9).

This question could be resolved by carefully collecting and examining cores from the proposed site, as Holt did at the WCS site. If no fractures capable of acting as preferred flow paths are found, then the question would be settled. However, if such fractures are found, then LES should be required to estimate the rate at which the fractures would transmit leakage from the NEF to underlying groundwater systems.

Q7. On pages 24, 26, 27, and 42 of its testimony, LES claims that water that leaks from the stormwater detention basin, and water that is discharged from the septic system, probably would not form perched bodies of water at the alluvial/Chinle because

most of it would be returned to the atmosphere by evapotranspiration (ET). On page 26, LES states that a water balance supports this conclusion. Do you agree?

A7. No. First, it must be noted that LES has not performed an analysis of the amount of water that would leak from the stormwater detention basin. The water balance that LES mentions in its testimony is not a serious attempt to estimate leakage rates (see NIRS/PC testimony, page 14).

Second, LES has not performed an analysis of the amount of leakage that would be returned to the atmosphere by evapotranspiration. Instead, LES cites the high evaporation rates in the area and refers to a paper by Walvoord et al. (NIRS/PC Exhibit 48) (LES testimony, pages 15 and 42). The paper concludes that no recharge occurs in thick desert vadose zones (LES testimony, page 15). This is no substitute for a site-specific analysis (see discussion below).

Third, LES's assertion is inconsistent with the existence of perched bodies of water below playas (buffalo wallows) at the WCS site (LES testimony, page 33). The stormwater basin would function like a playa. It would fill with rainfall or snowmelt, and water would leak into the subsurface. Perched bodies of water are likely to form beneath the stormwater basin, just as they form beneath the playas. In fact, LES states: "*Excavations into, and naturally occurring surface depressions ("buffalo wallows") in, the alluvium can act as "bowls" where water can more readily accumulate on top of the red-beds, which may allow localized perched zones to develop.*"

(LES testimony, page 33). The stormwater basin would be an unlined excavation into the alluvium.

Finally, the septic systems would discharge wastes below the ground surface. To some extent, these discharges would be shielded from evaporation.

It should be noted that NRC has stated that perched bodies of water could be expected to form at the alluvial/Chinle contact as a result of leakage from the stormwater detention basin and discharges from the septic systems (NRC Exhibit 1, DEIS, pages 4-13 and 4-14) (NIRS/PC Exhibit 41).

If LES wants to credibly argue that perched bodies would not form, it should perform an analysis to estimate the amount of water that would leak from the stormwater basin. It should also perform analyses to estimate the amounts of leakage and septic discharge that would reach the alluvial/Chinle contact. Finally, it should perform analyses to estimate the amount of storm water leakage and septic discharge that would be returned to the atmosphere by evapotranspiration. If sound analyses show that perched bodies would not form, this question would be settled. However, if this is not the case, LES should be required to determine the fate of the perched bodies of water.

Q8. On page 27 of its testimony, LES states: *"Moreover, NIRS/PC appear to assume that the contact between the alluvium and Chinle red beds beneath the site is uniform with respect to depth below ground surface."* Did you make such an assumption?

A8. No.

Q9. On pages 24 and 25 of its testimony, LES claims that if any leakage did pond on the alluvial/Chinle contact, downgradient transport would be limited due to evapotranspiration and the storage capacity of the soils. Do you agree?

A9. No. Regarding evapotranspiration, LES has not performed any analyses that quantify the effects of evapotranspiration on water that may pond on the alluvial/Chinle contact.

Regarding soil storage capacity, LES has not performed any analyses that quantify the effects of soil storage capacity on the movement of perched water.

Indeed, LES has not performed any analyses that address the fate of perched water.

In order to demonstrate how far perched water would travel, LES should be required to 1) perform an analysis to estimate the amount of water that would perch on the alluvial/Chinle contact, and 2) perform an analysis to determine the fate of any perched water (i.e., flow direction, flow rate, distance traveled before dissipating due to evapotranspiration other factors), and 3) identify potential discharge areas in the flow path of the perched water.

Q10. On page 27 of its testimony, LES states that it is " ... *not aware of any points in the site vicinity at which water purportedly flowing along the "alluvial/Chinle contact" is discharged.* " Is this correct?

A10. No. LES is aware of at least one point where water flowing along the alluvial/Chinle contact is discharged. This is the Wallach quarry, where water seeps from " ... *the base of the sand and gravel unit at the top of the Chinle clay. ... This shallow perched zone is not likely to be pervasive ...* " (LES Exhibit 1, page 3.4-2).

There is no indication that LES has made a systematic effort to identify any areas where water flowing along the alluvial/Chinle contact is discharged.

Q11. On page 31 of its testimony, LES offers the following explanation for the moisture found in boring B-9: "*This moisture is likely infiltrated precipitation that had yet to evapotranspire (since CJI locates drilling locations in low spots rather than high spots, i.e., rainfall may preferentially collect and infiltrate into the ground and then become available for evapotranspiration).*" Do you agree that this moisture is 'likely infiltrated precipitation'?

A11. Yes. This differs from LES's previous explanation and is consistent with the explanation presented in my testimony (NIRS/PC testimony, pages 6 and 7).

I also agree that infiltration may be preferentially concentrated in areas such as low spots. This would result in the formation of preferential flow paths (NIRS/PC testimony, page 7).

However, I disagree with LES on the fate of the infiltrated precipitation. LES believes the infiltrated precipitation will be removed by evapotranspiration (LES testimony, page 31). I believe that a portion of the infiltrated precipitation probably makes its way to the alluvial/Chinle contact and flows along the contact. That is, the moisture found in boreholes at the NEF site, and at the WCS site, are indications of episodic recharge (NIRS/PC testimony, pages 6 and 7).

LES still has not offered a clear explanation of the source of the moisture found at the base of boring B-2 (alluvial/Chinle contact). LES should state whether it believes the source of the moisture in B-2 is the same as the moisture in B-9 (i.e., infiltrated precipitation), or whether the moisture originates from another source[1]. Finally, it should be noted that LES's hydrologist was not present when these borings were drilled (NIRS/PC Exhibit 17, pages 16 – 18).

Q12. On page 15 of its testimony, LES invokes a paper by Walvoord et al. (LES exhibit 5) (NIRS/PC Exhibit 48) to support its claim that infiltrating precipitation would be removed by evapotranspiration. Have you reviewed this paper?

[1] Note: contrary to LES's implication (LES testimony, page 50), I have not claimed that the moisture found in these boreholes reflected saturated conditions. I have asked LES to explain the origin of this moisture.

A12. Yes, and I don't believe it can be used to show that all precipitation infiltrating at the NEF site would be removed by evapotranspiration.

First, the paper presents a new conceptual model of flow in desert vadose zones that differs from previous models (LES exhibit 5, pages 44-2 and 44-4) (NIRS/PC Exhibit 48). This is not to say that the conceptual model developed in this paper is incorrect. However, it is new, and subsequent research may cause it to be modified.

Second, the model assumes there are no preferential flow paths (LES Exhibit 5, page 44-5) (NIRS/PC Exhibit 48). Preferential flow paths currently form at the site when precipitation is concentrated in depressions or beneath sand dunes (LES testimony, page 31, and NIRS/PC testimony, page 7).

Finally, although Walvoord's paper may cast light on the movement of water through desert vadose zones, it is not a substitute for site-specific analyses.

Q13. On page 23 of its testimony, LES states that contaminant concentrations in water leaking from the stormwater basin will not exceed regulatory limits. On page 24, LES states that this will be confirmed by samples collected from the basin. Do you agree?

A13. No. One of the purposes of collecting samples is to determine whether discharges comply with regulatory standards. LES will not know whether water in the basin meets regulatory standards until samples are collected and analyzed.

In support of its contention, LES cites statements in Barrett, et al. (1995, NIRS/PC Exhibit 2) regarding the potential for contaminants in highway runoff to affect groundwater (LES testimony, page 53). It is true that soils can reduce the concentrations of contaminants in runoff, and that thicker soils and sediments generally result in greater reductions.

However, this does not mean that contaminants in the stormwater runoff from the NEF (generated in part from parking lots and roads) would not contaminate leakage that perched on the alluvial/Chinle contact. Barrett et al. describe cases where contaminants associated with highway runoff have affected the underlying groundwater (NIRS/PC Exhibit 2, page 44). In addition, the contaminant removal capacity of the alluvial materials underlying the proposed site is unknown. The alluvium would remove some contaminants, but there is no reason to believe it would remove all contaminants.

LES should be required to analyze stormwater for the contaminants that it would reasonably be expected to contain (NIRS/PC testimony, page 21). Because the stormwater basin would leak, groundwater samples should be analyzed for contaminants detected in the basin. This should include samples from wells designed to intercept any leakage that perches on the alluvial/Chinle contact.

Q14. Has LES changed its position regarding the potential for leakage from the lined basins?

A14. Yes. LES had claimed that the lined basins would not leak (NIRS/PC exhibit 24, pages 5 and 6). However, in its testimony LES states: " *The liners ... will greatly minimize, if not entirely preclude, the potential for subsurface infiltration of water collected in these basins.* " (LES testimony, page 26). And " ... *catastrophic failure is not considered a credible event ...* "(LES testimony, page 46)[2]. In his deposition, Mr. Harper stated that he had heard of cases where liners have leaked (NIRS/PC Exhibit 17, pages 117 and 118).

