

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
BEFORE THE COMMISSION

DOCKETED
USNRC

December 21, 2005 (3:30pm)

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

IN THE MATTER OF:

LOUISIANA ENERGY SERVICES
(NATIONAL ENRICHMENT FACILITY),

Docket No.
70-3103-ML

Applicant,

v.

ASLBP No.
04-826-01-ML

NUCLEAR INFORMATION AND RESOURCE
SERVICE AND PUBLIC CITIZEN,

Petitioners.

Thursday,
July 21, 2005

DEPOSITION OF:

ARJUN MAKHIJANI

called for examination by counsel for the Applicant,
pursuant to notice, at the Law Offices of Winston &
Strawn, 1700 K Street, N.W., Washington, D.C., at 8:00
a.m., when were present on behalf of the respective
parties:

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U.S. NUCLEAR REGULATORY COMMISSION

In the Matter of Louisiana Energy Services, L.P.

Docket No. 70-3103-MC Official Exhibit No. LES 117

OFFERED by Applicant/Licensee Intervenor _____

NRC Staff _____ Other _____

IDENTIFIED on 10/25/05 Witness/Panel Makhiani

Action Taken: ADMITTED REJECTED WITHDRAWN

Reporter/Clerk Bethany Engel

APPEARANCES:**On Behalf of the Applicant:**

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ALSO PRESENT:

TIMOTHY C. JOHNSON, Senior Mechanical Systems
Engineer, Office of Nuclear Material Safety and
Safeguards, Nuclear Regulatory Commission

ROD KRICH, Vice President, Licensing, Safety, &
Nuclear Engineering, National Enrichment
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JOSEPH P. MALHEREK, Policy Analyst, Critical Mass
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JENNIFER MAYER, Senior Associate, ICF Consulting

BRICE SMITH, Project Scientist, Institute for Energy
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I-N-D-E-X

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

8:06 a.m.

WHEREUPON,

ARJUN MAKHIJANI

was called for examination by Counsel for the Applicant and, having first been duly sworn, assumed the witness stand, was examined and testified as follows:

DIRECT EXAMINATION

BY MR. CURTISS:

Q Good morning. I'm Jim Curtiss with Winston & Strawn and we represent LES in this proceeding. Rod Krich is here with me, the Vice President of LES. Marty O'Neill with Winston & Strawn and Amy Roma, who you may not have met before, also with Winston & Strawn. So those are the people here. And Dave Repka on behalf of Winston & Strawn.

So welcome back. I think we'll be able to complete this deposition today, understanding that if you'd like to take a break at any time, we'll probably officially plan on one about mid-morning, around ten o'clock. But you can ask for a break at any time for

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1 any reason.

2 And we'll break for lunch at an
3 appropriate time. And hopefully complete it today.

4 The staff, I'm sure, will have questions.
5 And we'll have to judge the schedule based upon how
6 long it will take. But you can ask for a break at any
7 time.

8 I'd like to just briefly go back, Dr.
9 Makhijani, since you were deposed on November 16th and
10 17th, and just spend a few brief minutes here updating
11 things that you've done that might be relevant to this
12 proceeding since that time.

13 I don't want to go back through with you
14 all the things we reviewed at the last deposition. So
15 what I'd like you to do, unless you have a more
16 current resume, I'll -- this was the resume that was
17 entered into evidence in the deposition of November
18 16th. And we have copies here. We'd like to mark
19 this as Exhibit No. 1.

20 (Whereupon, the above-referred
21 to document was marked as
22 Deposition Exhibit No. 1 for

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1 identification.)

2 BY MR. CURTISS:

3 Q If you could just quickly review that
4 resume and indicate whether it reflects your current
5 professional experience, the activities that you've
6 undertaken since that time.

7 A Actually, I see that it hasn't been
8 updated since March 2004. If you'd like, my
9 publications since that time haven't been entered. So
10 I could have a more updated one sent or --

11 Q If you could provide it, do you -- can you
12 tell from looking at that resume, and I would
13 appreciate it if you could update it with a
14 comprehensive list of your activities, including your
15 publications since that one was prepared, but can you
16 tell from the list there whether there have been any
17 publications or speeches or articles or other
18 activities relevant to the issues in this proceeding
19 that are not represented in that resume?

20 A Yes, Dr. Smith and I wrote a report on
21 surveying uranium enrichment plants around the world.
22 It was published last September or October -- last

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1 October, I think, by the Institute. And there was an
2 article in the newsletter.

3 I normally don't put all my publications
4 and articles and things like that. Just the major
5 reports.

6 Q And what was the focus of that survey?

7 A It was just a survey of enrichment
8 technologies and news around the world. And where
9 there are research plants, where there are commercial
10 plants, military plants, and so on.

11 Q Okay. If you could make that available to
12 us and then make an updated resume available. Is
13 there --

14 A Excuse me. Would you like a copy of the
15 report?

16 Q Yes, could I please?

17 A Okay. Sure. Today?

18 Q Today or you can disclose it through
19 Lindsay --

20 A Okay.

21 Q -- in the normal course of the mandatory
22 disclosures.

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1 Is there any other activity --
2 understanding that you've submitted your July 2005
3 report and we have a copy of that and that is
4 obviously subsequent to the depositions of November,
5 is there any other activity that you think is relevant
6 to the issues in this proceeding?

7 A Well, I've done quite a bit of work as a
8 consultant to the Presidential Commission on Radiation
9 and Worker Health, not in my capacity with the
10 Institute but as an associate of Sanford Cohen &
11 Associates that listed under current employment in the
12 vitae that you have.

13 Q Yes.

14 A But I've done a good bit of work writing -
15 - coauthoring reports for the Advisory Board and
16 making presentations for the Advisory Board and so on.

17 Q Okay. Are those reports that you would
18 intend to rely on in this proceeding or otherwise
19 reference?

20 A I don't think so.

21 Q Okay.

22 A Since you asked me what major activity,

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1 that has been a very major activity.

2 Q Okay. Anything else?

3 A I do believe there are other reports. If
4 I can just make a little list at the break, I'll call
5 my office.

6 Q That would be fine. Thank you.

7 Have you been asked to appear as a witness
8 in this proceeding on behalf of NIRS/PC?

9 A Yes.

10 Q Okay. And are you appearing as an expert
11 in this proceeding?

12 A Yes.

13 Q Okay. Could you just, for the record,
14 describe what the basis is of your expertise on the
15 matters that you are going to be testifying on in this
16 proceeding?

17 A Yes. As it says in my resume, I have a
18 Ph.D. in electrical engineering, specializing in
19 nuclear fusion. I have worked on related nuclear
20 technology for more than two decades. I have written
21 on uranium enrichment. I testified as an expert
22 nuclear engineer in the prior LES proceeding.

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1 I have testified -- I've been deposed --
2 there was no trial in the Portsmouth Uranium
3 Enrichment Plant tort case. I was an expert in that
4 case. That case is still pending -- not finished.

5 I have written widely on nuclear
6 technologies. I have evaluated the economics of
7 various technologies, including nuclear waste disposal
8 technologies.

9 Q Okay. Would you describe what your
10 expertise is on the specific regulatory issues that
11 are the subject of your testimony in a particular
12 issue associated with 10 CFR Part 7, 10 CFR Part 61,
13 and any other issues that are regulatory matters that
14 you will be testifying on?

15 A Yes, I've written for two decades on
16 nuclear waste matters, including waste classification,
17 articles, books. I provided testimony, of course, in
18 the LES case and in this one. So I've studied the
19 regulations and written about them for quite some
20 time. And also testified as an expert about the
21 regulations.

22 Q Could you describe the activities that

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1 you've undertaken specifically with regard to your
2 representation of NIRS/PC in this case and the
3 activities and discussions you've had in preparation
4 for this deposition?

5 A Yes, we -- Dr. Smith, Dr. Brice Smith, my
6 colleague at the Institute, and I prepared the July 5,
7 2005 report. There was quite a bit of research and
8 review associated with that. So we did that.

9 I've reviewed the associated documents,
10 both the scientific papers as well as the final
11 environmental impact statement -- not the whole thing
12 but the parts that were relevant to this report.

13 I've reviewed LES documents that have been
14 filed since then that are relevant to this -- the
15 parts that are relevant to the cost and disposition of
16 depleted uranium.

17 Q Can you tell us what documents you've
18 reviewed and what discussions you've had relative to
19 the Envirocare site and the WCS site?

20 A Yes, well many of them are, of course,
21 referenced in this report. We've reviewed some of the
22 documents relating to the license that Envirocare.

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1 Went back and looked at the dose calculations that we
2 did in the November 2000 report, which we submitted,
3 which were done largely on the basis of Envirocare
4 parameters, semi-arid climate.

5 We did site-specific calculations to the
6 extent possible, assessing the radiation dose impact
7 of disposal at WCS.

8 We reviewed the WCS application for taking
9 federal uranium waste. I wrote a memo about that.

10 We reviewed the erosion paper submitted by
11 WCS and commissioned Dr. Carr, Professor Carr from the
12 University of Nevada to review that and prepare a
13 short letter report for us on the erosion question.

14 And we reviewed the cost questions
15 associated with disposal.

16 Q Okay. Anything else that you recall?

17 A That, I think, broadly covers it.

18 Q Okay. What I'd like to do is to turn now
19 to the interrogatory responses that were submitted on
20 behalf of the intervener in this proceeding. And I do
21 have copies of them here. And I'd like to have them
22 marked as exhibits, if I could.

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1 But perhaps I could ask you at the outset
2 -- and I'll ask the Reporter to mark the July 19th
3 response on behalf of Intervener, Nuclear Information
4 and Resource Service and Public Citizen, to
5 applicant's interrogatories dated July 8th as Exhibit
6 2.

7 (Whereupon, the above-referred
8 to document was marked as
9 Deposition Exhibit No. 2 for
10 identification.)

11 MR. CURTISS: And responses on behalf of
12 the Intervener, Nuclear Information and Resource
13 Service and Public Citizen, to Commission staff
14 interrogatories, Exhibit 3.

15 (Whereupon, the above-referred
16 to document was marked as
17 Deposition Exhibit No. 3 for
18 identification.)

19 BY MR. CURTISS:

20 Q You have those documents before you here.

21 A I have one of them.

22 Q You'll have the other one there to you

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1 shortly. The staff --

2 A Okay.

3 Q -- interrogatory responses is Exhibit 3.
4 That's 2, yes.

5 Dr. Makhijani, are you familiar with the
6 documents that you have before you?

7 A Yes.

8 Q And did you -- would you describe your
9 role in the preparation of these documents?

10 A Yes, in regard to the Commission staff
11 interrogatories, I had a much more detailed role. In
12 regard to Applicant interrogatories, I worked with Mr.
13 Lovejoy while he was at the office the day before
14 yesterday, on the 19th, and reviewed them for -- but
15 rather more rapidly. But I did have a role in
16 preparing them and I've reviewed them.

17 Q And is it your understanding that in these
18 two documents, these represent collectively the issues
19 upon which you'd be testifying in this proceeding?

20 A Yes. Of course, these documents also
21 refer to reports and other materials.

22 Q Okay. Are there any issues that you are

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1 going to be testifying on that are not addressed in
2 these two documents?

3 A In terms of issues, I don't believe so.

4 Q Okay. And do these documents accurately
5 reflect the testimony that you will deliver on those
6 issues in this proceeding?

7 A I think so. You know, as I've said, I've
8 reviewed Mr. Lovejoy's preparation of the Applicant
9 interrogatories rather more rapidly. But yes, broadly
10 it does because it was -- I reviewed it quickly before
11 it was sent off.

12 Q Let me focus then on Exhibit 2, which is
13 the Applicant's interrogatories.

14 A Yes.

15 MR. LOVEJOY: You might want to mark them
16 2 and 3.

17 MR. CURTISS: Two is the Applicant's, 3 is
18 the staff I think is the way they've been designated.

19 BY MR. CURTISS:

20 Q For the Applicant interrogatories, in each
21 of the admitted and in the case of the one opposed
22 contention, these interrogatories ask who the witness

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1 will be and the subject matter on which each of the
2 witnesses is expected to testify. You are the sole
3 witness identified here to be testifying on these
4 various contentions. And I want to confirm for the
5 record, as these interrogatories ask, what is the
6 subject matter of your testimony, that you have
7 reviewed this document, which purports to represent
8 the subject matter of your testimony, and it does, in
9 fact, represent that.