Although LES now concedes that leakage may occur, they claim that an analysis of the leakage is unnecessary because 1) the lined basins will only contain low concentrations of contaminants, 2), any leakage is not likely to migrate, and 3) " ... *LES will implement a monitoring program designed to detect any postulated releases to the environment.*" (LES testimony, pages 46 and 47).

Taking these arguments in order:

1) Although LES hopes that contaminant concentrations will always be below regulatory limits, there is no guarantee that this will be the case. As stated above,

[2] It should be noted that I have never claimed that catastrophic failure would occur. I have stated that lined basins often leak, and that LES should estimate the amount of leakage that may occur. NRC has also stated there is a possibility that the basins will leak (NRC testimony concerning EC-1, page 15).

one of the purposes of collecting samples is to determine whether discharges to basins comply with standards.

2) Migration of leakage along the alluvial/Chinle contact is addressed above. In the absence of leakage rate estimates, it is not possible to determine the extent of migration.

3) LES plans to install five monitor wells. However, only one of them will be capable of detecting leakage migrating along the alluvial/Chinle contact. The planned position of this well makes it unlikely that it would intercept leakage from any of the basins (LES testimony, pages 37 and 38, NRC Exhibit 1, figure 6-2, and NIRS/PC Exhibit 4, figure 4).

LES should be required to estimate leakage rates from the lined basins, and determine the fate of any leakage that would pond on the alluvial/Chinle contact.

Q15. On page 49 of its testimony, LES claims that the geomembrane leakage data in Laine and Miklas are not germane to NEF. Do you agree?

A15. No. The data in Laine and Miklas come from a variety of geomembrane-lined sites including tanks, ponds, and landfills (NIRS/PC Exhibit 22, page 36). The primary factors that cause geomembranes to leak are common to all lined facilities. These are: 1) manufacturing defects, 2) installation defects, and 3) deterioration after

installation (NIRS/PC testimony, pages 17 and 18). The lined basins at NEF would be also subject to these factors. Therefore, the data are germane to the NEF.

Q16. On page 45 of its testimony, LES states that the TEEB liner will stay within the manufacturer's specifications. Will the manufacturer guarantee the liner's integrity?

A16. LES is not aware of any warranties offered by geomembrane manufacturers (NIRS/PC Exhibit 17, page 48).

Q17. On page 46 of its testimony, LES discusses a hypothetical uranium infiltration depth. Has LES performed any analyses to estimate the depth to which uranium may infiltrate?

A17. Not as of September 2004 (NIRS/PC Exhibit 17, pages 61 and 62).

Q18. On pages 18 and 39 of its testimony, LES states that the laboratory measurements of the permeability of the Chinle are likely to be higher than *in situ* values because of deformation/fracturing caused by the sampling process. Do you agree?

A18. No. Although deformation and fracturing may occur, LES has not cited any information that indicates that deformed or fractured samples were tested in the laboratory. In fact, laboratory measurements tend to be performed on the most uniform and intact samples available (NIRS/PC Exhibit 43, page 20).

Available data show that underestimates of permeability are much more common than overestimates (NIRS/PC testimony, page 10). Laboratory tests often underestimate actual permeabilities because the samples are not representative of larger-scale field conditions such as fractures (NIRS/PC Exhibit 25, page 131, Exhibit 43, pages 20 and 27, and Ehibit 17, pages 20 and 21). In addition, samples from fractured zones often are not recovered during coring (i.e., are not retained in the core barrel). When they are recovered, fractured samples often fall apart when removed from the barrel. There is no indication that LES or any other investigator attempted to measure the permeability of fractured zones in the laboratory.

Q19. On page 15 of its testimony, LES makes the following statement regarding the water bearing zones in the Dockum: "*Indeed, WCS investigators have concluded that the very large hydraulic head differences associated with these units indicates a lack of hydraulic communication in the Triassic Dockum Group in the site area.*" Do you agree?

A19. No. Groundwater may flow between units with very large hydraulic head differences.

Q20. On page 29 of its testimony, LES states that the pesticide detected in MW-2 probably did not reach the Chinle via a fast flow path. Do you agree?

A20. Yes, although my explanation of the pesticide detection differs from LES's (NIRS/PC Exhibit 17, pages 55 and 56).

I believe the pesticide detection was probably caused by contaminated surface soils that were introduced into MW-2 as it was drilled. Some soil samples taken at the site contained the same pesticide found in MW-2 (NIRS/PC Exhibit 28, analyses of soil samples).

Q21. On pages 31 and 32 of its testimony, LES states the saturated zones found at Wallach Quarry are intermittent. Is this consistent with LES's previous statements?

A21. No. According to LES exhibit 1, page 3.4-2, there is a perennial seep at the Wallach quarry.

Q22. On page 34 of its testimony, LES states that the water in the Santa Rosa Aquifer is old, having been recharged more than 15,000 years ago. Do you agree?

A22. I agree that the bulk of the water in the Santa Rosa Aquifer is old. However, if some water recharges the aquifer along fast flow paths such as fractures, a component of the water in the aquifer would be young. The presence of young water would be indicated by the presence of post-bomb tritium or chlorine-36. A component of young water would indicate that the aquifer is vulnerable to contamination from leakage originating at the proposed NEF.

According to the paper cited by LES (LES Exhibit 6) (NIRS/PC Exhibit 9), the estimates of groundwater ages for the Santa Rosa are not based on any data from the vicinity of the site. As the authors (Dutton and Simpkins) state: " ... *data coverage in the Dockum Group beneath the Southern High Plains is poor.*" (LES

Exhibit 6, page 10) (NIRS/PC Exhibit 9). The paper contains no tritium or chlorine-36 data from the Santa Rosa.

A later paper by Dutton does contain tritium data from four wells in the lower Dockum (Santa Rosa?) (NIRS/PC Exhibit 8). These data indicate that the Dockum water does not contain a significant component of young water. However, the closest tritium measurement is from a well more than 100 miles from the proposed site (NIRS/PC Exhibit 8, pages 222, 225, and 227). Thus, these data are not directly applicable to the NEF site.

The bulk of the water in the Santa Rosa Aquifer at the site is probably quite old. The question is, however, whether it contains a young component. There are no data from the site, or even from within 100 miles of the site, that would answer this question. LES should be required to determine whether the groundwater in the Santa Rosa contains a component of relatively young water that would indicate recharge via fast flow paths. This could be done by collecting tritium and chlorine-36 samples from wells at the proposed site.

Q23. On pages 33 and 44 of its testimony, LES states that gravel is not consistently present through the site. Do you agree?

A23. Yes. However, with respect to flow paths beneath the site, the issue is not whether gravel is 'consistently present'. The issue is whether continuous zones of gravel

extend beneath and beyond the site. Such zones could act as fast flow paths for leakage that ponds on the alluvial/Chinle interface.

The alluvial materials beneath the site are stream-laid deposits - mixtures of sand, gravel, silt, and clay. Some zones within the alluvium are overbank deposits. These consist primarily of fine-grained materials (silt and clay). Other zones are channel deposits. These consist primarily of coarse-grained materials (sand and gravel). These channel deposits may extend for miles. Channel deposits should be considered when assessing the flow rate of leakage that may pond on the alluvial/Chinle interface.

Q26: On page 35 of its testimony, LES states that " ... *releases from the Wallach Quarry and the Sundance Services "produced water" lagoons north of the NEF site would be readily differentiated from potential releases from the NEF site.*" Does LES offer any information to support this statement?

A26. No.

Q27: On page 35 of its testimony, LES states that the Lea County landfill is downgradient of the proposed site. Do you agree?

A27: I agree in part. It is true that the landfill is downgradient of the site with respect to the groundwater system in the Chinle. However, the landfill appears to be upgradient of the site with respect to any water flowing along the alluvial/Chinle contact. As explained by NRC, perched groundwater flowing along the contact

would flow down the slope of the contact (NRC testimony, page 21). According to the limited information available, the alluvial/Chinle contact appears to slope from the landfill toward the site (NIRS/PC Exhibit 4, figure 4). If this is true, then the landfill is upgradient of the site with respect to water flowing along the contact.

Q28: On page 54 of its testimony, LES refers to your testimony as a "parade of horribles". Is this a reasonable characterization of your testimony?

A28: No. My testimony shows that LES has not answered a host of fundamental questions regarding the hydrology of the proposed site and the operation of the NEF. From LES's point of view, the answers to these questions may be pleasant or horrible.

Q29. Have you reviewed NRC's testimony regarding EC-1?

A29. Yes.

Q30. Do you have a general opinion of the testimony?

A30. Yes. I disagree with a number of NRC's assertions regarding EC-1. Some of NRC's testimony is based on insufficient information. Some of NRC's testimony is incorrect.

Much of the information that rebuts NRC's testimony is contained in my prefiled testimony. As with the LES testimony, I will reference most of this testimony, rather than repeating it.

Q31. In its testimony on pages 8, 10, and 12, NRC claims that the closest possible discharge location for leakage emanating from proposed NEF is Monument Draw. NRC also claims that Monument Draw is not used due to its intermittent flow. Do you agree?

A31. Monument Draw may be the closest existing discharge location, although neither NRC nor LES appear to have performed a field search for potential discharge locations (NIRS/PC testimony, page 16).

Regarding the use of Monument Draw, it is true that it flows only intermittently. However, surface water is not the primary concern. Groundwater in the alluvium along the Draw has been used as a source of domestic supply (NIRS/PC testimony, page 5). This source is within two miles of the proposed site (NIRS/PC Exhibit 37, plate 2).

Based on the limited information available, Monument Draw appears to be hydraulically down gradient of any leakage that would flow from the NEF. The slope of the alluvial/Chinle contact is approximately 2% toward the south-southwest (NRC testimony, page 9, and NIRS/PC Exhibit 4, page 8 and figure 4). According to NRC's estimate of the flow rate along the contact (252 m/yr, 0.16 mi/yr), leakage emanating from the NEF could travel over four miles in 30 years (NRC testimony,

page 9). Of course, this leakage would continue flowing for some period after the NEF stopped operating.

Q33. On page 13 of its testimony, NRC states that an attempt to estimate leakage rates from the lined basins " ... *would have little or no meaning, and in fact could be very misleading.*" Do you agree?

A33. No. Estimates of leakage rates from lined facilities such as basins and landfills are routinely performed. The EPA has developed computerized models to estimate these rates (e.g., HELP, EPACMTP, NIRS/PC Exhibits 10 and 12). LES/NRC should be required to estimate leakage rates from the lined basins.

Q34. On page 19 of its testimony, NRC states that the moisture found in boring B-9 represents precipitation that that infiltrated into the shallow subsurface (6 – 14 feet). Do you agree?

A34. Yes. However, I disagree with NRC on the fate of the infiltrated precipitation. NRC believes the infiltrated precipitation will be removed by evapotranspiration (NRC testimony, page 19). I believe that a portion of the infiltrated precipitation probably makes its way to the alluvial/Chinle contact and flows along the contact. That is, the moisture found in boreholes at the NEF site, and at the WCS site, is an indication of episodic recharge (NIRS/PC testimony, page 7).

My interpretation is supported by the moist clay found in boring B-2 at the alluvial/Chinle contact (depth = 35 feet, NIRS/PC testimony, page 6). Moist clay at the alluvial/Chinle contact also occurs at the WCS site. In a study conducted by Holt, moist clay was found in 16 of 25 borings that penetrated the contact (NIRS/PC testimony, page 7). The depth of the moist clay at WCS ranged from 19 to 37 feet (NIRS/PC Exhibit 19, records of borings). The moist clay in boring B-2, and in the borings at the WCS site, is likely the result of recharge that ponded along the interface between the alluvial materials and the relatively impermeable Chinle. The clay retains water longer than the overlying alluvium.

NRC does not offer an explanation for the moisture in the clay at the alluvial/Chinle contact. It merely refers to the moist clay as an isolated observation (NRC testimony, page 19).

Q35. On pages 22 and 23 of its testimony, NRC contends that the permeability measurements performed at the proposed site (a slug test), and at the WCS site (laboratory measurements on core samples), constitute an adequate assessment of permeability at the NEF site. Do you agree?

A35. No. As explained in my testimony, slug tests and laboratory measurements on cores are not likely to measure the permeability of fractures that may be present (NIRS/PC testimony, page 10).

There is no indication that any investigator attempted to measure the permeability of fractured zones at the NEF site or the WCS site. This is a significant oversight, as fractures may be the pathways through which leakage from the NEF would flow to water bearing units in the Chinle Formation or the Santa Rosa Aquifer.

According to NRC, fractures that may act as fast flow paths probably do not exist at the proposed site. This conclusion is based, in part, on the notion that any fractures caused by faulting at the WCS site (see below) would be closed (NRC testimony, page 24). However, this is not consistent with the data obtained by Holt. Holt found evidence of water movement through fractures at the WCS site (NIRS/PC testimony, page 9).

The question of the existence of fractures could be resolved by carefully collecting and examining cores from the proposed site, as Holt did at the WCS site. If no fractures capable of acting as preferred flow paths are found, then the question would be settled. However, if such fractures are found, then LES/NRC should be required to estimate the rate at which the fractures would transmit leakage from the NEF to underlying groundwater systems.

It should be noted that all of the groundwater beneath the proposed site is subject to protection by the State of New Mexico (NIRS/PC Exhibit 35, page 2).

Q36. On page 23 of its testimony, NRC mentions faults that were recently discovered in the Chinle Formation (Triassic Red Beds) at the WCS site. NRC states that an evaluation of the faults found no evidence of fast flow paths. This is attributed to healing of the fractures. Do you agree with this interpretation?

A36. No. Holt found evidence of water movement through fractures at the WCS site. His borings logs report fractures that have healed, as well as fractures with mineral deposits. The mineral deposits indicate that the fractures have acted as groundwater flow paths (NIRS/PC testimony, page 9).

In addition, LES and NRC do not appear to have investigated the potential effects of these faults on the proposed site. They should determine whether the faults at the WCS site extend toward or beneath the NEF site. A memo from G.L. Environmental Inc. to LES indicates that a fault exists beneath the proposed site. The memo asks: " ... *will information on the fault under NEF be provided?*" (NIRS/PC Exhibit 15). LES's hydrologist has stated that, when investigating a site, he would wish to know whether a fault was present (NIRS/PC Exhibit 17, pages 100 and 101).

Q37. On page 25 of its testimony, NRC appears to claim that the analyses listed in DEIS table 6-9 are sufficient to monitor the concentrations of fuels in stormwater runoff. Do you agree?

A37. No. The only analysis in DEIS table 6-9 that might directly detect the presence of fuel components is 'Oil and Grease'. However, the detection limit for the Oil and

Grease analysis is 0.5 ppm, while the human health standard for the fuel component benzene is 0.01 ppm (NIRS/PC Exhibit 36, page 12). Therefore, the analyses listed in DEIS table 6-9 are not sufficient to monitor fuels in stormwater runoff.

Q38. On page 27 of its testimony, NRC's claims that BOD (biological oxygen demand[3]) and COD (chemical oxygen demand) analyses would detect the presence of PAHs, aliphatic hydrocarbons, and alcohols. Do you agree?

A38. No. These analyses do not detect the presence of individual contaminants. Instead, they are gross measures of the amount of organic matter in water, as indicated by changes in the concentration of oxygen or some other oxidant (NIRS/PC Exhibit 16, page 3).

Furthermore, the detection limits proposed for BOD and COD are 2 mg/L and 1 mg/L, respectively (NRC Exhibit 1, table 6-9). However, the drinking water standards for some PAHs[4] are much lower that these detection limits. For example, the human health standard for benzo-a-pyrene is 0.0007 mg/L (NIRS/PC Exhibit 36, page 12). Thus, even if PAHs could be detected by BOD or COD analyses, some of them would only be detected once their concentrations exceeded standards by a factor of more than 1000.

Q39. Does this conclude your testimony?

A39. Yes.

[3] Also known as biochemical oxygen demand (NIRS/PC exhibit 20).
[4] PAHs are a group of chemicals that includes: acenaphthylene, benzo-a-pyrene, fluoranthene, naphthalene, and other compounds (NIRS/PC exhibit 41, page 21).

1 CHAIR BOLLWERK: If we could do the
2 exhibits then I think we are all set.
3 MR. LOVEJOY: Mr. Rice, do you have, over
4 there, volume 1 and volume 2 marked NIRS/PC exhibits?
5 WITNESS RICE: Yes.
6 MR. LOVEJOY: And do those contain
7 exhibits referred to in connection with your testimony
8 on EC-1?
9 WITNESS RICE: Yes.
10 MR. LOVEJOY: Would the Board like me to
11 refer to them individually?
12 CHAIR BOLLWERK: That would be the best
13 thing, yes, just very briefly, it doesn't have to be
14 anything extensive.
15 MR. LOVEJOY: Starting with number 3,
16 exhibit 3 is extracts from the Groundwater Hydrology
17 by Herman Bower.
18 (Whereupon, the above-
19 referenced to document was
20 marked as NIRS/PC Exhibit No. 3
21 for identification.)
22 MR. LOVEJOY: NIRS/PC exhibit 5 is the
23 section 6 Geology report, I think it is extracts,
24 dated August 2004 by Cook-Joyce.
25 (Whereupon, the above-

1 referenced to document was
2 marked as NIRS/PC Exhibit No. 5
3 for identification.)
4 MR. LOVEJOY: NIRS/PC exhibit 6 is
5 extracts from the work hydrogeology by Davis and
6 DeWiest.
7 (Whereupon, the above-
8 referenced to document was
9 marked as NIRS/PC Exhibit No. 6
10 for identification.)
11 MR. LOVEJOY: NIRS/PC exhibit 7 is -- it
12 has an acronym cover sheet, and it is by DOE, the year
13 2000 Yucca Mountain Project Unsaturated PMR, and
14 Associated AMRs, Conceptual and Numerical Models of UZ
15 Flow and Transport.
16 (Whereupon, the above-
17 referenced to document was
18 marked as NIRS/PC Exhibit No. 7
19 for identification.)
20 MR. LOVEJOY: NIRS/PC exhibit 8 is a paper
21 by dutton, Groundwater Isotopic Evidence For
22 Paleorecharge in U.S. High Plains Aquifers.
23 (Whereupon, the above-
24 referenced to document was
25 marked as NIRS/PC Exhibit No. 8

1 for identification.)

2 MR. LOVEJOY: NIRS/PC exhibit 10 has

3 already been identified.