10 A Yes.

11 Q Okay. I'm going to come back to these
12 documents with specific references as we go through
13 them. I wanted you to have them before you.

14 Are you familiar with the characteristics
15 of the depleted uranium that will be generated by the
16 National Enrichment Facility?

17 A Yes.

18 Q And would you describe what your
19 familiarity is and what the characteristics are?

20 A Depleted uranium is the tail stream from
21 a uranium enrichment plant. It will be generated over
22 the life of the facility to the tune of about 133,000

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1 metric tons. Depleted uranium consists of the three
2 isotopes of uranium that occur naturally but in
3 different proportions than natural uranium.

4 Natural uranium has about 99.284 percent
5 U-238 and .711 percent U-235, .005 percent U-234. And
6 those percentages are different in depleted uranium.
7 Depleted uranium might contain .25 percent U-235 and
8 .001 percent U-234. And the rest would be U-238.

9 It's radiological characteristics, natural
10 uranium is about 670 nanocuries per gram in natural
11 form and depleted uranium would be about 400
12 nanocuries per gram.

13 Q And are there any transuranic elements in
14 the depleted uranium tails that you've referred to?

15 A There are sometimes transuranic elements
16 in depleted uranium tails if it is made from recycled
17 uranium. But so long as uranium enrichment is done
18 from natural uranium, there would not be expected to
19 be transuranic elements.

20 Q So in the normal course, unless there is
21 a transuranic element that appears from reprocessing
22 or some other activity, you would not expect that

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1 there would be transuranic elements in depleted
2 uranium of the type the National Enrichment Facility
3 would generate?

4 A Yes. In the sense -- transuranic in the
5 literal sense that it would have atomic numbers bigger
6 than 92.

7 Q And are you familiar with the procedures
8 that are set forth in the application relative to the
9 cylinder inspection for purposes of insuring there are
10 no such elements present in the waste?

11 A No, I haven't actually reviewed the
12 cylinder inspection because I have focused on the
13 deconversion and disposal. But as I said, one would
14 not -- so long as the enrichment is happening from
15 natural uranium, the transuranic elements would not be
16 present in depleted uranium.

17 Q Would you describe your position on the
18 appropriate classification of depleted uranium under
19 10 CFR Part 61?

20 A Well, there is currently no classification
21 under 10 CFR Part 61. As I read the Commission's
22 ruling, the Commission has said it is low-level waste.

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1 But it hasn't said that it is low-level waste under 10
2 CFR Part 61. So there is no classification currently
3 under 10 CFR Part 61 officially.

4 Q Have you ever taken the position that
5 depleted uranium is Class A waste under 10 CFR Part
6 61?

7 A Well, yes. As we discussed last time, in
8 the former proceeding in 1994, I did misread and
9 confuse the staff's position that it was Class A
10 waste. It seems to have been declared so again in the
11 FEIS with the Commission's provision. So I have taken
12 that position. But I did acknowledge the error in the
13 last deposition.

14 Q And nothing has changed in 10 CFR Part 61
15 relevant to this issue since you took that position in
16 the previous proceeding?

17 A In the regulation itself?

18 Q Yes.

19 A I am not aware that the regulation has
20 been changed.

21 Q Is it your position that depleted uranium
22 is under the specific terms of 10 CFR Part 61 properly

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1 classified as greater than Class C waste?

2 A Well, if you look at 10 CFR Part 61 and
3 the definitions of Class A, B, and C waste, it is
4 clearly more radioactive than that. So as I've
5 described in the reports this time and the last time,
6 from a scientific point of view, the characteristics
7 of depleted uranium, in terms of being an alpha
8 emitter and more than 100 nanocuries per gram are
9 similar to what would be classified by the EPA as
10 transuranic waste or what would be classified as
11 greater than Class C waste. That's not a legal
12 definition but a scientific definition.

13 The National Academy of Sciences' report,
14 which is cited in our July report and I believe also
15 in our November report, took the same position that
16 from a technical point of view, there is only a
17 difference of nomenclature and I believe I said last
18 time that if we borrow from Shakespeare and say a rose
19 by any other name.

20 So this is essentially an alpha emitting
21 substance with more than 100 nanocuries per gram. So
22 it has those characteristics scientifically of greater

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1 than Class C waste, yes.

2 Q If I could set aside the question of how
3 you think it should be classified, is it possible to
4 state your view as to how it is classified under
5 current 10 CFR Part 61?

6 A As I said, it is not currently classified
7 under 10 CFR Part 61. I gave my opinion about what
8 its scientific characteristics are which would be
9 similar to greater than Class C waste.

10 Q But you wouldn't take the position that
11 this greater than Class C waste?

12 A Well, as I read the Commission's ruling,
13 which is the response to the legal side of the
14 question, this is low-level waste that has not been
15 classified under 10 CFR Part 61.

16 In the absence of a legal classification,
17 and in my job as a scientist and an engineer, I can
18 only give you the scientific characteristics of this
19 thing.

20 Q Have you previously testified?
21 Understanding at the outset you indicated you are an
22 expert on regulatory issues in Part 61, have you

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1 previously testified on the proper classification of
2 depleted uranium under Part 61?

3 A Yes.

4 Q And that previous testimony, which you
5 acknowledge is in error, was that it is Class A waste
6 under Part 61?

7 A Well --

8 MR. LOVEJOY: Do you care to assist the
9 witness with some testimony to refer to?

10 MR. CURTISS: Yes, I can, yes.

11 BY MR. CURTISS:

12 Q From your deposition, on page --

13 MR. LOVEJOY: Is this the November
14 deposition in this case?

15 BY MR. CURTISS:

16 Q It is. I won't enter this into evidence
17 but the record should reflect that I am going to show
18 the witness page 48 of the deposition of Tuesday,
19 November 16th, 2004 of Dr. Makhijani. And you'll see
20 there in the highlighted section -- if you can perhaps
21 read that into the record.

22 A I had a view then about the proper

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1 classification of depleted uranium and I expressed it
2 then. I believe on looking at 10 CFR 61.55, Table 1
3 and Table 2, that the clear inference, other than
4 nomenclature, was that under this system of
5 classification, the technical inference from this rule
6 was that depleted uranium should be classified as
7 Class C waste because it was the same as greater than
8 Class C waste or transuranic waste.

9 Q Explain to me what you mean by other than
10 the nomenclature.

11 A Well, as I've just said there is just a
12 nomenclatural difference, not a radiological
13 characteristic difference in terms of environmental
14 impact between waste containing uranium in the natural
15 isotopes of more than 100 nanocuries per gram and
16 waste containing transuranic alpha-emitting isotopes
17 at more than 100 nanocuries per gram. So that's what
18 I mean as a nomenclatural difference.

19 And what I said here is that it should be
20 classified as greater than Class C waste. I didn't
21 say it was classified as greater than Class C waste.
22 And it could be classified as transuranic waste.

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1 There's no transuranic waste
2 classification under 61.55. EPA has a transuranic
3 waste classification. And as I've said before and
4 would say again, these two, from a radiological
5 standpoint so far as depleted uranium is concerned,
6 are equivalent. But it has never been declared as
7 such. I would like it to be declared as such.

8 Q So if I could summarize your position --
9 let me make sure that -- you correct me if this is not
10 right. Under the current provisions of 10 CFR Part
11 61, depleted uranium is not able to be classified as
12 Class A or greater than Class C?

13 A Well --

14 Q But should be classified as comparable to
15 greater than Class C?

16 A Sorry -- I didn't know you hadn't
17 finished.

18 The depleted uranium was considered for
19 inclusion in Part 61 in the draft stage of the rule,
20 as you know. And depleted uranium was then excluded
21 from the final rule explicitly.

22 So that depleted uranium, as such, is not

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1 covered since it was explicitly dropped in the final
2 Part 61 rule.

3 What I have been saying since '94 one way
4 or another is that depleted uranium should be
5 classified as greater than Class C waste being similar
6 to transuranic waste. So in that category, there are
7 a number of different kinds of greater than Class C
8 waste. Of course, there are greater than Class C
9 waste under Part 61 when they exceed the limits in
10 Table 1 and 2 of 61.55. But depleted uranium was
11 dropped from Part 61.

12 And my position has been that in looking
13 at the intent and radiological characteristics of
14 greater than Class C waste, in the alpha-emitting
15 line, and looking at the alpha-emitting line in the
16 EPA rules, depleted uranium belongs there although it
17 is not there currently.

18 Q A form of low-level waste but greater than
19 Class C?

20 A Yes. Since low-level waste is defined
21 under -- in the Commission's ruling as everything
22 other than high level, and 11.e.2 as a catchall

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1 category but not in Part 61.

2 Q You referred to the Commission's decision
3 in which they determined that depleted uranium was
4 low-level waste but declined to rule on the
5 classification as you've described it.

6 Is there any part of that that you agree
7 or disagree with?

8 A The whole rule?

9 Q That aspect of it. The part that says
10 this is low-level waste but it has not been classified
11 as Dr. Makhijani described it. Do you agree with the
12 Commission's determination that this is low-level
13 waste?

14 A My concern primarily is with how this
15 material is treated. And what its environmental
16 impact is. I read the Commission's decision in this
17 regard a couple of times. And tried to think about
18 it.

19 So long as -- and I don't read the
20 Commission as excluding the possibility of its
21 classification as greater than Class waste that would
22 have to be disposed of in a repository. And it's just

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1 a legal clarification of some laws. And so to that
2 extent, I would agree with it, yes. That would be
3 fine.

4 Q If I could turn to the next document,
5 which I'd like to identify as Exhibit 4 -- if this
6 could be identified as Exhibit 4 --

7 (Whereupon, the above-referred
8 to document was marked as
9 Deposition Exhibit No. 4 for
10 identification.)

11 BY MR. CURTISS:

12 Q -- Dr. Makhijani, do you recognize this
13 document?

14 A Yes.

15 Q And were you involved in the preparation
16 of this document?

17 A I'm indicated as the author of it.

18 Q And would you look at it and tell us for
19 the record if you are familiar with the substance of
20 this document?

21 A Okay.

22 Q If I could refer you to page 2 of this

1 document.

2 A Okay.

3 Q You see the table at the top. Then there
4 are one, two, three paragraphs down, the sentence
5 that states IEER has for many years opposed the
6 classification of DU as low-level waste. I take it
7 that means you are opposed to the classification of DU
8 as Class A waste?

9 A Yes.

10 Q And I take it to the extent as you
11 referred to earlier greater than Class C waste is in
12 some circumstances low-level waste, you're opposed to
13 the designation of DU as greater than Class C waste?

14 A Well, the context of this --

15 MR. LOVEJOY: Object to the form of that
16 question. It contains an assumption. But go ahead
17 and answer it if you can.

18 THE WITNESS: I forgot the question.

19 BY MR. CURTISS:

20 Q All right. I'll repeat the question. You
21 previously indicated -- setting aside what Part 61
22 itself says, that you believe DU is greater than Class

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1 C.

2 MR. LOVEJOY: I don't think he said that.
3 I object to that.

4 BY MR. CURTISS:

5 Q Have you testified before or taken the
6 position that DU is greater than Class C?

7 A As I just testified, I believe the DU
8 should be classified as greater than Class C waste
9 designated for the geologic disposal.

10 Q And greater than Class C waste is a form
11 of low-level waste under Part 61?

12 A It is not classified -- DU is not
13 classified under Part 61. Greater than Class C of
14 certain kinds is described in Part 61 but not DU.

15 Q What type of greater than Class C waste
16 under Part 61 is low-level waste?

17 A Well, under Part 61, there is a specific
18 list of radionuclides and listed concentrations in
19 Tables 1 and 2. And depleted uranium is not part of
20 that. Whenever the concentrations exceed the ones for
21 the radionuclides described in Table 1 and 2, it would
22 be greater than Class C waste.

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1 But since depleted uranium is not there
2 and was not -- and was explicitly dropped from the
3 rule, it remains to be classified under Part 61.

4 Q What do you mean by the statement that
5 you, for many years, opposed the classification of DU
6 as low-level waste?

7 A Well, what I mean by that is that low-
8 level waste is generally disposed of in shallow land
9 burial. And I don't believe that -- and all of our
10 work has shown that depleted uranium is not suitable
11 for shallow land burial.

12 And so the intent of that statement and
13 the context of the statement generally is that
14 depleted uranium should not be classified in such a
15 way that would allow land disposal.

16 Q Shallow land burial disposal?

17 A Shallow land -- well, land disposal could
18 mean shallow land or intermediate disposal. Anything
19 other than a deep geologic repository. It's been my
20 position that no classification of depleted uranium
21 should be allowed that permits its disposal in
22 anything other than a deep geologic repository.

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1 Q And what do you mean by a deep geologic
2 repository?

3 A Comparable to WIPP or Yucca Mountain.

4 Q Either one of those would be acceptable
5 for purposes of disposing of DU?

6 A I didn't say that. I said that it would
7 be comparable in the regulatory sense that
8 repositories are defined under a different rule. And
9 they have different type -- different criteria. They
10 have different release limits. They have different
11 dose limits.

12 The WIPP rule, for instance, has specific
13 release limits for radionuclides by radionuclide and
14 has certain packaging requirements to meet those
15 release limits and so on. That's what I mean by deep
16 geologic repository.

17 Q What are the characteristics of the deep
18 geologic mine? Aside from the regulatory requirements
19 that you've described, what are the geologic,
20 hydrologic characteristics of a deep geologic mine
21 that you, in describing that as an option, believe
22 would be acceptable for DU disposal?

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1 MR. LOVEJOY: You mean a repository?

2 BY MR. CURTISS:

3 Q A deep geologic repository or mine,
4 whatever.

5 A Well, a deep geologic repository is not
6 just a mine. A deep geologic repository is a geologic
7 isolation system. It is described, for instance, in
8 the 1983 National Academy report on geologic
9 isolation.

10 The purpose -- and it has to be seen as a
11 system. It consists of a set of engineered barriers,
12 starting with the waste and the waste form itself,
13 which should inhibit the release of the radionuclide,
14 packaging, further engineered barriers, seals and
15 backfill that would prevent the migration of
16 radionuclide. And a geologic setting that should
17 retard the flow of radionuclides into the human
18 environment.

19 And all of this, of course, is judged by
20 certain regulatory criteria. I've long had the
21 position, for the record, in regard to Yucca Mountain
22 that it is the worst single site that has been

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1 investigated in this country for a geologic
2 repository.

3 Q Is there any deep geologic repository that
4 fits the characteristics that you've just described?

5 A Well, I have published my own views about
6 how a deep geologic repository should be selected.
7 And I have often been in print and in my articles, on
8 the record, as saying that I do not oppose deep
9 geologic repositories. On the contrary, I believe we
10 need deep geologic repositories for spent fuel and
11 other radioactive wastes of the character of
12 transuranic waste, depleted uranium, and so on.

13 I believe that the proper way to locate a
14 geologic repository is not to rush into site
15 identification but to do several things for 10 to 20
16 years before that. The things that need to be -- and
17 I've specified that in things that I have written and
18 I can supply you that material if you like -- but I
19 can summarize it quickly.

20 There are a numbers of places that are
21 already contaminated with radioactive materials.
22 There are many places, of course, with high natural

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1 concentrations of radioactive materials. These places
2 should be carefully studied for characteristics of
3 migration. To some extent, they have been studied but
4 I think they need to be studied in the context of
5 geologic isolation.

6 Mother nature knows how to contain
7 radioactive waste in certain circumstances,
8 radioactive materials for long periods in certain
9 circumstances, and those circumstances are in a
10 geologic context.

11 We need to understand how to mimic those
12 materials and make packages and engineered barriers
13 that fit geologic settings. And I believe that
14 engineered barriers and waste packages should be
15 developed in the specific context of the geologic
16 setting.

17 So there are a number of criteria like
18 that that should be looked at in terms of rock types
19 and engineered barrier types, whether it is granite or
20 clay or whatever type of rock.

21 And there is enough experience. And I
22 believe we need a lot of in situ research. I

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1 recommended that Yucca Mountain, for instance, be a
2 non-radioactive research site for doing heater tests
3 and so on. So after 10 or 20 years, you can actually
4 know enough to do both engineered barriers and
5 geologic repository.

6 I felt the Swedish program, for instance,
7 has done well in this regard. So I think the Swedish
8 program might be a good starting point to think about
9 how to do geologic repository and engineered barrier
10 development.

11 Q Would you describe that as a plausible
12 strategy as that term is used in this proceeding?

13 A Well, I would -- if you're going to
14 develop a geologic repository, that would certainly be
15 an essential element of a plausible strategy. Whether
16 it becomes actually plausible, reasonable as an actual
17 repository, it's certainly a plausible strategy for
18 scientific research for a geologic repository.

19 Whether it becomes a plausible strategy
20 for an actual geologic repository has to be seen at
21 the end of that process.

22 Q Would you consider it to be a plausible

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1 strategy, as that term of art is used in this
2 proceeding, sufficient to inform a cost estimate for
3 purposes of that strategy?

4 A No, what I've described is a process of
5 scientific research for 10 to 20 years. And you
6 cannot develop the cost estimates of a technology in
7 advance of completing the scientific research because
8 that is at a commercial level.

9 Q So with the description that you've just
10 given, it's not possible at this point to develop a
11 cost estimate for that strategy that you've just
12 articulated?

13 A Well, for an ideal strategy for repository
14 development such as I have described, I don't know
15 what it would cost. I think that we can look at the
16 only operating deep geologic repository that has been
17 licensed as a guide for what might happen in regard to
18 transuranic waste.

19 The deep geologic repository that I was
20 referring to and that I have written about is a
21 repository that is capable of containing the most
22 radioactive waste which, of course, is spent fuel.

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1 So since we started from Yucca Mountain,
2 I went in the direction of describing what it would
3 take to develop a deep geologic repository for spent
4 fuel which is, of course, another level of difficulty
5 beyond the problem of depleted uranium or transuranic
6 waste disposal.

7 Q Based upon that, do we have any confidence
8 in cost estimates of the strategy that you've
9 outlined, given the substantial research that you
10 think needs to be undertaken at this point?

11 A Cost estimates of what?

12 Q The cost estimates of a plausible
13 strategy? You've indicated that substantial
14 additional research needs to be done. Is it possible
15 today, using the term plausible strategy and the cost
16 estimate that flows from that in the NRC context, to
17 develop a cost estimate for the strategy that you've
18 just outlined today?

19 A Well, the strategy that I outlined today,
20 as I just testified, is for spent fuel. And I don't
21 believe that this current proceeding is about spent
22 fuel.

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1 Q That's correct.

2 A As I wrote -- as we say in the November
3 2004 report, that the best guide for the costs of --
4 I believe as an engineer who has done engineering
5 economics for some time, the best guide to something
6 has to be what is happening on the ground.

7 And if we're talking about licensing, it's
8 not about what I would wish in the ideal world. It is
9 about developing a cost estimate based on what is the
10 reality on the ground and what has been licensed by
11 the government, which I believe is what this
12 proceeding is about.

13 I have said that depleted uranium has the
14 characteristics of transuranic waste and should be
15 disposed of in a deep geologic repository comparable
16 to that for transuranic waste. We actually have one
17 that has been successfully licensed. And I believe
18 it's the best to look to the costs of that repository
19 for developing a guide for depleted uranium disposal.

20 I don't believe anybody in the world has
21 got a very good idea about spent fuel repository
22 costs. And as you know, Yucca Mountain costs have

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1 escalated and escalated and escalated. And I wouldn't
2 want to volunteer today what it would cost to dispose
3 of high-level waste and spent fuel in this country.

4 Q Let's move on then. Is it your position
5 that the only acceptable form for the disposition of
6 depleted uranium is the uranium dioxide form?

7 A I think this is a matter for detailed
8 consideration. The uranium dioxide form, I believe,
9 is the best form. A detailed environmental impact
10 assessment should be done in the context of where it
11 would be disposed of.

12 As I have said, that the geologic
13 isolation system in any deep repository, whether it is
14 for depleted uranium or spent fuel, consists of where
15 you are going to put something, the waste packages,
16 and the specific location.

17 On a generic basis, since depleted uranium
18 dioxide would be capable of being formed into ceramic
19 pellets, put in zircon waste forms, I believe that
20 that is the best starting point for thinking about the
21 waste form for depleted uranium. And if I were to
22 develop cost estimates, I think that that would be the

1 best basis to do it because that's the indicated form
2 for deep geologic disposal.

3 But since no environmental impact for a
4 site has been done, I cannot say it is the only
5 possible thing. They may be zircon forms, and I
6 believe it is in our November report, that may be
7 titanate forms of uranium that might be also suitable.
8 So it is certainly not the only thing that can be
9 considered.

10 Q Have we had any experience with the
11 process that you've described of putting depleted
12 uranium in the uranium dioxide form into ceramic
13 pellets?

14 A Oh, yes. That's what nuclear power plant
15 fuel is, ceramic pellets made out of uranium dioxide.

16 Q And that's the process that you are
17 proposing for the depleted uranium to be put in
18 ceramic pellets?

19 A Well, putting it in dioxide form, it can
20 be put into ceramic pellets much better than U-308
21 powder. It can also be put in zircon and other waste
22 forms. And what we recommended in our November report

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1 is that the NRC should look at this in its
2 environmental impact statement.

3 I can't remember if that is an explicit
4 recommendation but clearly if there is to be a license
5 for this plant, then the disposal should consider the
6 alternatives of uranium dioxide as well as other forms
7 like zircon that would be suitable for deep geologic
8 packaging and disposal.

9 Q And is there sufficient experience in the
10 area of ceramic pellets or other zircon forms with
11 depleted uranium that you are aware of?

12 A Well, I don't know that anybody is making
13 depleted uranium into ceramic pellets. But depleted
14 uranium has exactly the same chemical characteristics
15 as natural uranium or enriched uranium that has been
16 made into ceramic pellets all the time in the nuclear
17 power industry. So no change is required in the
18 industry. It's easier because it is less radioactive.

19 Q And have you looked at the -- in addition
20 to the cost, have you looked at the environmental and
21 safety issues associated with the ceramic pellet
22 process?

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1 A Not in the context of this proceeding.
2 I've looked at fuel fabrication plants before. But I
3 have not -- I don't think I looked at emissions from
4 making ceramic pellets and so on. I think that should
5 be done.

6 Q Okay. I'm going to shift gears now if I
7 could. And we're going to turn back to the
8 interrogatories and specifically Exhibit 2 if you have
9 that there, the response -- LES, the Applicant
10 interrogatories.

11 Dr. Makhijani, are you familiar with the
12 term plausible strategy as that term is used in this
13 proceeding?

14 A Yes.

15 Q And would you describe what plausible
16 strategy means and what it requires an Applicant to
17 demonstrate?

18 A Well, as I understand it, a plausible
19 strategy has to be a reasonable and credible plan to
20 fulfill the objective of depleted uranium deconversion
21 and disposal, which is what I am testifying about.

22 Q Is the purpose of a plausible strategy to

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1 establish a cost estimate?

2 A Well, a cost estimate is part of plausible
3 strategy. You can't have a reasonable plan without a
4 cost.

5 Q What other purpose is a plausible strategy
6 intended to accomplish?

7 A Well, you have to have I think three or
8 four elements. Three I can think of right away. One
9 is, of course, a cost element. The other is the
10 health and environment element. Is the disposal
11 option purposed? Is the preferred option proposed?
12 Can it meet the dose limits that are prescribed in the
13 relevant regulation which would be, in this case, 25
14 millirem per year?

15 And the third is are the parties that are
16 involved in the deconversion and disposal -- well,
17 there would be two part to this. Are the parties
18 involved in the deconversion and disposal
19 technologically and scientifically competent and
20 experienced to do the job? And are they, in the
21 regulatory sense, in a position to do the job?

22 Oh, and then I guess you would have to

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1 look also at the history of the purposed parties to do
2 the job. And evaluate whether their commitments can
3 be taken seriously. So I guess under the third part,
4 I have three different items for that.