4 CHAIR BOLLWERK: Right, we just admitted

5 it into evidence.

6 MR. LOVEJOY: NIRS/PC exhibit 11 is an EPA

7 paper entitled Slug Tests.

8 (Whereupon, the above-

9 referenced to document was

10 marked as NIRS/PC Exhibit No.

11 11 for identification.)

12 MR. LOVEJOY: NIRS/PC exhibit 12 is

13 extracts from EPA's composite model for Leachate

14 Migration with Transformation Products, April '03.

15 (Whereupon, the above-

16 referenced to document was

17 marked as NIRS/PC Exhibit No.

18 12 for identification.)

19 MR. LOVEJOY: NIRS/PC exhibit 13 is an EPA

20 paper, Survey of Technologies for Monitoring

21 Containment Liners and Cover.

22 (Whereupon, the above-

23 referenced to document was

24 marked as NIRS/PC Exhibit No.

25 13 for identification.)

1 MR. LOVEJOY: NIRS/PC exhibit 14 is
2 extracts from Freeze and Cherry Groundwater.
3 (Whereupon, the above-
4 referenced to document was
5 marked as NIRS/PC Exhibit No.
6 14 for identification.)
7 MR. LOVEJOY: NIRS/PC exhibit 15 is a hard
8 copy of an email from G.L. Environmental to George
9 Harper April 6 of '04.
10 (Whereupon, the above-
11 referenced to document was
12 marked as NIRS/PC Exhibit No.
13 15 for identification.)
14 MR. LOVEJOY: NIRS/PC exhibit 16 is
15 entitled the Science of Chemical Oxygen Demand by
16 Boyles.
17 (Whereupon, the above-
18 referenced to document was
19 marked as NIRS/PC Exhibit No.
20 16 for identification.)
21 CHAIR BOLLWERK: Number 17 we've already
22 admitted.
23 MR. LOVEJOY: So 17 is in. NIRS/PC
24 exhibit 18 is extracts from the work Soil and Water by
25 Daniel Hillel.

1 (Whereupon, the above-
2 referenced to document was
3 marked as NIRS/PC Exhibit No.
4 18 for identification.)
5 MR. LOVEJOY: NIRS/PC 20 is an extract
6 from a compendium of chemical terminology biochemical
7 oxygen demand.
8 (Whereupon, the above-
9 referenced to document was
10 marked as NIRS/PC Exhibit No.
11 20 for identification.)
12 MR. LOVEJOY: NIRS/PC exhibit 21 is a
13 deposition of Campbell, Krich, Peery, Stokes and
14 Woomer, September 17th of '04.
15 (Whereupon, the above-
16 referenced to document was
17 marked as NIRS/PC Exhibit No.
18 21 for identification.)
19 MR. LOVEJOY: NIRS/PC exhibit 23 is the
20 USGS publication Groundwater Hydrology and Water
21 Quality of the Southern High Plains Aquifer Melrose
22 Air Force Range, Cannon Air Force Base, Curry and
23 Roosevelt Counties, New Mexico.
24 (Whereupon, the above-
25 referenced to document was

1 marked as NIRS/PC Exhibit No.
2 23 for identification.)
3 MR. LOVEJOY: NIRS/PC exhibit 25 is an
4 extract from the book hydrology for engineers by
5 Linsley, Kohler, and Paulhus.
6 (Whereupon, the above-
7 referenced to document was
8 marked as NIRS/PC Exhibit No.
9 25 for identification.)
10 MR. LOVEJOY: NIRS/PC exhibit 29 is a
11 pleading in this matter, entitled Answer Louisiana
12 Energy Services LP to the Request for Hearing and
13 Petitions for Leave to Intervene of the New Mexico
14 Attorney General and Nuclear Information and Resource
15 Services and Public Citizen.
16 (Whereupon, the above-
17 referenced to document was
18 marked as NIRS/PC Exhibit No.
19 29 for identification.)
20 MR. LOVEJOY: NIRS/PC exhibit 30, another
21 pleading for this matter, it is entitled Applicant's
22 objections and responses to interrogatories from
23 Nuclear Information and Resource Service and Public
24 Citizen, September 23 of '04.
25 (Whereupon, the above-

1 referenced to document was
2 marked as NIRS/PC Exhibit No.
3 30 for identification.)
4 MR. LOVEJOY: NIRS/PC exhibit number 31 is
5 comments by the National Enrichment Facility
6 concerning the Draft Environmental Impact Statement,
7 November 5 of '04.
8 (Whereupon, the above-
9 referenced to document was
10 marked as NIRS/PC Exhibit No.
11 31 for identification.)
12 MR. LOVEJOY: NIRS/PC exhibit 32 is
13 engineering data by Lockwood Greene, Engineering and
14 Construction, March 30 of '04.
15 (Whereupon, the above-
16 referenced to document was
17 marked as NIRS/PC Exhibit No.
18 32 for identification.)
19 MR. LOVEJOY: NIRS/PC exhibit 33 has
20 certainly been identified.
21 CHAIR BOLLWERK: It has also been
22 admitted.
23 MR. LOVEJOY: Been admitted, okay, yes.
24 CHAIR BOLLWERK: Yes.
25 MR. LOVEJOY: Thank you. NIRS/PC exhibit

1 34 is a paper, infiltration rates through landfill
2 liners, by Murphy and Garwell.
3 (Whereupon, the above-
4 referenced to document was
5 marked as NIRS/PC Exhibit No.
6 34 for identification.)
7 MR. LOVEJOY: NIRS/PC exhibit 35 is
8 comments dated November 8 of '04, on the Draft
9 Environmental Impact Statement by the New Mexico
10 Environment Department.
11 (Whereupon, the above-
12 referenced to document was
13 marked as NIRS/PC Exhibit No.
14 35 for identification.)
15 MR. LOVEJOY: NIRS/PC exhibit 36 is New
16 Mexico Water Quality Control Commission Regulations,
17 September 15 of '02.
18 (Whereupon, the above-
19 referenced to document was
20 marked as NIRS/PC Exhibit No.
21 36 for identification.)
22 MR. LOVEJOY: NIRS/PC exhibit 37 is
23 extracts from the work Geology and groundwater
24 conditions in southern Lea County, New Mexico, by
25 Nicholson and Clebsch.

1 (Whereupon, the above-
2 referenced to document was
3 marked as NIRS/PC Exhibit No.
4 37 for identification.)
5 MR. LOVEJOY: NIRS/PC exhibit 38 is a
6 figure by the witness, figure 1.
7 (Whereupon, the above-
8 referenced to document was
9 marked as NIRS/PC Exhibit No.
10 38 for identification.)
11 MR. LOVEJOY: NIRS/PC exhibit 39, figure
12 2, by the witness.
13 (Whereupon, the above-
14 referenced to document was
15 marked as NIRS/PC Exhibit No.
16 39 for identification.)
17 MR. LOVEJOY: NIRS/PC exhibit 40 is figure
18 3 as drawn by the witness.
19 (Whereupon, the above-
20 referenced to document was
21 marked as NIRS/PC Exhibit No.
22 40 for identification.)
23 MR. LOVEJOY: NIRS/PC exhibit 42 is a
24 pleading from this matter entitled NRC Staff's
25 Response to Interrogatories, a document request, by

1 Petitioners Nuclear Information and Resource Service
2 and Public Citizen to Commission Staff.
3 (Whereupon, the above-
4 referenced to document was
5 marked as NIRS/PC Exhibit No.
6 42 for identification.)
7 MR. LOVEJOY: NIRS/PC exhibit 43 I think
8 is already in evidence.
9 CHAIR BOLLWERK: That is correct.
10 MR. LOVEJOY: NIRS/PC exhibit 45 is a
11 paper by Reddy, and Butul, a Comprehensive Literature
12 Review of Liner Failures and Longevity.
13 (Whereupon, the above-
14 referenced to document was
15 marked as NIRS/PC Exhibit No.
16 45 for identification.)
17 MR. LOVEJOY: NIRS/PC exhibit 46 is
18 Comments by the U.S. Department of the Interior,
19 Steven Spencer, dated November 5 of '04, on the Draft
20 Environmental Impact Statement for the National
21 Enrichment Facility.
22 (Whereupon, the above-
23 referenced to document was
24 marked as NIRS/PC Exhibit No.
25 46 for identification.)

1 MR. LOVEJOY: NIRS/PC exhibit 47 is a USGS
2 paper entitled Concentrations of Polycyclic Aromatic
3 Hydrocarbons and Major Trace Elements in Simulated
4 Rainfall Runoff in Parking Lots, Austin, Texas, 2003.
5 (Whereupon, the above-
6 referenced to document was
7 marked as NIRS/PC Exhibit No.
8 47 for identification.)
9 MR. LOVEJOY: And NIRS/PC exhibit 49 is a
10 paper captioned Polyflex Inc., March 1997, entitled
11 Leakage through Liner Systems, by George Yazdani.
12 (Whereupon, the above-
13 referenced to document was
14 marked as NIRS/PC Exhibit No.
15 49 for identification.)
16 MR. LOVEJOY: We move the introduction and
17 evidence of these exhibits.
18 CHAIR BOLLWERK: So 49 is the last one?
19 MR. LOVEJOY: It is.
20 CHAIR BOLLWERK: Okay, just let me be
21 clear on one thing. Exhibit number 26, that I had on
22 my list, just so I -- is that one of the ones that was
23 withdrawn, or was a map, a wall map?
24 MR. LOVEJOY: That was a wall map which
25 turned out to have been designated as sensitive

1 material. And we decided not to introduce it.