5 Q Let's take those each in turn.

6 A Yes.

7 Q The technological and scientific
8 competence to do the job --

9 A Yes.

10 Q -- as part of a plausible strategy. Could
11 you describe what you mean by that?

12 A Yes. I'll give you two different
13 examples. One positive and one negative.

14 So in regard to deconversion, Cogema is
15 doing deconversion in France on a commercial basis.
16 So I would say if LES has a contract with Cogema to do
17 deconversion or a memorandum of understanding that
18 Cogema will do deconversion, I would not raise any
19 technological questions about it.

20 I would say it is fine. They have an
21 operation on the ground. They have long operated it.
22 They are currently operating it. That should be the

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1 guide. In regard to technology and cost, there is
2 something on the ground. And I think that is the best
3 way to proceed.

4 As a contrary example, in the July 5th,
5 2005 report, we have the case of WCS that clearly does
6 not know uranium composition, that does not know
7 radionuclide ratios, that does not know to look in a
8 table. I don't believe that WCS would be qualified
9 even to receive any uranium waste much less dispose of
10 it.

11 Q All right. Let's turn to the second on
12 then which focus on the regulatory issue. What
13 element of the regulatory showing, in your view, is an
14 element of a plausible strategy?

15 A Yes, Envirocare, for instance, has been
16 mentioned in various ways in the final environment
17 impact statement as an institution and a site where
18 depleted uranium could be disposed of. And as it
19 happens, the License Amendment 22 of Envirocare
20 restricts the amount of depleted uranium that
21 Envirocare can possess at any one time.

22 And I do not believe that it is plausible

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1 under a License Amendment 22 that Envirocare would be
2 able to dispose of depleted uranium waste coming from
3 LES.

4 Q Are there any other components of that
5 second point -- the regulatory component of a
6 plausible strategy?

7 A Yes. I've said that WCS is not
8 technologically or scientifically qualified to receive
9 the waste. It doesn't have a license. A license
10 application is pending for WCS to take federal uranium
11 waste. It was not able to discriminate even waste
12 data in a technically correct way.

13 I believe WCS should be denied a license
14 given its showing in regard to its lack of knowledge.
15 And I think anybody that relies on WCS getting a
16 license and presents that as a plausible strategy
17 would not be credible. I don't believe it is credible
18 that -- WCS is not a credible party to dispose of
19 waste.

20 They don't have a license and they're not
21 technologically competent. And I believe if Texas
22 grants them a license, that the NRC should step in to

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1 protect the public health and cancel it.

2 Q For purposes of the plausible strategy
3 showing that an Applicant is required to make in this
4 proceeding, is it required, as part of that showing,
5 that the facilities that are to be employed, whether
6 it is the disposal facility that you are referring to
7 here, a deconversion facility must be licensed as a
8 prerequisite to relying on them is a plausible
9 strategy?

10 A No, I've already said that I would accept
11 Cogema for deconversion as a plausible strategy, a
12 deconversion plant There has not even been a license
13 application for that.

14 But I think on the face of it and the
15 facts on the ground, I mean I can't predict what the
16 license application would say and what the position
17 would be when the license application is made or what
18 Cogema's track record would be at the time but as we
19 sit here, I would say that even without an actual
20 license, that it is certainly plausible to assume that
21 Cogema could get a license.

22 They have a license in a country with

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1 comparable regulations. And they are operating a
2 plant. And so it certainly plausible.

3 Whether it can actually be done in the
4 event is a separate question. And I realize that.
5 But I do not believe, by contrast, that it is
6 plausible since WCS doesn't have a license. It is not
7 competent in regard to radioactive waste. It has not
8 a demonstrated record of experience in disposing of
9 large amounts of uranium.

10 It is certainly not plausible to accept
11 WCS as part of a plausible strategy for depleted
12 uranium management.

13 Q So there are circumstances in which, in
14 satisfying the plausible strategy test, you cited
15 Cogema and deconversion, it's not a necessary
16 prerequisite that the facility have a license. But in
17 the case of WCS, you have come to the conclusion for
18 the reasons you articulated that they could never get
19 a license?

20 A No, I didn't say they could never get a
21 license. I said that if they got a license, the NRC
22 should protect the health and cancel it.

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1 Q Let me correct the record. I think I did
2 mischaracterize it. You said they shouldn't get a
3 license?

4 A Yes.

5 Q And for that reason, reliance on WCS as a
6 plausible strategy isn't appropriate?

7 A That's not the reason. The reason is the
8 anterior statement. That WCS should not get a license
9 because it is incompetent and has demonstrated its
10 incompetence in making any sensible scientific
11 statement about uranium.

12 And we have demonstrated that the
13 statements that it has made in its application are
14 physically impossible based on elementary physics.
15 And a company that is not able to discern waste data
16 is not qualified to receive depleted uranium waste.
17 And should not be allowed to dispose of it.

18 Q Okay. I want to go back to Exhibit 2 on
19 a different subject. I'll come back to this. But I
20 have one question and then we'll take a break here if
21 we could.

22 At the top of page 4, in Exhibit 2, which

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1 are the Applicant's response -- the NIRS/PC responses
2 to the Applicant's interrogatories. The sentence
3 actually begins on the previous page, Dr. Makhijani.

4 Such a requirement is particularly
5 important in the case of an Applicant, like LES, and
6 the language I'd like to focus on is that must finance
7 the disposition of DU from operations.

8 What do you mean by that statement?

9 MR. LOVEJOY: Can he take what time he
10 needs to read the context?

11 MR. CURTISS: Yes, absolutely.

12 THE WITNESS: Thank you.

13 MR. CURTISS: Maybe what we ought to do
14 here to allow you to, as Counsel has suggested, to
15 understand the context of this, if you could look at
16 this during a break? Let's take a quick break. We've
17 been going about an hour. And then we'll come back
18 and focus on that question. So we'll go off the
19 record now. Thank you.

20 (Whereupon, the foregoing matter went off
21 the record at 9:04 a.m. and went back on the record at
22 9:15 a.m.)

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1 BY MR. CURTISS:

2 Q Dr. Makhijani, before we took the break we
3 were referring to Exhibit 2 and the discussion that
4 begins, or the sentence that begins on the bottom of
5 page 3 and includes the statement that, "Such a
6 requirement is particularly important in the case of
7 an applicant like LES that must finance the
8 disposition and DU from operations." What do you mean
9 by that statement?

10 A Yes. As I read the document, LES has
11 proposed to put up financial assurances of about \$190-
12 odd million. In our own estimate of costs made on
13 November 2004, I believe the total costs of depleted
14 uranium disposal would range to -- in the \$2 billion
15 and up range, at least \$2 billion.

16 And in view of the discrepancy between the
17 required resources, and any upfront monies that LES is
18 willing to put up, the only source of financing for
19 depleted uranium disposal would have to be the charges
20 that LES makes. In any case, it would have to be the
21 charges that LES makes.

22 If you look at page 27 of the same

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1 Exhibit 2, the Board, the Licensing Board in the prior
2 matter, in relation to LES, the Clayborne Enrichment
3 Center case, said exactly what it said on page 4, that
4 we should expect that LES should finance its depleted
5 uranium deconversion disposal costs out of the charges
6 that it makes to its clients.

7 In November, we also calculated the per
8 separative work unit costs of depleted uranium
9 disposal, and they are rather large if depleted
10 uranium disposal is done properly -- \$40, \$50 per
11 separative work unit and up.

12 And in view of the fact that these large
13 charges may not be able to be passed on, which also
14 the Licensing Board has said, in a competitive market
15 it's very important that to ensure in some way that
16 the full monies for depleted uranium disposal will be
17 available from LES, and that there will not be
18 stranded wastes on the backs of people in New Mexico
19 or wherever it is taken, or the taxpayer.

20 Q Is it the magnitude of the financial
21 assurance, then, that necessitates that the cost of
22 financial assurance be financed out of operations? Is

1 that your point?

2 A If LES were willing to put up \$2- to
3 \$3 billion up front, I would -- I would no longer make
4 this point. But so long as LES is not willing to put
5 up the full cost of depleted uranium up front, which
6 it is unlikely to do and has not offered to do, it's
7 an order of magnitude off, I think one should -- it
8 should be required that LES finance by charges, and
9 those charges should be reasonably calculated. And
10 the viability of this plant should be evaluated in
11 that context.

12 Q Irrespective of what the Board ultimately
13 determines to be the appropriate charge or cost for
14 tails disposition, if LES complies with the financial
15 assurance requirements of the regulations, would that
16 be sufficient in your view?

17 A No, I think there would be lot of
18 regulations and situations where the NRC has done
19 things with its licensees where the taxpayers have
20 been stuck or the government has done things with
21 private parties. I can give you two examples sitting
22 here.

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1 The Getty Oil reprocessing plant in West
2 Valley was shut down after six years, and taxpayers
3 were left with billion dollar plus liabilities. In
4 the case of Sequoia Fuels, General Atomics I believe,
5 although I'd have to check on that, said that it will
6 put up decommissioning money. And when it shut down
7 the plant, it walked away from its liabilities, and
8 the NRC did not have money in -- in the bank from
9 General Atomics to be able to enforce anything.

10 So when a corporation doesn't have
11 sufficient assets to cover the taxpayers, I think it's
12 very important that the monies be put up front.
13 Actually, I think that's the best thing.

14 Q Specifically, what I hear you saying is
15 that the compliance with the regulations, and, in
16 fact, the regulations themselves, are insufficient to
17 address the concern that you're raising.

18 A Well, I don't say the regulations are
19 insufficient. I think the Commission certainly has
20 the power to order any licensee to put up sufficient
21 funds. It should just do it.

22 Q Let me restate my question, then. If

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1 irrespective of what the Board determines to be the
2 cost that has to be financially assured, LES, for that
3 cost, complies with the existing financial assurance
4 regulations, is that sufficient, in your view, to
5 address this issue?

6 MR. LOVEJOY: Object to the form of the
7 question. That's a pretty formless hypothetical. You
8 haven't given a specific figure. How can he answer?

9 BY MR. CURTISS:

10 Q Well, whatever the figure is.

11 A Are you saying whether I would endorse an
12 action of the government, whatever it does? The
13 answer to that is no. I have -- you have to look --
14 you have to look at whether the government's action is
15 prudent in regard to the facts on the ground, and I've
16 given you two examples where the government allowed
17 very significant liabilities in terms of health to be
18 left on the ground for the neighbors of the plant, and
19 for the corporation that owned it, to walk away from
20 its liabilities.

21 And so, obviously, any governmental action
22 in regard to a license has to be looked at in regard

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1 to the past record of the industry.

2 Q Let me --

3 A And the government itself.

4 Q Let me restate my question to clarify it.

5 On the issue of the mechanism for financial assurance,
6 as opposed to the amount, is it your position that if
7 LES complies with the existing regulations that
8 address the mechanism for financial assurance that
9 that is sufficient, or is it your position that those
10 regulations are in some way inadequate to address your
11 concern?

12 MR. LOVEJOY: Objection. I think you need
13 to point out what regulations on mechanism you're
14 referring to.

15 THE WITNESS: And sufficient for what?

16 BY MR. CURTISS:

17 Q Let me back up. At the outset, Dr.
18 Makhijani, in response to my question about whether
19 you were an expert on Part 61 and Part 70 --

20 A Right.

21 Q -- you've said you were -- the financial
22 assurance regulations that I'm speaking about are in

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1 Part 70.

2 A Yes.

3 Q And so --

4 A You didn't mention them specifically. I
5 presumed you were talking about that.

6 Q The financial assurance mechanisms in Part
7 70, a section of the regulations that you're
8 testifying as an expert on, my question goes to the
9 mechanism in Part 70 for financial assurance, not the
10 amount but the mechanism which flows from your comment
11 that LES ought to be required to put the entire amount
12 up front. That's the mechanism for financial
13 assurance.

14 And my question is: if LES complies with
15 the mechanism, the alternatives, available to it in
16 the existing Part 70 financial assurance regulations,
17 is that sufficient to address your concern? Or are
18 those regulations insufficient to address the concern
19 that you're raising?

20 A No, no. My --

21 MR. LOVEJOY: Object to the form of this
22 question. You go ahead and deal with it as you can.

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1 THE WITNESS: My problem is not with the
2 regulations, just to be clear. I don't think that LES
3 complies with the mechanism of the regulation. LES
4 has to comply with the license condition, and under
5 those regulations that the NRC would set for this
6 plant.

7 And what I'm saying is that the NRC has to
8 -- should specify that sufficient funds be put up
9 front, which is what he said, or that sufficient
10 charges be made as part of the -- as part of the
11 marketing of enrichment services, to cover the
12 realistic costs which in my judgment would be \$2- to
13 \$3 billion, and that the viability of this plant
14 should be examined in that context.

15 I have no problem with the regulation
16 itself. This is a statement about what should be
17 required as a license condition.

18 BY MR. CURTISS:

19 Q Okay. Thank you. Let me move on. Same
20 Exhibit 2, if I could, on page 5. And I want to ask
21 a series of questions, Dr. Makhijani, beginning at the
22 top of page 5, in the sentence that begins, "In some

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1 situations."

2 A Yes.

3 Q Perhaps if you could read that paragraph
4 down to C, actually the entire page, and then I'll
5 have some questions about that.

6 A Okay.

7 Q Beginning at the top of that page, in the
8 first sentence, the phrase "business commitment of
9 some level." "In some situations, it is not possible
10 to establish the cost of an element of decommissioning
11 a plant unless a business commitment of some level of
12 assurance is provided." What do you mean by "business
13 commitment of some level"?

14 A By a "business commitment of some level"
15 I mean a commitment to supply services within a range
16 of costs, or a mechanism that would determine the
17 specific costs based on an actual plant. For example,
18 in the case of a deconversion plant, the plant that is
19 actually operating in Europe, and services by that
20 party.

21 Some specific credible way in which the
22 cost can be relied on as part -- to be determined to

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1 be reasonable. A promise to negotiate a cost, for
2 instance, is not such a thing. So if there -- if
3 there is an informal understanding without any
4 commitment -- and I don't say it should be at the firm
5 contractual level, but certainly there should be an
6 indicated range and a means by which a price and a
7 contract would be determined, and a basis on which it
8 should be determined.

9 That has to be a part of a plausible cost
10 commitment. It cannot be a vague assurance that can
11 be changed or a vague -- a vague statement that can be
12 changed at any time that contains no basis for how it
13 might be changed, when it might be changed, whether
14 there are any upper limits to the cost, and so on.

15 Q That sentence begins, "In some situations,
16 it's not possible," so forth and so on.

17 A Yes.

18 Q What do you mean by "in some situations?"
19 Are there some situations where a business commitment
20 of some level is required and others where it's not?

21 A Well, I think a level of business
22 commitment would depend on the element of the cost.

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1 I gave you a positive example at the very start of
2 this discussion in regard to Cogema. They are
3 operating a plant. They have inexperience at the
4 plant. They have given you a certain estimate, and I
5 don't know -- I guess -- have all parties here signed
6 the confidentiality --

7 Q Yes. I believe on our side they have, but
8 perhaps if there's a way not to speak to the specific
9 --

10 A Okay. Yes.

11 Q -- proprietary matters to answer the
12 question, that would at least ensure that nothing is
13 disclosed inadvertently.

14 A Okay. No problem. There was a certain --
15 there was a certain figure that was provided by Cogema
16 in relation to its contract with -- with Urenco for
17 deconversion and transport and storage. I believe
18 that that kind of -- that kind of number and
19 memorandum of understanding with that kind of party,
20 around that number or some provisions for cost
21 escalation for exchange rate considerations, how
22 exchange rate considerations would be addressed, this

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1 would be satisfactory.

2 However, a conversation or a letter
3 exchange and a promise to negotiate with Envirocare or
4 WCS, where WCS has no license and Envirocare may not
5 even be qualified to accept the waste. This is --
6 this is not satisfactory.

7 Q You've spoken to two that are examples of
8 this point that you've made here in your testimony --
9 Cogema on the one hand, the cost estimate that's based
10 upon the operating facility, and WCS on the other
11 hand. Are there other components of the plausible
12 strategy having to do with other elements of it that
13 you think fall on one side or the other of this? In
14 some situations you need this business commitment?

15 MR. LOVEJOY: Object to the form of that
16 question. I think you need to identify what strategy
17 you're referring to. I mean, I'm not sure LES has
18 made clear what its plausible strategy is. If you do
19 that, then he can address the components.

20 BY MR. CURTISS:

21 Q The components of the plausible strategy
22 that I'd like to ask you about, you've spoken to two

1 already -- disposal at WCS and deconversion by Cogema.
2 You're familiar, as you lay out in your testimony
3 here, about the other elements of the strategy, which
4 include disposal at other locations -- you speak to
5 Envirocare -- and transportation.

6 With respect to those two elements of the
7 plausible strategy, Envirocare, and the transportation
8 estimate, would you consider those to be situations
9 where it is not possible to establish the cost element
10 unless there is a business commitment of some level?

11 A In the case of Envirocare, I think there
12 has to be a business commitment. I don't think,
13 actually, that Envirocare today could give you a
14 reasonable business commitment, because it is
15 prohibited by License Amendment 22, as I read it, or
16 would likely be prohibited from accepting very large
17 quantities of depleted uranium waste.

18 I could give you another example. The
19 calcium fluoride disposal would require a business
20 commitment at a greater level than has been presented
21 by -- by LES. You have a cost estimate from -- from
22 Lee County Landfill, \$31 a ton.

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1 The final environmental impact statement
2 addresses only one option for calcium fluoride
3 disposal, which is a low-level waste. I don't believe
4 that any commitment from Lee County Landfill to
5 dispose of calcium fluoride would be acceptable under
6 the final environmental impact statement as it stands.

7 And I don't believe that's a satisfactory
8 level of business commitment and a commitment from a
9 low-level waste operator with an indicated range of
10 prices, that it's within the general range of what's
11 possible within the Compacts they're operating, such
12 as the Atlantic Compact would be much more along the
13 lines of what is required.

14 Q The one example that you've given, then,
15 where you, based upon the experience of the vendor in
16 operating a facility and producing a cost estimate,
17 that as you've described it earlier in response to
18 this question you would say doesn't require a business
19 commitment of some level has to do with a deconversion
20 experience of Areva.

21 A Yes. I think -- I think as a corporation,
22 just separate from, you know, siting and various other

1 factors, as a corporation I would say Areva is in a
2 good position to -- to on the basis -- if it is on the
3 basis of its experience, to arrive at some kind of --
4 and give you a business commitment that is -- that is
5 credible, provided, of course, it is specific.

6 Q Let me flip over to page 9, then, on this
7 very subject, Exhibit Number 2, and ask you to read
8 the paragraph B that begins about the middle of that
9 page.

10 A Yes.

11 Q Is it your position in this paragraph that
12 for us to be able -- for LES to be able to rely on
13 Areva for deconversion that there has to be a contract
14 in place?

15 A No. But the existing memorandum of
16 understanding doesn't mention a cost, it doesn't
17 mention the basis on which the cost would be arrived
18 at. It's actually a little more than what's in the
19 press release, and I don't believe that that's a
20 satisfactory arrangement.

21 I don't think a firm contract is required,
22 but as I testified before it has to be a cost that is

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1 credible based on its operating experience. And as I
2 am reading the more recent matters, LES has retreated
3 in terms of its -- the cost estimates that it has
4 provided based on the experience of Cogema's operation
5 at the deconversion plant.

6 In fact, I think the situation today is
7 less credible than it was when we filed our November
8 report, because if you take the cost that was given to
9 us from the Cogema plant, and multiply by the
10 appropriate exchange range, which, by the way, is not
11 \$1 to the euro, the figures that you get are
12 considerably in excess of what LES is presenting.

13 Q Is this paragraph in your testimony -- in
14 this report on your testimony intended to take the
15 position that in order for LES to rely on Areva there
16 must be a contract in place?

17 A No, I've already said that I don't think
18 that a contract is required to be in place, but I
19 think a cost figure that is derived from their
20 experience, and based on their experience, is
21 necessary.

22 Q I want to focus your attention in on the

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1 last three lines of this answer. "Does not commit any
2 party to make such a contract." Is that intended to
3 mean that a contract is not required? "Nor to take
4 steps towards such a contract."

5 A Well, as I said, a contract is not
6 required. What it says is that -- that -- as I've
7 just testified, it's a little more than a press
8 release that says we're going to talk. I don't think
9 a commitment to talk is -- is sufficient for a
10 plausible strategy.

11 A memorandum of understanding, which --
12 which contains the basis on which the costs are going
13 to be determined, which contain some upper limits,
14 which contains, I believe, firm reference to their
15 operating experience, says something about how
16 exchange rate considerations are going to be handled,
17 I don't say that you are going to fix an exchange
18 rate, but I certainly have dealt with international
19 contracts in my own little institute, and I do know
20 that some party has to bear the exchange rate risk.
21 And if you don't specify which party is going to bear
22 the exchange rate risks, you don't have a plausible

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1 strategy.

2 Q Let me flip back to page 5. And if you
3 answered this question already, I want to focus your
4 attention on response C, and specifically the sentence
5 that reads, "Thus, the need for contractual
6 arrangements depends upon whether such arrangements
7 are necessary to make the plan reasonable and
8 credible." Could you describe, beyond the examples
9 you've given here, what you mean by that?

10 MR. LOVEJOY: What is reasonable and
11 credible?

12 MR. CURTISS: No. What he means by this
13 statement in his testimony.

14 MR. LOVEJOY: Well, I'll just note for the
15 record that these are interrogatory responses on
16 behalf of NIRS/PC. This is not Dr. Makhijani's
17 prepared testimony. But you're welcome to ask him
18 questions in these terms.

19 THE WITNESS: Now I forgot the question.

20 MR. LOVEJOY: Could the Reporter read back
21 the question? Or could you restate it, please?

22 BY MR. CURTISS:

1 Q Let me just -- I can rephrase the
2 question. I would note that each one of these
3 interrogatories asks for the position, the substance
4 of the facts and positions of Dr. Makhijani. And at
5 the outset of the deposition, he indicated that he --
6 you indicated, excuse me, that you were involved in
7 the preparation of this, and it reflected the
8 testimony that you will give and the issues upon which
9 you will be testifying.

10 A Broadly and generally I think I testified.
11 We can refer to the testimony that I actually gave.

12 Q Is there anything in here that represents
13 NIRS used, but not yours?

14 A As I said, I got -- I got a draft. I'm
15 trying to be careful and accurate. I got a draft of
16 this from Lindsay at 4:00 yesterday. It's a complex
17 document. I got two reports that we've prepared.
18 Brice and I worked on answers to the Nuclear
19 Regulatory Commission staff's interrogatories, which
20 cover a good bit of the same territory.

21 I actually decided that, you know, I had
22 to go through this rather rapidly before it was

1 prepared. I'm in general agreement with it, but I'm
2 not going to stand by every single word and phrase in
3 here, because I didn't write every single word and
4 phrase and approve it.

5 This is -- this is something that I
6 generally agree with. I helped edit it. I went over
7 it. I gave my comments to Lindsay, he entered them
8 into the computer, and I reviewed it for probably 15
9 minutes before -- in its final form before --

10 Q Okay.

11 A -- it was sent off.

12 Q I appreciate that. Maybe we can get at
13 the issue consistent with that caveat on page 5 under
14 response C. The sentence, "Thus, the need for
15 contractual arrangements depends upon what
16 arrangements are necessary to make the plan reasonable
17 and credible." Do you agree with that statement?

18 A Yes.

19 Q Okay. Would you describe what you, in
20 agreeing with that statement, intended to mean?

21 A Yes. I'll again give you two examples.
22 WE've talked about Cogema and the deconversion plant,

1 and I've told you that a contract with Cogema wouldn't
2 be necessary, but you would have to have a great deal
3 more than what you have currently.

4 In the case of WCS, which doesn't have a
5 license, and which is unqualified, I believe that a
6 contract with WCS would at least be necessary, but not
7 sufficient in my view. In that regard, first of all,
8 the WCS would have to, on a prior basis, get a price
9 from the Texas Compact Commission.