2

3 CHAIR BOLLWERK: Again, I'm using an old

4 list so that is probably -- all right. Then the

5 record should reflect that NIRS/PC exhibits 3, 5, 6,

6 7, 8, 11, 12, 13, 14, 15, 16, 18, 20, 21, 23, 25, 29,

7 30, 31, 32, 34, 35, 36, 37, 38, 39, 40, 42, 45, 46,

8 47, and 49 have been marked for identification.

9 Any objections from the parties to the

10 admission of any of those?

11 MR. REPKA: No objection.

12 MS. CLARK: No objection.

13 CHAIR BOLLWERK: All right, there being no

14 objection those exhibits, as identified by counsel,

15 and identified for the record are moved into evidence.

16 (The documents referred to,

17 having been previously marked

18 for identification as NIRS/PC

19 Exhibit Nos. 3, 5, 6, 7, 8, 11,

20 12, 13, 14, 15, 16, 18, 20, 21,

21 23, 25, 29, 30, 31, 32, 34, 35,

22 36, 37, 38, 39, 40, 42, 45, 46,

23 47, and 49 were admitted into

24 evidence.)

25 CHAIR BOLLWERK: All right, anything

1 further from your point?

2 MR. LOVEJOY: Nothing further on direct.

3 CHAIR BOLLWERK: All right, then we can

4 move to the cross.

5 MR. CURTISS: Thank you, Mr. Chairman.

6 EXAMINATION BY MR. CURTISS OF

7 GEORGE RICE

8 MR. CURTISS: Mr. Rice, I know we are late

9 in the afternoon, and I'm going to try to keep my

10 questions relatively brief. But I do have several

11 questions that I would like to go through with you.

12 If I could first ask you to refer to page

13 9 of your direct testimony, which is, I believe,

14 answer 13. In the middle of page 9, under 2 chinle

15 dry, I would like to refer you to the statement that

16 reads:

17 In response to episodic recharge events,

18 water may flow along fractures only a few times each

19 year, or perhaps only every few years. And my

20 particular question goes to the exhibit that you cite

21 in support of that proposition, at footnote 42, if

22 that is still the correct footnote, referring to

23 exhibit 7.

24 If you could get a copy of exhibit 7 and

25 refer to that? I have a series of questions that I

1 would like to ask you about.

2 CHAIR BOLLWERK: While he is looking for

3 that, did you provide the Court Reporter with copies

4 of Mr. Rice's direct testimony, two copies? Thank

5 you.

6 MR. CURTISS: Mr. Rice, do you have

7 exhibit 7 before you?

8 WITNESS RICE: Yes.

9 MR. CURTISS: Could you explain, to us, on

10 page 9 of your testimony, in support of the statement

11 that you have made, that begins, in response to

12 episodic recharge events, what exhibit 7 tells you

13 insofar as your support for that statement?

14 WITNESS RICE: Before I do that, may I

15 just make a clarification? Some people refer to me as

16 Dr. Rice. I don't have a Ph.D., I have a Masters, just

17 to clarify.

18 But now, Mr. Curtiss, to answer your

19 question as to what in exhibit 7 supports my

20 statement, if you look at page 21 of this exhibit, and

21 you look at the second paragraph, it is actually the

22 first complete paragraph on that page, the statement

23 reads:

24 Significant infiltration occurs only every

25 few years. In these years the amount of infiltration

1 still varies greatly, depending on storm amplitudes,
2 durations, and frequencies.
3 MR. CURTISS: And could you tell me the
4 extent to which you are familiar with the geology, and
5 the geohydrology at Yucca Mountain?
6 WITNESS RICE: I'm somewhat familiar with
7 the geology and geohydrology at Yucca Mountain. I
8 have done some work there.
9 MR. CURTISS: And would you describe what
10 the geology and geohydrology is?
11 WITNESS RICE: Well, in the portion that is
12 being referred to here as a volcanic rock, it is a
13 tough, a fractured tough.
14 MR. CURTISS: And how does it relate to
15 the geohydrology and geology of the NEF site?
16 WITNESS RICE: Both are fractures, flow-
17 through fractures. The same principle would apply.
18 Often, when you have a fractured system, episodic
19 recharge will occur only a few times a year, or
20 perhaps only once every few years.
21 And that is why it is analogous to what
22 may happen at NEF.
23 MR. CURTISS: If I could direct your
24 attention here to page 19 of this exhibit, under
25 section 6, analysis/model, the second sentence that

1 begins: These processes are closely related to the
2 hydrogeologic features of the unsaturated zone, which
3 consists of heterogenous volcanic rocks.
4 These rocks have been welded and fractured
5 to varying degrees, and are divided into hydrogeologic
6 units.
7 Is it your testimony that the geohydrology
8 and the geology at Yucca Mountain, which this
9 paragraph says, this report closely relates to because
10 of the specific geohydrology is relevant here to the
11 geology at the NEF?
12 WITNESS RICE: No, Mr. Curtiss, I'm not
13 saying that the geologies are similar. But what I'm
14 saying is that this phenomenon of episodic flow-
15 through fractures occurs at Yucca Mountain, and it may
16 also occur at the NEF site.
17 MR. CURTISS: And is the extent of
18 fracturing similar at Yucca Mountain as it is at the
19 NEF site?
20 WITNESS RICE: Well, that is not known.
21 Unfortunately no work, or very little work, has been
22 done at the NEF site to attempt to characterize
23 whatever fracture systems may be present.
24 MR. CURTISS: Let me direct your attention
25 to exhibit number 25.

1 JUDGE ABRAMSON: Sorry, Counsel, whose
2 exhibit 25, NIRS/PC exhibit?
3 MR. CURTISS: Yes, I'm sorry, NIRS/PC
4 exhibit 25. All of my questions will be directed to
5 NIRS exhibits.
6 Do you have the exhibit before you, Dr.
7 Rice?
8 WITNESS RICE: Mr. Rice.
9 MR. CURTISS: Mr. Rice, excuse me.
10 Hydrology for engineers is the title of this. Would
11 you explain, to us, what this exhibit is being cited
12 for?
13 WITNESS RICE: Yes, the issue has to do
14 with how do laboratory measurements of permeability
15 compare with a field measurements of permeability.
16 And I think it is generally accepted that laboratory
17 measurements of permeability are generally less,
18 result in a lower permeability than field measurements
19 do.
20 The main reason that laboratory
21 measurements are lower is that they don't get a
22 representative volume of the rock that you are
23 investigating. In particular they won't pick up
24 fractures that may exist, because a core will have a
25 diameter of one to two inches, and often will miss a

1 fracture.

2 In addition to that, even if the core that

3 you think is fractured, it usually won't be run in the

4 permeameter for a permeability test, because these

5 tests are normally done on impact samples.

6 MR. CURTISS: And if I could direct your

7 attention to page 129 of this exhibit?

8 WITNESS RICE: Yes.

9 MR. CURTISS: Moisture in the zone of

10 saturation, and moving over to page 131, under

11 determination of permeability?

12 WITNESS RICE: Yes.

13 MR. CURTISS: The sentence that begins:

14 Such tests have limited practical value because of the

15 difficulty of placing samples of unconsolidated

16 materials. Do you see the sentence I'm referring to?

17 WITNESS RICE: Yes.

18 MR. CURTISS: Doesn't this exhibit, in

19 fact, represent an analysis of samples in the aquifer,

20 in the saturated zone? And if so, could you explain

21 the relevance of this to the vadose zone that we are

22 dealing with here?

23 WITNESS RICE: Well, it could be

24 permeability measurement of either saturated zone

25 material, or permeability, or on unsaturated zone

1 material.

2 But it goes on to say: Flow and solution

3 cavities are rock fractures, which refers to solid

4 rock, rather than just unconsolidated material. So it

5 applies.

6 MR. CURTISS: Okay. Could you point us to

7 where that reference is, where it goes on to say that?

8 WITNESS RICE: Yes, about the section 6.8,

9 and I will go down lines, 1, 2, 3, 4, 5, 6, the 7th

10 line, the first complete sentence there, it says, flow

11 in solution cavities are rock fractures.

12 MR. CURTISS: Yes, I'm reading that. And

13 isn't the sentence that precedes that indicative of

14 the fact that this is a report that focuses on tests

15 in an aquifer, and in the saturated zone?

16 WITNESS RICE: Excuse me, let me read

17 this.

18 (Witness reviews document.)

19 WITNESS RICE: Well, yes, it refers to

20 aquifer, and I would presume that aquifer refers to

21 saturated. However, the same principles apply on the

22 unsaturated zone.

23 MR. CURTISS: So this report doesn't

24 directly relate to the vadose zone that we are dealing

25 with?

1 WITNESS RICE: Pardon me?

2 MR. CURTISS: This report does not

3 directly relate to the vadose zone that we are dealing

4 with at the NEF site?

5 WITNESS RICE: Yes, it does.

6 MR. CURTISS: Let me ask you to turn to

7 exhibit 38, and I also want to direct your attention

8 to exhibit 40, if I could. Do you have the exhibits 38

9 and 40?

10 WITNESS RICE: Yes.

11 MR. CURTISS: Could you explain what these

12 exhibits represent?