10 As WCS has said, it is not in a position
11 -- the prices for disposal will not be set by WCS, but
12 by the Commission. So any assurance that WCS gives
13 you about a price is really -- I don't think it's
14 worth the paper that it's printed on, because WCS is
15 not licensed and it -- it is not authorized to set a
16 price.

17 And so until the Commission sets a price,
18 and WCS gets a license, those will be the minimum
19 conditions. I also believe that WCS would have to
20 demonstrate somewhat more confidence than it has.

21 Q Okay. Would it be fair to say that -- and
22 we've talked about this issue in a couple of different

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1 places, including the nature of the business
2 commitment and the contractual nature that you are
3 speaking about here. And I'd like to extract from
4 your examples what I understand you to be saying, and
5 you can correct me if I misunderstand it.

6 That the extent which business commitments
7 and/or contracts are required really hinges upon, in
8 your view, a determination as to whether the vendor
9 for that activity has experience in the area,
10 including licenses or facilities that have been
11 operated that are the basis for demonstrating that the
12 vendor has experience in a particular area.

13 A Yes, that's necessary. Not sufficient,
14 but necessary.

15 Q What else would you have to demonstrate?

16 A Well, you have to demonstrate actual
17 contract performance in the past. If you're not going
18 to have a contract, you'll have to demonstrate that
19 you have actually performed under contracts given to
20 other parties. So if you've got a party, for
21 instance, that has egregiously violated contracts, and
22 that give you an assurance or even a contract, I think

1 you have to look again.

2 Q Okay. On the top of page 10 in Exhibit 2,
3 under C, there's a reference to TLI and the
4 transportation services, the cost estimate provided by
5 TLI for transportation of various materials for LES.

6 A Right.

7 Q And that statement, "The e-mail from TLI
8 makes no commitment to provide transportation
9 services, and does not provide any information to
10 support the figures stated." Can you tell me, if you
11 know, who TLI is?

12 A Yes. Actually, that's the transportation
13 company that you negotiated with or discussed with to
14 give you an estimate of -- I believe the upper limit
15 estimate was 85 cents a kilogram of uranium.

16 Q And are you familiar with the experience
17 of TLI in the transportation of nuclear materials?

18 A No, actually, I did not look at TLI in any
19 detail.

20 Q And if they had extensive experience, and
21 had in that extensive experience all of required
22 licenses, and if they, in caring out those activities

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1 under their licenses met commitments that they had
2 made to the customers that they provided the
3 contractual commitment that you referred to, would you
4 believe that to be a reasonable estimate, if that
5 company met those criteria, without any further
6 commitment from them?

7 A Well, I think -- I think you have to have
8 at least a memorandum of understanding, and I -- that
9 gives an upper limit to the costs, and that sets forth
10 the bases on which costs will be calculated and
11 changed.

12 I don't believe that what you have from
13 TLI currently -- currently contains that. In this
14 regard, with the proviso that you just stated, my
15 position would be somewhat similar to my position with
16 Cogema, that it would put them in the same category,
17 although, as I said, I have not investigated that.
18 And we didn't cover transportation issues in any
19 significant detail in the July report.

20 Q Are you going to testify on the
21 transportation issue?

22 A Oh, yes. To some extent, yes, but we have

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1 not focused in detail on -- on this question, with the
2 proviso, I would say, that they are presuming that
3 what you said characterizing them is correct. That
4 the level of plausible strategy in the transportation
5 element would have to be similar to Cogema.

6 Q Okay. Do you agree with the statement
7 made in paragraph C?

8 A I haven't reviewed all documents in
9 relation to TLI and its background. I reviewed the
10 particular exchange of paper where they give you that
11 85-cent estimate. And if that is the basis of your 85
12 cents, then I think it's -- it's -- something more
13 than that is necessary.

14 As I have said, if there is a memorandum
15 of understanding that I'm not aware of, then -- then
16 I would not agree with it. But as I believe -- as it
17 stands, I think it's okay probably.

18 Q Okay. Now go back to page 5 of Exhibit 2.
19 In the partial paragraph at the top, in the middle of
20 that paragraph, the sentence that begins, "Further, it
21 is not possible." Do you see where I am?

22 A Yes.

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1 Q Could you read that?

2 A Aloud or --

3 Q To yourself.

4 A Yes.

5 Q Do you agree with that statement?

6 A Yes.

7 Q Is it your position in this proceeding
8 that under no circumstance can a strategy for the
9 disposal of depleted uranium be found to be plausible
10 unless a specific site is identified?

11 A Yes.

12 Q And would you also take that position for
13 other elements of plausible strategy? Let me give you
14 an example. Would it be possible to assess -- for the
15 agency to find that the applicant has presented a
16 plausible strategy and a reasonable cost estimate with
17 respect to transportation without identifying specific
18 transportation routes?

19 A I haven't -- I haven't actually, as I just
20 testified, looked -- looked at the question of
21 transportation in detail, and certainly I haven't
22 looked at the question of transportation routes. And

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1 I don't believe I'm going to testify about
2 transportation routes.

3 Q Okay. Would you -- this refers to
4 disposal, Dr. Makhijani, this paragraph. Would you
5 reach the same conclusion -- that is to say, it's not
6 possible to determine whether a given disposal
7 strategy will accomplish something? Would you reach
8 the same conclusion for a deconversion facility?

9 A Let me say this about transportation
10 routes, although I'm not going to testify about it.
11 Transportation routes for movement of waste are
12 established. Waste is being moved. Even spent fuel
13 is being moved, and successfully so far.

14 That is not -- the siting of a geologic
15 repository, which I believe would be required for
16 depleted uranium, is a considerably more complex and
17 rare matter than movement of waste. So the -- I think
18 as a first step, in regard to deconversion and
19 identifying the party, certainly it is quite -- Cogema
20 is a plausible party.

21 And if you have an agreement of a way to
22 set the price and exchange rate risks, and so on, I

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1 think the first step in a deconversion plausible
2 strategy would certainly not require a contract with
3 Cogema, as I said.

4 Q I'm sorry. I have a slightly different
5 question. Would it require, referring to this
6 paragraph, the sentence that begins -- would it
7 require identification of a specific site for a
8 deconversion facility?

9 A No. I think -- I think if you had a
10 siting process, I think that would be sufficient. The
11 -- I don't -- I think that nuclear facilities of that
12 nature are sited and licensed in this country, and so
13 if there were a siting process that required of the
14 licensing this -- this would be okay. I don't think
15 an exact site would have to be identified. I think a
16 siting process would probably be sufficient.

17 Q I have one other question on that
18 paragraph, the last sentence that begins, "NIRS/PC do
19 not contend that a facility must be fully licensed in
20 all respects." Do you see where I am?

21 A Yes.

22 Q If you could read that sentence.

1 A Yes.

2 Q Do you agree with that sentence?

3 A Yes.

4 Q The same answer goes on to state that, "If
5 a facility is unable to be licensed or to operate as
6 proposed, it would not be a critical element of DU
7 dispositioning strategy."

8 A A credible element.

9 Q Credible. Would not be a credible
10 element, excuse me, of a DU dispositioning strategy.

11 A Yes.

12 Q How would one determine that a facility is
13 unable to be licensed without going through the
14 licensing process?

15 A Well, I've just given you an example. Let
16 me go back to Cogema. They are operating a facility
17 like the one you're proposing under circumstances that
18 are very similar to the one that you're proposing.
19 They have successfully done so. They know the costs,
20 and I haven't looked at -- I haven't looked at the
21 record. I'm presuming that they are more or less --
22 or completely operating within the norms of the French

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1 Radiation Protection regulation.

2 And so I think -- and I actually presume
3 that they are in making all my statements, and -- and
4 so I think -- I think that in that case the party --
5 I would judge the party that would be able to be
6 licensed or the facility that you are proposing, and
7 for the services that you want them to provide.

8 In contrast, I would say that, for the
9 reasons I've already said a couple of times, WCS would
10 not be able to operate or license -- be licensed as
11 proposed to dispose of depleted uranium, because it
12 doesn't possess a license and should not possess a
13 license because it's not competent to protect the
14 public health there in regard to depleted uranium
15 waste in large quantities.

16 Q For a deconversion facility, which you
17 have spoken to in response to several of the questions
18 here, based upon the experience -- correct me if this
19 is not correct -- based upon that experience, a site
20 needn't be located, identified, so long as there's a
21 regulatory process for such a facility to be licensed.
22 The license doesn't have to be issued, and the plant

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1 doesn't have to be built in order to determine that
2 it's a plausible strategy, and a reasonable cost
3 estimate can be formulated therefor.

4 MR. LOVEJOY: Object to the form of the
5 question. It misstates his testimony.

6 MR. CURTISS: I asked him to correct me if
7 he's wrong -- I'm wrong.

8 THE WITNESS: I didn't say that the siting
9 process should exist in the regulations. I said that
10 a siting process should exist for this facility.
11 Certainly, the siting process is what the Nuclear
12 Regulatory Commission has established in general that
13 are applied in specific cases when facilities are
14 licensed.

15 And since this facility is an essential
16 part of the LES overall plan for building an
17 enrichment plant, and taking care of the waste, I
18 think a siting process for this facility has to be
19 identified, but a specific site need not be.

20 BY MR. CURTISS:

21 Q And the plant obviously needn't be built.

22 A Yes.

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1 Q Okay. On page 11 -- one more question on
2 this topic -- of Exhibit 2, under paragraph E, if you
3 could read that to yourself.

4 A Yes.

5 Q Do you agree with that paragraph?

6 A Yes.

7 Q And I want to focus specifically -- this
8 is a discussion of the Paducah and Portsmouth
9 deconversion facilities. Are you familiar with the
10 contract that has been executed for the construction
11 of these facilities?

12 A Some time ago I looked at it. I haven't
13 looked at it recently.

14 Q Who are the principal vendors involved in
15 this?

16 A The UDS is the vendor involved.

17 Q And who are the individual companies
18 involved in that?

19 A Framatome, I believe. Is it Westinghouse?
20 I -- let me refresh my memory.

21 Q And is Framatome related in some way to
22 Cogema?

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1 A Are they both part of Areva? If I
2 remember correctly. Is that right?

3 Q I believe that's correct, but you're
4 testifying here.

5 A Sometimes, you know, corporate boxes.

6 Q Yes. The phrase, "Currently, neither
7 facility has been built." On the basis -- let's just
8 assume here that the UDS contact involves the Cogema
9 technology. When you say "neither facility has been
10 built," I'm now confused as to whether, for a
11 deconversion facility, the facility actually has to
12 have been built for purposes of satisfying the
13 plausible strategy standard.

14 MR. LOVEJOY: Do you have -- is this a
15 question?

16 MR. CURTISS: Yes, I do.

17 BY MR. CURTISS:

18 Q Set aside the question of who is building
19 this facility, the phrase, "Currently, neither
20 facility has been built," Dr. Makhijani, you have
21 currently -- previously testified that with respect to
22 a deconversion plant, as part of LES's plausible

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1 strategy, that given Cogema's experience that the
2 plant doesn't have to be sited or licensed or built.

3 And what I'm trying to clarify with the
4 witness is the statement here that suggests that the
5 facility has to be built. And could you reconcile
6 that with your earlier observation that suggested that
7 a Cogema -- because of the Cogema experience, the
8 plant neither needs to be sited, licensed, or built.

9 A Well, I'd be happy to do it. In the
10 earlier case, my testimony specifically referred to an
11 agreement between two private parties -- LES and
12 Cogema. I think if you have a sufficient level of
13 assurance between two private parties, where both
14 private parties are -- have some level of liability,
15 they are more likely to carry out their agreements
16 than when one of the private parties happens to be the
17 government department called the Department of Energy.

18 I note for you that the -- in the case of
19 Department of Energy, even when things are built,
20 sometimes they are not built. Let me give you an
21 example of that apparent contradiction.

22 In 1982, the Department of Energy started

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1 to build a vitrification plant and a preprocessing
2 plant for high-level waste at Savannah River Site.
3 Department of Energy took -- with an estimated budget
4 in 1987 of \$1.2 billion. The eventual budget, by
5 1992, was \$3.9 billion. It didn't open for several
6 years until after that. And when it did open, it was
7 a plant that was only capable of processing about 10
8 percent of the volume of high-level waste.

9 The history of the Department of Energy in
10 managing its contractors is very poor. I can give you
11 the example of the Frenald Vitrification Project where
12 the pilot plant melter fell out, the bottom fell out
13 of it. Before -- before any radioactive test could be
14 done, the whole project was canceled.

15 And, of course, even though nothing was
16 done, there were significant cost escalations. Yucca
17 Mountain is a big hole in the ground, and its status
18 after 16 -- after 23 years after the Nuclear Waste
19 Policy Act, and so on.

20 So my specific statement in paragraph E,
21 to be rather brief, and I've given the examples and
22 the reasons, are that with the DOE I don't believe

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1 that even if you had a contract with the DOE that it
2 would be sufficient, because, as I referred to earlier
3 without saying DOE, DOE had been in egregious
4 violation of its contracts with nuclear utilities to
5 lift nuclear waste, and even is paying fines, but
6 there's no plan to lift the waste.

7 The Portsmouth plant I think is already
8 delayed. The plant construction falls behind.
9 Portsmouth Daily Times -- what is the date of this?
10 July 15, 2005. The -- let me just read the
11 appropriate part from here. "Construction on a
12 building to convert nuclear waste to a more stable
13 form at the Portsmouth Gaseous Diffusion Plant is 12
14 to 14 months behind schedule, a Department of Energy
15 official said on Thursday." That's just for starters.

16 Q Could you identify, for the record, what
17 you're reading from there, Dr. Makhijani?

18 A I'm reading from the Portsmouth Daily
19 Times, "Plant Construction Falls Behind." I believe
20 it's the 15th of July the story was created on. It's
21 an article by Jeff Barron in the Portsmouth paper
22 here.

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1 The Department of Energy's history in
2 mismanaging waste from that, and many other programs,
3 we documented it in my earlier testimony I referred
4 to, and this is just a statement. These statements
5 are made only after a long a very careful study.

6 I referred in my earlier testimony --
7 deposition to containing the Cold War mass, where we
8 made detailed analyses of the mismanagement of waste
9 management programs by the Department of Energy,
10 delays, cost overruns, technical data, and so on. And
11 the Department of Energy actually acknowledged many of
12 the problems and said that they would respond to our
13 report, and we tried to help them correct the problem,
14 I believe unsuccessfully.

15 Q Would the issues that you've just
16 discussed relative to the performance of the
17 Department of Energy in various areas be the subject,
18 among other things, of prefiled testimony that you
19 will submit in this proceeding?

20 A Yes.

21 Q I'd like to move on now and ask if you
22 could look at Exhibit Number 5.

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1 MR. CURTISS: And if the Reporter could
2 identify this as Exhibit Number 5. This is a letter
3 from William Sinclair of the Utah Radiation Control
4 Board, Daniel Shrum of Envirocare, dated July 8, 2003.
5 And attached to this document is a document of 31
6 pages in length identified as License Amendment Number
7 22.

8 (Whereupon, the above-referred
9 to document was marked as
10 Makhijani Deposition Exhibit
11 No. 5 for identification.)

12 BY MR. CURTISS:

13 Q Do you have that before you, Dr.
14 Makhijani?

15 A Yes.

16 Q Do you recognize this document?

17 A Yes.

18 Q Have you reviewed it?

19 A Yes.

20 Q What is this document?

21 A This is the License Amendment 22, I
22 believe, and the one we discuss in our July 5 report,

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1 in specific reference to Item K on page 2.

2 Q Okay. On page 2, Item K, second
3 horizontal column from the bottom?

4 A Yes.

5 Q If you can look at the middle column there
6 that begins, "Custom source."

7 A Yes.

8 Q What is meant by the term "custom source"?

9 A It means a source that comes from a
10 particular vendor that would be wanting to dispose of
11 waste that has a specific description as given there.

12 Q And what is meant by the term "uranium
13 shavings"?

14 A Well, uranium shavings would presumably
15 come from the machining of depleted uranium metal when
16 it is -- when it is being fabricated into components,
17 and so on.

18 Q And you earlier testified that you're
19 familiar with the depleted uranium that will be
20 generated by the NEF. Is it in a metal form?

21 A No.

22 Q And could you explain why you think this

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1 term "uranium shavings," which addresses a metal form
2 as you've testified, covers the type of material that
3 NEF would generate and send to Envirocare as a
4 possible disposal source?

5 A It's for purposes of environmental impact
6 in the long term for uranium in shallow land disposal.
7 You have to assume that metal would become oxidized,
8 because it would be in an oxidizing environment.
9 We're talking about very long periods of time.

10 NEF would be disposing of uranium in oxide
11 form. I think the general characteristics, therefore,
12 for the long term in terms of radiological impact
13 would not be different than the decay products of
14 uranium. Of course, specifically radium has external
15 radiation, which is not dependent on chemical form.

16 And as we have shown in the July report,
17 the external radiation impact of shallow land disposal
18 for intruders is expected to be significant, and that
19 is not related to the chemical form. So so long as
20 depleted uranium is restricted in this way for
21 radiological purposes or -- or radiation control
22 purposes, broadly the same restrictions could be

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1 expected to apply.

2 Q Is it your -- you testified that you're
3 familiar with this document. You've reviewed it. Is
4 it your position that the language in line K prohibit
5 -- would prohibit the disposal at Envirocare of the
6 depleted uranium in a U-308 form, if so converted,
7 generated by NEF?

8 A Well, what we've said in the July 5
9 report, that it's very unlikely that it will be
10 allowed. We haven't made a definitive finding in this
11 regard, because we recognize that this particular line
12 relates to a custom source.

13 But we have looked at it in terms of
14 radiological impact. Presumably, that's why there is
15 a restriction on -- on depleted uranium and all of
16 these other things in terms of -- in terms of the
17 total -- and you'll see that many of them are actually
18 alpha-emitting transuranic radionuclides that are
19 similarly restricted in the same Americium-241 not to
20 exceed 51 millicuries, depleted uranium not to exceed
21 56.8 millicuries, and so I might take the incidental
22 opportunity to state how similar the transuranic and

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1 the uranium limits are.

2 And the -- so we feel that because of the
3 -- because of the long-term similarity in terms of
4 impact, it's very unlikely that depleted uranium would
5 be allowed in the U-308 form in the quantities, since
6 even a single drum would contain more than 56.8
7 millicuries.

8 Q Is this another example where if we ignore
9 the nomenclature of the license your argument is that
10 this would bar the disposal of the UF-6 from the NEF
11 because it's similar to this material?

12 A No, no. It is not a nomenclatural
13 question. This is -- when you asked me the basis on
14 which we have made conclusions, I said this is -- this
15 is the radiological impact of disposing of uranium
16 over the long term in shallow land burial -- would be
17 essentially similar to disposing of uranium oxide for
18 two reasons, because uranium metal would be oxidized
19 when it is disposed of in an oxidizing atmosphere.
20 Shallow land burial is oxidizing.

21 And then, you have the decay products off
22 U-238, specifically Radium-226, which will be

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1 important in the dose. So the radiological
2 characteristics are the same.

3 In this case it's not nomenclatural,
4 because we're talking about depleted uranium in both
5 cases.

6 Q I'm a lawyer, and I'm going to ask a legal
7 question.

8 A Okay.

9 Q But premised upon your expertise on
10 matters involving this license and the regulations
11 under which this was issued, does the language in K
12 prohibit, as a regulatory or licensing matter, that
13 disposal of the type of depleted uranium generated by
14 the NEF, if it were converted to U-308 and sent to
15 Envirocare for disposal?

16 A No, it -- as I have said, it does not
17 explicitly prohibit it. That's why we haven't
18 concluded that it is prohibited. But we've concluded
19 that it's very unlikely that it will be allowed, given
20 the spirit of the regulation to protect the public
21 from radiation.

22 Q I'd like to ask you take a look at your

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1 July 5, 2005, report, a copy of which we have here,
2 and I'd like to have it identified as Exhibit 6.

3 MR. LOVEJOY: Can we mark that as an
4 exhibit?

5 MR. CURTISS: Excuse me?

6 MR. LOVEJOY: Can we mark that as an
7 exhibit if he's going to be referring to it?

8 MR. CURTISS: Yes, Exhibit 6. And we will
9 pass out copies here and identify it as Exhibit 6.

10 (Whereupon, the above-referred
11 to document was marked as
12 Makhijani Deposition Exhibit
13 No. 6 for identification.)

14 BY MR. CURTISS:

15 Q If you could look at page 8 -- let's take
16 a break. We'll go off the record and take a break.

17 (Whereupon, the proceedings in the
18 foregoing matter went off the record at
19 10:12 a.m. and went back on the record at
20 10:22 a.m.)

21 BY MR. CURTISS:

22 Q I'd like to just jump back, if I could for

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1 a minute, to Exhibit 5, which is License Amendment
2 Number 22. And on the page that we're referring to,
3 I neglected to ask you, having asked you about the
4 custom source and the uranium shavings, what do you
5 understand by "in a homogenous concrete mix"?

6 A Well, I think it would be grouted in some
7 way, that the shavings would be mixed with grout, and
8 that would be the waste form that would be disposed
9 of.

10 Q You earlier referred to the possibility of
11 material oxidizing.

12 A Yes.

13 Q Is it, based upon the description here
14 where the uranium shavings are contained in the
15 homogenous concrete mix, physically possible for the
16 material to oxidize? And, if so, what's the physical
17 nature of that reaction?

18 A Yes. The concrete, of course, is not
19 expected to be durable on the time scale that we're
20 talking about, which are thousands of -- or tens of
21 thousands of years. The experience with grout so far,
22 in terms of a matrix for waste, has -- does not

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1 indicate that it would last for that long. In fact,
2 there have been examples where waste has been grouted,
3 say at Rocky Flats, where the grout has fallen apart
4 in years or a decade.

5 And so the oxidization process would occur
6 over a long period of time, but certainly consonant
7 with the periods of time that we're talking about in
8 terms of dose calculation for depleted uranium.

9 Q Is it your understanding from K that this
10 custom source that's referred to here with the uranium
11 shavings in a homogenous concrete mix is a form and
12 covers that form for purposes of disposal? Is that
13 something that would be disposed of at Envirocare?

14 A Well, that's what it says, that it would
15 be --

16 Q Where does it say that?

17 A I don't see why else it would be sent to
18 Envirocare, other than for disposal. And Envirocare,
19 as I understand it, is a disposal facility, and this
20 regulation applies to what it may possess at any one
21 time. But presumably in preparation for disposal.

22 Q Everything in this license, then, that's

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1 identified here, sealed sources, sealed neutron
2 sources, liquids -- I'm just reading from C at the top
3 right on down -- is disposed of Envirocare. Is that
4 the way you interpret this license?

5 A Well, I haven't -- I haven't look at all
6 of the radionuclides. I really focused on the
7 question of what is acceptable in terms of depleted --
8 or not acceptable in terms of depleted uranium, since
9 we are not concerned with all of the other
10 radionuclides. I haven't actually examined the other
11 parts of this.

12 Q I understood your point to be because it's
13 in the licensing it must be something that they're
14 disposing of.

15 A Yes.

16 Q And that led to my question. Is
17 everything that's listed in this table something that
18 they're disposing of?

19 A I haven't looked at that question, as I
20 just said.

21 Q Do you know whether this is -- this custom
22 source that they're referring to is, in fact, disposed

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1 of versus used for some other purpose?

2 A I believe it is for disposal, but I'd have
3 to check.

4 Q Okay. Let's, then, turn to Exhibit 6 if
5 we could. And on page 8 if you -- look at the
6 reference at the top of page 8, which I take it
7 discusses this same issue that you -- we've just
8 reviewed in the license itself.

9 A Yes.

10 Q In the sentence beginning, "While the
11 license condition in Amendment 22 specifically --
12 applies specifically to a custom source, the
13 similarity of this waste makes it very unlikely that
14 the far larger quantities being considered," so forth
15 and so on.

16 Your point here is that condition K, by
17 its terms, doesn't prohibit disposal, but because this
18 waste is similar the logic of it ought to prohibit
19 disposal?