13 WITNESS RICE: Yes. Excuse me, you said --

14 MR. CURTISS: Exhibit 38, let's begin with

15 that one.

16 WITNESS RICE: Okay, 38, excuse me. Yes,

17 this is my schematic representation of the geologic

18 cross section in the vicinity of the proposed NEF

19 site.

20 And what it shows is that the official

21 materials, you have around 40 feet of unconsolidated

22 material, alluvium. And for roughly 1,000 feet

23 beneath that alluvium, there is the Dockum group and

24 the Chinle formation of the Dockum group.

25 And then below that there is the Santa

1 Rosa aquifer, which is also part of the Dockum group.
2 What I have tried to depict on here, by these sort of
3 smudge lines, are places where water may exist beneath
4 the site.
5 So I have shown, at approximately 220
6 feet, the saturated zone in the Chinle extending
7 beneath the site. However, I think I should point out
8 that although this zone is thought to be continuous
9 underneath the WCS site it appears not to extend
10 completely beneath the NEF site.
11 MR. CURTISS: What is the basis for the
12 vertical, roughly vertical dotted lines with the
13 question marks beside them, what is the scientific
14 basis for that?
15 WITNESS RICE: Well, I was going to finish
16 describing --?
17 MR. CURTISS: Okay, please.
18 WITNESS RICE: May I?
19 MR. CURTISS: Go ahead.
20 WITNESS RICE: So the second layer down
21 there represents a 600 foot saturated zone that was
22 reported to be present somewhere in the vicinity of
23 the WCS site. But we don't know whether or not it is
24 present at the NEF site. So that is why I have the
25 question mark.

1 And then below that I represent saturation
2 in the Santa Rosa aquifer. Now, up on the surface I
3 show one of the playa, the buffalo wallows that exist
4 out toward the WCS site. And I show how when that is
5 filled with water, water seeps down and ponds on the
6 surface of the Chinle, at the Chinle alluvial
7 interface.
8 Now, these dashed lines that are -- those
9 are possible fractures that may exist.
10 MR. CURTISS: Mr. Rice, you don't have any
11 independent scientific evidence to support the
12 vertical fractures?
13 WITNESS RICE: Well, sure, I do.
14 MR. CURTISS: This is just your pictorial
15 representation of where they may be?
16 WITNESS RICE: Well, let me explain a
17 couple of things. We know that fractures exist in the
18 Chinle, that is clear from the Holt report. Fractures
19 extend all the way from the interface of the alluvium
20 in the Chinle, the fractures are found there.
21 Fractures are found down at 200 feet, or so, and in
22 between.
23 So we know that the Chinle is fractured.
24 What we don't know is whether or not those fractures
25 are interconnected or not, as Mr. Toblin and Mr. Peery

1 said, whether they are interconnected or not, to form
2 a network of fast flow paths. This is an unanswered
3 question that remains at the NEF site.
4 MR. CURTISS: And that is what you are
5 seeking to represent by the question mark?
6 WITNESS RICE: Yes, that that is not
7 known.
8 JUDGE ABRAMSON: If I may, counsel, I
9 would like to pursue these couple of questions with
10 you, Mr. Rice.
11 You indicated ponding beneath the playa,
12 as you characterized ponding?
13 WITNESS RICE: Yes.
14 JUDGE ABRAMSON: Did we have information,
15 do you view this "pond" as a region where water
16 occupies a significant volume fraction of the material
17 there? In other words, let's say that there were no
18 water there would be large void spaces?
19 WITNESS RICE: Yes, they are saturated
20 zones, if that is your question.
21 JUDGE ABRAMSON: It is a saturated zone
22 but it could, do you believe it is, when we say it is
23 saturated, I can picture a large number of extremes of
24 saturation. One would be a cavern that is full of
25 water.

1 WITNESS RICE: Yes.

2 JUDGE ABRAMSON: Another would be high

3 density silt that happens to be saturated. But if I

4 squeezed it I wouldn't get much water out of it.

5 WITNESS RICE: Yes.

6 JUDGE ABRAMSON: Well, what are you

7 viewing when you talk about this "poind"?

8 WITNESS RICE: Yes. This water that is

9 ponded on the relatively permeable Chinle within the

10 alluvium.

11 JUDGE ABRAMSON: I understand that.

12 WITNESS RICE: And the alluvium consists

13 of silts, sands, and gravels.

14 JUDGE ABRAMSON: So what we have is silts,

15 sands, and gravels, we may have silts, sands and

16 gravels, which are saturated. But if I were to

17 estimate the volume fraction that constituted water,

18 what would you think that number would be?

19 WITNESS RICE: Well, actually you are

20 talking about the porosity of that material.

21 JUDGE ABRAMSON: Okay.

22 WITNESS RICE: And the porosity would be

23 filled with water. And for material like this it

24 would range from 15 to 40 percent, 15 to 35 percent.

25 JUDGE ABRAMSON: It could be as high as 40

1 percent. And if there were 40 percent --

2 WITNESS RICE: It could be as high as 40

3 percent.

4 JUDGE ABRAMSON: -- what kind of, how

5 would you characterize material? If I did, if I took

6 a sample out of there, what would I find that would

7 have 40 percent porosity, how would you characterize

8 that, would that be gravel, would that be sand, would

9 sand have 40 percent porosity?

10 WITNESS RICE: Forty percent is probably

11 on the high end, maybe I should go down to like 30

12 percent. But what you would find that would have that

13 kind of porosity is gravel, or sand, or mixtures of

14 sand and gravel.

15 JUDGE ABRAMSON: If I had hexagonally

16 closed packed spheres, what would be the void

17 fraction?

18 WITNESS RICE: That is, roughly, 25

19 percent, I believe.

20 JUDGE ABRAMSON: And if I have some

21 irregular things put in there, in between, then the

22 number would be less than 25 percent?

23 WITNESS RICE: Well, it depends upon the

24 orientation of the irregular --

25 JUDGE ABRAMSON: Of course.

1 WITNESS RICE: But it could be more or
2 less.
3 JUDGE ABRAMSON: Does experimental data
4 support the view that sand has a 30, 25 percent --
5 what does experimental data tell us about the --
6 WITNESS RICE: Yes. I believe if you were
7 to look in some of the exhibits that we have here,
8 Freeze & Cherry, for example, and you looked at the
9 porosity of sand and gravel, it would be in range of
10 15, 20, 30 percent.
11 JUDGE ABRAMSON: Okay. And, did these --
12 we don't -- do we have information from the core
13 borings that were taken on the WCS site and the NEF
14 site that tell us approximately the porosity of the
15 material at the interface?
16 WITNESS RICE: Yes.
17 JUDGE ABRAMSON: I'm trying to get a feel
18 for whether there's a real potential for porous flow
19 along this interface or not.
20 MR. REPKA: Yes, I know. At the NEF site
21 I do not know if there is any site specific data for
22 that, or at the WCS. I'm not aware of any porosity
23 measurements that have been performed.
24 And I believe that is the reason that Mr.
25 Toblin shows a literature value for porosity.

1 JUDGE ABRAMSON: If I look at the core
2 information that Mr. Lovejoy referred to earlier, in
3 a lot of instances where there was gravel present or
4 fractures present, it was characterized as silt with
5 sand and gravel, for example, where we're talking
6 about gravel, what would you think would be the
7 porosity for something like that, silt with sand
8 gravel?
9 WITNESS RICE: Well, the silt and sand
10 would fill the spaces between the gravels. That would
11 tend to lower the porosity ten or fifteen percent.
12 JUDGE ABRAMSON: Okay. Now, when we're
13 looking at these dotted lines, which you're
14 postulating are interconnected fracture zones, it's
15 clear -- to me at least -- that the boring indicate
16 that there were some fractures.
17 WITNESS RICE: Yes.
18 JUDGE ABRAMSON: When we worry about the
19 kind of fractures that you're postulating might exist,
20 how would -- if such a fracture existed, what would
21 happen when we sunk a well into the 220 foot region?
22 If a material fracture existed, what would
23 the water do in that well when we got into the 220
24 foot?
25 WITNESS RICE: Yes. Well, that -- are you

1 talking about the issue -- that was about confinement
2 in --
3 JUDGE ABRAMSON: Yes, whether the water
4 will rise up in that well or whether it will stay at
5 that surface.
6 WITNESS RICE: Yes, I disagree with what
7 Mr. Peery had to say about this. I think to find a --
8 a completely confined aquifer is a very rare thing.
9 There's always a certain amount of leakage, a certain
10 amount of semi-confinement.
11 JUDGE ABRAMSON: Right.
12 WITNESS RICE: And, there certainly are
13 cases. I worked on a case in the last couple of years
14 where an aquifer is confined and it has a clay layer
15 on it, yet there are fractures in that clay.
16 And it allows water from that confined
17 aquifer to move up into the overlying aquifer, yet it
18 remains a confined aquifer.
19 JUDGE ABRAMSON: So, the fractures allowed
20 it to move up. And, were the flow-rates through those
21 fractures material? Or would you characterize them as
22 flow or as seepage?
23 WITNESS RICE: Well, there was enough flow
24 so that people who were pumping an overlying aquifer
25 could take advantage of the additional water that

1 resulted from that upward flow. If I may --

2 JUDGE ABRAMSON: Go ahead.

3 WITNESS RICE: If I may also address

4 another point, this notion that somehow if there are

5 large differences in hydraulic head between units that

6 means that there isn't flow between the units, that's

7 simply incorrect.

8 You know, there are a number of examples.

9 Well, there are many examples where you have large

10 differences in hydraulic heads between units, yet you

11 have flow between those units.

12 So, one of the best examples I can think

13 of is Los Alamos. We have a series of perched

14 aquifers. And then you have a regional aquifer. And,

15 between those perched aquifers you have unsaturated

16 fracture material.

17 And the water moves from one perched

18 aquifer to fractures down into another perched

19 aquifer, and from there down into the original. And

20 yet, there are very large head differences between

21 these aquifers on the order of hundreds of feet.

22 JUDGE ABRAMSON: And, is this because the

23 fractures are -- or that the flow paths are not large

24 enough to release the head differences?

25 WITNESS RICE: These are unconfined

1 systems in this case, in the case I just mentioned.

2 JUDGE ABRAMSON: And Los Alamos is

3 unconfined, totally unconfined?

4 WITNESS RICE: Yes, the perched as well as

5 the region.

6 JUDGE ABRAMSON: And, the system we're

7 talking about, we think this 220 foot layer and the

8 600 foot layer are relatively confined, maybe not

9 perfectly confined. Is that --

10 WITNESS RICE: Yes. Although, certainly

11 the same thing could happen there. You know, you may

12 have 100 feet difference in hydraulic head between the

13 Ogallala and the underlying dockum, or perhaps several

14 hundred feet.

15 But, certainly, the water may flow from

16 the Ogallala along fractures down into the dockum.

17 That certainly may happen.

18 JUDGE ABRAMSON: And the flow rate would

19 depend upon the hydraulic resistance of the fracture?

20 WITNESS RICE: That's right, the

21 properties of the fractures.

22 JUDGE ABRAMSON: And, if the fractures

23 were -- so, the fractures -- for the water not to rise

24 up in the well sunk into 220 foot level, the fracture

25 would have to have little enough hydraulic resistance

1 to relieve the hydraulic pressure gradient. Is --

2 WITNESS RICE: In order for it to remain

3 confined yet fractured?

4 JUDGE ABRAMSON: Yes.

5 WITNESS RICE: There cannot be a huge

6 amount of fractured permeability, otherwise it would

7 be unconfined.

8 JUDGE ABRAMSON: Okay. Sorry.

9 JUDGE KELBER: In other words, you can

10 conceive of a fracture which has resistance roughly

11 equal to several hundred feet of hydraulic head?

12 WITNESS RICE: I'm not sure I understand.

13 JUDGE KELBER: Well, if I have a pipe

14 between two reservoirs, I can attach an equivalent

15 hydraulic head because, in usual experience, water

16 flows from a high pressure region to a low pressure

17 region.

18 WITNESS RICE: I have --

19 JUDGE KELBER: In order for there not to

20 be a lot of flow, in other words, for the pressure to

21 remain high in one region and low in the other, the

22 intervening pipe must be very small.

23 WITNESS RICE: Not necessarily.

24 JUDGE KELBER: I see. Okay, I don't

25 understand Newton's Laws, but all right. I mean, a

1 simple application of Newton's Laws.

2 WITNESS RICE: I'm sorry, but there

3 certainly are cases where you have confined systems

4 with water levels significantly different between the

5 systems, yet there's flow along fractures.

6 JUDGE KELBER: We're not --

7 JUDGE ABRAMSON: Yes, the question is, how

8 much resistance -- is it not accurate to say that if

9 the resistance is low enough there won't be a

10 hydraulic head difference?

11 WITNESS RICE: That is correct.

12 JUDGE ABRAMSON: Okay.

13 WITNESS RICE: That is correct.

14 JUDGE ABRAMSON: So that's the question,

15 is what's the flow resistance along this relieving

16 path? There may be a fracture. What it seems to me

17 that the ground between you two is how much resistance

18 is there in the fracture.

19 Nobody doubts there are fractures. One

20 party says they're tiny and, even if they're

21 interconnected, the flow resistance is so great that

22 it doesn't create a material flow path.

23 And the other party says flow resistance

24 is low enough that there's a material flow path. Is

25 that --

1 WITNESS RICE: What I'm saying is that we
2 haven't done, or LES hasn't done the investigations to
3 determine what the effect of fractures may be here.
4 JUDGE ABRAMSON: Okay. I'm sorry
5 Counselor, but I think we got the picture now.
6 MR. CURTISS: I have just two more
7 questions, one on Exhibit 38. Mr. Rice, have you
8 visited the NEF site.
9 WITNESS RICE: Yes.
10 MR. CURTISS: And, when you visited the
11 site, was there evidence of a playa or the buffalo
12 wallow that you represent on?
13 WITNESS RICE: At the NEF site?
14 MR. CURTISS: At the NEF site.
15 WITNESS RICE: There are none at the NEF
16 site.
17 MR. CURTISS: Okay. Could I direct your
18 attention to Exhibit 49, please?
19 WITNESS RICE: Yes.
20 MR. CURTISS: And, if you would, turn to
21 page 304, the paragraph under the bulleted items that
22 begins geomembrane link location. Do you see the
23 paragraph there?
24 WITNESS RICE: Not yet. Let's see, what
25 was the paragraph.

1 MR. CURTISS: It begins geo-membrane leak
2 location and repair can be expensive and time
3 consuming.
4 WITNESS RICE: Yes.
5 MR. CURTISS: All right. The next
6 sentence reads construction of a leak-free liner
7 system requires a competent design liner installation
8 and testing by trained technicians and construction
9 quality assurance by qualified inspectors who are
10 independent of a liner manufacturer installer.
11 Do you have any reason to believe that LES
12 won't comply with that?
13 WITNESS RICE: Well, I believe that you'll
14 do the best job that you can. However, we know from
15 experience that many line systems leak. And it's
16 reasonable to suppose that your system will leak to a
17 certain extent as well.
18 MR. CURTISS: And, as it says here in your
19 exhibit, if LES retains a competent designer liner
20 installation and tested by trained technicians, that
21 will minimize the prospects --
22 WITNESS RICE: That may reduce the amount
23 of leakage.
24 MR. CURTISS: Okay.
25 WITNESS RICE: But you can still expect

1 leakage to occur.

2 MR. CURTISS: Okay. We don't have any

3 further questions.

4 JUDGE KELBER: Is that why a leak

5 detection system is useful?

6 WITNESS RICE: That's one reason the leak

7 detection system is useful, yes.

8 JUDGE KELBER: Can leaks be repaired?

9 WITNESS RICE: Leaks can be repaired if

10 they are detected.

11 JUDGE KELBER: If they're detected. So,

12 if leaks are detected and repaired, the amount of

13 fluid that has leaked out, possibly in this case into

14 the second, laying on top of the second liner or two

15 feet of clay or whatever, would be reasonably small.

16 WITNESS RICE: Well, I would think we need

17 to talk about the two different basins. We have the

18 one double lined basin, the TEEB.

19 JUDGE KELBER: Yes, I'm talking right now

20 about the double lined basin.

21 WITNESS RICE: Yes.

22 JUDGE KELBER: Which has the leak

23 detection system.

24 WITNESS RICE: Yes. But, it's also

25 possible for the leak detection to be bypassed if

1 there are leaks in the liner below the system, below
2 the pipes that feed water to the leak detection zone.
3 JUDGE KELBER: Well, certainly that wasn't
4 -- wasn't that a type of leak detection system?
5 WITNESS RICE: No.
6 JUDGE KELBER: Are all leak detection
7 systems faulty in that regard?
8 WITNESS RICE: No. I'm not saying that
9 it's faulty, just that it can be bypassed.
10 JUDGE KELBER: I see. So, there isn't
11 really much sense to putting a leak detection system
12 in then?
13 WITNESS RICE: No, it will detect some
14 leakage, but not all of it. That's why I think it's
15 a wise thing to have a Vadose zone leak detection
16 system beneath your lining system.
17 JUDGE KELBER: That can't be bypassed?
18 WITNESS RICE: That can be bypassed too.
19 It's another --
20 JUDGE KELBER: I'm trying to understand
21 why people should go to the expense of a leak
22 detection system of any sort if they can all be
23 bypassed.
24 WITNESS RICE: But, certainly leak
25 detection systems are better than not having leak

1 detection systems.

2 MR. CURTISS: We don't have any further

3 questions.

4 CHAIR BOLLWERK: Any further questions

5 from the --

6 JUDGE ABRAMSON: I would just like to ask

7 Mr. Rice one question about the potential water at 600

8 feet beneath the NEF site. Mr. Rice, could you, if

9 you don't have it, perhaps Counsel could get it for

10 you, just take a look at answer 23 by Mr. Harper and

11 Peery in their pre-filed direct. It's on page 15 of

12 the copy I have.

13 WITNESS RICE: The answer to question 23?

14 JUDGE ABRAMSON: Yes. Look at the second

15 paragraph where they said, with respect to

16 groundwater, the few saturated water bearing units

17 present beneath the NEF site occur at distinct depths

18 approximately 220, 600 and 1,115.

19 WITNESS RICE: Yes.

20 JUDGE ABRAMSON: In your mind, does -- is

21 NEF saying that there isn't a saturated water-bearing

22 layer at 600 feet? Because that was one of the things

23 that was at contention with part of your testimony.

24 WITNESS RICE: No. There are several

25 things here. First, the saturated zone is at 220

1 feet. Three monitor wells were installed, but that
2 zone --
3 JUDGE ABRAMSON: I'm just asking -- I'm
4 not asking whether they know it. I'm asking whether
5 they're suggesting here to you that it doesn't exist?
6 WITNESS RICE: No, I believe they are
7 suggesting -- if I read this correctly, they're
8 suggesting that it does exist.
9 JUDGE ABRAMSON: Okay. That's really all
10 I wanted to ask. If you want to follow-up in that
11 context, it's okay. And, let me just see. I may have
12 one other question.
13 I think we've covered this one pretty
14 well. Okay, that's all I have.
15 CHAIR BOLLWERK: All right. Then we'll
16 move to --
17 JUDGE ABRAMSON: Let me see if there's any
18 of -- I want to make sure I didn't open a Pandora's
19 box.
20 CHAIR BOLLWERK: Is there anything you
21 want to say?
22 MR. CURTISS: We're done with our
23 questions Mr. Chairman.
24 CHAIR BOLLWERK: All right. Let me then
25 turn to the Staff for their cross examination.

1 MS. CLARK: I do not have any cross
2 examination.
3 CHAIR BOLLWERK: All right. Then let me
4 turn to Mr. Lovejoy and see if he has any redirect.
5 MR. LOVEJOY: No further questions.
6 CHAIR BOLLWERK: None at all? All right.
7 Then it appears that we, at least at this point, done
8 with your testimony Mr. Rice. We appreciate your
9 service to the Board.
10 And we will see you again with respect to
11 Contention EC-2, I believe.
12 WITNESS RICE: Yes.
13 CHAIR BOLLWERK: All right. At this
14 point, I believe we are -- is there anyone -- are
15 there any that would not be in the rebuttal, sur-
16 rebuttal, and anyone else to put on with respect to
17 this Contention.
18 MR. REPKA: WE're not planning to do any.
19 But I would just ask the Board, does the Board have
20 any questions for our panel based on anything they've
21 heard since they were here this morning?
22 JUDGE ABRAMSON: I don't. If I do I'll
23 try to get it during EC-2.
24 MR. REPKA: Okay. So, with that we have
25 nothing further at this point.

1 CHAIR BOLLWERK: All right. Having said
2 that, let me see. At this point I believe we have
3 completed everything on EC-1, unless anyone has
4 anything further they want to put in.
5 All right. At this point I think we will
6 adjourn. Just let me point out, tomorrow morning we
7 will begin with Contention EC-4. We have a couple of
8 matters to deal with with respect to that.
9 I guess there's the question of the en
10 limine motion that's pending. Also, we can receive
11 the communication, I guess, from LES late on Friday
12 about a potential exhibit that may require -- if I've
13 got the right thing here. I thought it was EC-4.
14 MR. CURTISS: Perhaps I can clarify. EC-
15 4, which we'll come to tomorrow morning, we do have on
16 exhibit that is proprietary. In an effort to
17 facilitate a discussion of this issue in the most way,
18 we have reviewed the testimony, the direct testimony,
19 which has a proprietary question and answer number
20 seven.
21 And tomorrow we're prepared to offer that
22 question and answer as a non-proprietary version. So,
23 that will eliminate the question and answer part. We
24 also will introduce and exhibit that, which is a
25 recent press release which covers much of the

1 material.

2 Again, in an effort to have this session

3 as open as possible, we do have the one exhibit that

4 we will be offering as proprietary. If there are

5 questions on the proprietary exhibit, which is the

6 memorandum of agreement itself, we'll need to go into

7 closed session on that.

8 But, we're trying to facilitate as open a

9 session as possible.

10 CHAIR BOLLWERK: Okay. Then we'll have to

11 -- you don't know?

12 MR. LOVEJOY: I do not know. But it does

13 seem likely that there will be questions on the

14 proprietary exhibit.

15 CHAIR BOLLWERK: All right. Can we

16 structure this in such a way that that would come,

17 perhaps, last, at the end so that -- I mean, the Court

18 Reporter can certainly create a separate transcript

19 that is, has a yellow cover on it suppose.

20 But it would be better to put it in some

21 way so that we can separate that from the rest of the

22 testimony. I do not know -- I'll have to think about

23 how that would happen, the cleanest way to do that.

24 Will you accept that or come back to us in

25 some way?

1 JUDGE ABRAMSON: Well, could we do all of
2 EC-4 in sequence without the proprietary stuff then do
3 whatever we need to do proprietary in a confined block
4 right afterwards and then get back on the --
5 MR. CURTISS: Yes, I think that would
6 work. From our perspective, the proprietary exhibit
7 and the public portions that I just referred to go to
8 a substantial part of the concern that's been raised
9 by NIRS and EC-4 having to do with the Anhydrous HF
10 process.
11 And, from our standpoint, if we address it
12 at the beginning, that's fine, at the end that's fine.
13 But, if you'd like to segregate that, that would leave
14 two or three relatively minor issues from our
15 perspective that we could address in public session.
16 JUDGE ABRAMSON: Is it your view that if
17 we did that first before we went into oral EC-4 that
18 it might shorten what we need to discuss in EC-4?
19 MR. CURTISS: Well, at least it's our view
20 and our hope.
21 JUDGE ABRAMSON: Your hope? Would that
22 work for you Counselor, to deal with the proprietary
23 stuff first, just the new exhibit and whatever needs
24 to be done with it? And that might make it easier for
25 the public because we can start off with closed

1 session and then open in public --

2 JUDGE KELBER: We have some things to deal

3 with first before we get into EC-4, including the in

4 limine motion.

5 CHAIR BOLLWERK: Well, the en limine

6 motion we can actually put off until we get to the

7 actual testimony by the witness. So, that will be

8 later then their witness testimony we're talking

9 about. That would come first. So, either way we can

10 --

11 JUDGE KELBER: Okay.

12 CHAIR BOLLWERK: Well, again, the best way

13 to do it is to segment it somehow so we that we only

14 have to -- it does concern me a little bit excluding

15 the public in the first instance because we'd start

16 right first thing in the morning with it.

17 But we're going to have to do it at some

18 point one way or the other. So, it might well be

19 better if we did it, we got over, and whatever time

20 you would need for the cross examination, I do not

21 know a half hour, and then move on from there.

22 MR. LOVEJOY: That seems reasonable to me.

23 MR. CURTISS: That would be fine.

24 JUDGE ABRAMSON: Start with -- is that

25 what I'm hearing?

1 CHAIR BOLLWERK: Yes. I think that's what
2 we'll try to do then, is try to deal with that first.
3 We'll probably open, briefly explain what we're about
4 to do, and then close the session.
5 And then hopefully we can be brief about
6 it so that those individuals who are here from members
7 of the public can simply gather in the back. And we
8 won't delay them very long in coming in.
9 MR. CURTISS: Okay.
10 CHAIR BOLLWERK: That would be my hope so
11 we can move through it rapidly. We do need a list of
12 individuals who would be eligible to be here. I
13 believe LES sent us one.
14 JUDGE KELBER: Yes.
15 CHAIR BOLLWERK: I do not know if you
16 would have a list as well.
17 MR. LOVEJOY: I believe we sent one by
18 email. It's, I think, the experts, myself, Mr.
19 Malkerek, are all --
20 CHAIR BOLLWERK: When did you send the
21 email?
22 PARTICIPANT: I have a list that was --
23 CHAIR BOLLWERK: EC-7. Now, is it the
24 same list or would it be different?
25 MR. LOVEJOY: It would be the same list.

1 CHAIR BOLLWERK: The same list? All
2 right. Well, as long as it's the same list. Then we
3 can deal with that. Is there anybody from the Staff
4 that's going to be any different from any --
5 JUDGE ABRAMSON: The experts --
6 CHAIR BOLLWERK: No, he wouldn't be, I
7 don't think.
8 JUDGE ABRAMSON: The experts you need for
9 this particular issue are on the list. That's all I
10 want to make sure.
11 MR. LOVEJOY: Yes.
12 JUDGE ABRAMSON: Okay.
13 CHAIR BOLLWERK: Okay. Well, again, when
14 we close it, we'll kind of go around the room and make
15 sure everybody -- we can account for everyone that
16 needs to be there.
17 And then we'll move on from there. Again,
18 I want to -- members of the public having to come as
19 little as possible. We can do it first thing, get it
20 over with and move on from there.
21 JUDGE ABRAMSON: They can have coffee
22 while we --
23 CHAIR BOLLWERK: That'll work. All right.
24 Anything else with respect to EC-1 at this point? All
25 right. Nothing? Hearing nothing, then we will --

1 with the thanks of the Board today for your
2 presentation.
3 We found them, obviously, very useful.
4 This is a very interactive pair of technical Judges
5 here, as you're all seeing. I think they have a lot
6 of interest in what's going on and what this case is
7 about.
8 Having said that, we will stand adjourned
9 until nine o'clock tomorrow morning.
10 (Whereupon, at 6:10 p.m., the above-
11 entitled matter was adjourned.)

CERTIFICATE

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

Name of Proceeding: Louisiana Energy Service, LP

Docket Number: 70-3103-ML

Location: Hobbs, NM

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.

Edward A. Johns
Official Reporter
Neal R. Gross & Co., Inc.