20 A I didn't -- I didn't say -- make a
21 statement about what ought to be or not ought to be.
22 We made a statement that because of the similarity of

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1 the waste, in terms of radiological impact, they are
2 unlikely to fulfill these conditions.

3 And, moreover, the context of this
4 statement in the report also is that anything other
5 than Class A waste is prohibited to be disposed of at
6 Envirocare. The Utah legislature explicitly banned
7 Class B and Class C waste. And so in light of my
8 earlier testimony about the characteristics of
9 depleted uranium, this would also not fit
10 radiologically, and this particular restriction in
11 License Amendment 22 is certainly compatible with
12 that.

13 Q Would the disposal of depleted uranium of
14 the type that would be generated at NEF be permissible
15 under their license?

16 A Well, it -- the disposal of depleted
17 uranium of the type that would be permitted, if it
18 were less than 250 pounds in a drum, may well be
19 permissible. But I think the disposal of depleted
20 uranium in anything like the quantities that we're
21 talking about would be unlikely to be permitted.

22 Q If I could ask you to take a look at what

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1 I'd identify as Exhibit 7 -- and ask the Court
2 Reporter to so mark it -- an April 6, 2005, memorandum
3 from Scott Flanders to Matthew Blevins. Are you
4 familiar with this document?

5 (Whereupon, the above-referred
6 to document was marked as
7 Makhijani Deposition Exhibit
8 No. 7 for identification.)

9 A I believe so. I think I looked at this
10 recently. I've looked at a lot of documents recently.
11 I think I have, yes.

12 Q This is a -- this document records a
13 telephone -- summarizes a telephone call that
14 apparently took place between NRC and Utah's Division
15 of Radiological Control. Do you know what role DRC,
16 Division of Radiological Control, in Utah plays with
17 respect to the Envirocare site?

18 A They're the licensing authority.

19 Q Okay. So they're responsible for
20 regulating the site?

21 A Yes.

22 Q And do you know whether they're the entity

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1 within Utah that's the agreement state authority
2 responsible for this site?

3 A Yes.

4 Q And what does that mean, that Utah DRC is
5 an agreement state? What does that mean?

6 A That means that the NRC has delegated to
7 the State of Utah the authority to make -- to grant
8 licenses and to examine license applications, subject
9 to the condition that they're doing a good job.

10 Q They're the responsible regulatory
11 authority, then, with respect to the Envirocare site,
12 pursuant to an agreement state program that the NRC
13 has authorized?

14 A Yes.

15 Q All right. Would you, if you could, and
16 understanding that you've read this document before,
17 would you review the back and forth between the NRC
18 staff and DRC staff under question 1 on the second
19 page -- the first page of the telephone summary behind
20 the memo?

21 A Can we go off the record for a second?

22 MR. CURTISS: Yes.

1 (Whereupon, the proceedings in the
2 foregoing matter went off the record at
3 10:30 a.m. and went back on the record at
4 10:32 a.m.)

5 MR. CURTISS: Okay. Back on the record.

6 BY MR. CURTISS:

7 Q Have you reviewed the answer to
8 question 1?

9 A Yes.

10 Q And, in particular, what I'd like to refer
11 you to is the second set of questions and answers that
12 begins at the bottom of page 1. NRC staff requested
13 clarification of Amendment 20, so forth and so on.
14 DRC staff confirmed this statement that -- and
15 indicated this was consistent with the uranium value,
16 so forth and so on.

17 At the top of page 2 of the document, DRC
18 staff indicated that at this time they have no
19 reservations about accepting DU in an oxide form,
20 specifically DU-308. DRC staff further noted that
21 there are no volume restrictions in the Envirocare
22 license.

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1 Setting aside the question of whether
2 Amendment 22, subsequently adopted, bars what they say
3 is permitted here, how would you -- in terms of this
4 dialogue, would you comment on whether the Envirocare
5 license permits what the regulator says it does?

6 A Well --

7 MR. LOVEJOY: Object to the form of that
8 question. If you want to show him Amendment 20 and
9 ask him to interpret it, perhaps he can do that. But
10 this doesn't contain that.

11 BY MR. CURTISS:

12 Q What do you interpret the statement on the
13 top of page 2 to mean relative to what's permitted
14 under the Envirocare license?

15 A I think I interpret this --

16 MR. LOVEJOY: Same objection. Go ahead.

17 THE WITNESS: I interpret this statement
18 as meaning that if depleted uranium were classified as
19 Class A under 10 CFR 61.55, which is the only kind of
20 waste permitted to be disposed of, that at this time
21 the DRC would have no reservations, because Envirocare
22 has no volume restrictions.

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1 But DU is not classified under 10 CFR
2 61.55, and obviously the NRC staff is not in agreement
3 with the Commission. So the context of this --
4 context of this discussion has to be seen in regard to
5 the position of the staff and what was said here about
6 61.55, which I don't think is relevant.

7 BY MR. CURTISS:

8 Q Your point is that while this states that
9 the state regulator has no objection to the disposal
10 of the U-308, because it's not Class A waste it
11 couldn't be and hasn't been disposed of at Envirocare.

12 A It has not -- it has not been classified
13 under 61.35 as Class A waste or any other kind of
14 waste. So it couldn't be disposed of. The
15 regulator's statement I think has to be seen in the
16 context of what they themselves have approved for
17 Envirocare, which is only Class A waste Envirocare is
18 not authorized to dispose of.

19 And I can't imagine that the Utah
20 regulators would imply in any way that they would be
21 permitting waste that is not Class A waste to be
22 disposed of.

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1 Q Okay.

2 A But since that -- Class A is the staff's
3 position, and the staff had this conversation, this is
4 not a surprise.

5 Q Could I ask that the next document, which
6 we'll identify as Exhibit 8, a letter dated February
7 3, 2005, disposed by LES, as Bates Number 05472, a
8 letter from Al Rafati, Executive Vice President,
9 Envirocare, to Mr. E. James Ferland, would you please
10 read that letter?

11 (Whereupon, the above-referred
12 to document was marked as
13 Makhijani Deposition Exhibit
14 No. 8 for identification.)

15 A Yes.

16 Q And doesn't this letter clearly state,
17 last sentence of the first paragraph, "Envirocare has
18 previously received and disposed of depleted U-308 in
19 this manner at our facility in Clive, Utah"?

20 A Yes, it says that.

21 Q And they could only do that if it was
22 Class A waste, is that your position?

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1 A Well, I have not examined the regulatory
2 validity of Envirocare actions in the past. It
3 certainly says they have disposed of it as Class A
4 waste. And as I read the Commission's decision of
5 January 2005, the Commission has said that DU is not
6 yet classified.

7 So I think this may be a matter for the
8 Commission to take up with the State of Utah in terms
9 of fulfillment of its responsibilities as an agreement
10 state.

11 Q Exhibit 7, which we just reviewed, states
12 that the state regulator, which is operating as an
13 agreement state under the authority --

14 A Yes.

15 Q -- from the Commission indicates they have
16 no reservations about accepting DU in an oxide form,
17 and no volume restrictions in the Envirocare license.
18 And Exhibit 8 says, in fact, they have disposed of it
19 in a Class A disposal cell. Would you interpret these
20 two as suggesting that your interpretation of
21 Amendment 22 is incorrect?

22 A No, I might --

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1 MR. LOVEJOY: Object to the form of the
2 question. He's not addressing Amendment 22. The
3 witness has testified, if I -- correct me if I'm
4 mischaracterizing your testimony -- that Amendment 22
5 would, because of the nature of the material addressed
6 in Amendment 22, bar the disposal of the U-308 in
7 Envirocare.

8 THE WITNESS: No.

9 MR. LOVEJOY: And on that basis, I've
10 understood the testimony to say that we cannot dispose
11 of depleted U-308 at Envirocare, and, hence, that
12 cannot be part of our plausible strategy.

13 THE WITNESS: No. Actually, I didn't say
14 that. Amendment 22 permits up to 250 pounds, and this
15 actually doesn't specify the quantities that are being
16 disposed of previously.

17 So if there were 10, 15 pounds of material
18 that are being disposed of, it -- it's the quantity --
19 the radiation dose and the dose limit of 25 millirem
20 doesn't just depend on the radionuclide. It obviously
21 depends on the quantity of the radionuclide that is
22 disposed of. That is the whole spirit of a lot of the

1 regulation differentiating one waste from another
2 waste.

3 Part 61, Table 1 and 2, are distinguished.
4 The same radionuclides belong in different categories,
5 depending on the concentrations and quantities. So
6 this doesn't tell me what has been disposed of before.
7 What I would say is if -- if they have been disposed
8 of in large quantities, then they appear to me to be
9 at variance with the Commission's position that there
10 is as yet no classification of depleted uranium under
11 Part 61, even though it has been declared to be low-
12 level waste.

13 And this remains an issue to be settled.
14 So that's why I said that perhaps if large quantities
15 of U-308 have been disposed of as Class A waste,
16 perhaps the Commission ought to look into how its
17 agreement state is interpreting the regulation, in
18 light of its own ruling.

19 BY MR. CURTISS:

20 Q Irrespective of the quantities disposed of
21 here, do you understand this letter to indicate that
22 depleted U-308 has been disposed of at Envirocare in

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1 a Class A disposal cell?

2 A Yes, I read that as -- as saying that it
3 has been.

4 MR. CURTISS: Okay. If I could have
5 Exhibit 9. And I would note before we pass this out
6 this has been labeled protected material.

7 (Whereupon, the above-referred
8 to document was marked as
9 Makhijani Deposition Exhibit
10 No. 9 for identification.)

11 BY MR. CURTISS:

12 Q Is this -- this is the report, Dr.
13 Makhijani, of November 2004. It is attached to a
14 pleading that was protected. Is it intended that this
15 report also be protected and -- or has it been
16 released publicly?

17 A No, we released a redacted form of the
18 report.

19 MR. LOVEJOY: There were I think some --
20 some cost data that --

21 THE WITNESS: Yes, we redacted the cost.

22 BY MR. CURTISS:

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1 Q Cost data from LES.

2 A Yes.

3 Q Okay. Well, this is the version that was
4 attached to -- I think everybody here has executed the
5 disclosure, so --

6 A Yes. Actually, we only have two copies of
7 that in the office.

8 Q Oh, okay.

9 THE WITNESS: I believe two. It's two,
10 right?

11 DR. SMITH: Yes. I think we may have an
12 extra agreement with us.

13 BY MR. CURTISS:

14 Q If I could refer you to page 23 of the
15 report --

16 A The July report?

17 Q The November 2004, which I would ask be
18 marked as Exhibit 9. I'm particularly interested in
19 the paragraph, the first full paragraph that begins,
20 "In our screening calculations."

21 A Yes.

22 Q If you could read that, and just let me

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1 know when you're ready for the question.

2 A Yes.

3 Q If I understand this paragraph, Dr.
4 Makhijani, you have assumed certain things in arriving
5 at your conclusion that the disposal of depleted
6 uranium in a shallow land burial facility would result
7 in the 25-millirem limit in the regulations being
8 exceeded by significant amounts, orders of magnitude.

9 And this paragraph sets forth the
10 assumptions that you've made about several things.
11 You call these your screening calculations. Do you
12 know whether, as you assume in these screening
13 calculations, Envirocare disposes of depleted uranium
14 "as a layer of bulk DU-308 powder more than 26,000
15 square meters in area and two meters thick under 7.6
16 meters of cover material with an unsaturated zone 20
17 meters thick separating the DU from the underlying
18 aquifer"?

19 A These are generic calculations, as it said
20 in the report. There are some parameters in terms of
21 the thickness of the cover, and so on, and rainfall
22 that were derived to be similar to the Envirocare site

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1 or some other semi-arid area. They were not meant to
2 be representations of what Envirocare does, and I
3 don't believe we've said that.

4 This was a very simplified screening
5 calculation, and this is the manner in which screening
6 calculations are meant to be done to produce an upper
7 limit dose. And if the upper limit dose is very small
8 -- so if these screening calculations had produced a
9 one millirem dose, I would have said, "No worry. Do
10 it."

11 But since the screening calculations
12 produced very high doses, the next step is obviously
13 to do a site-specific analysis. This is just a --
14 sets it up for an upper limit calculation.

15 Q Could I refer you, then, back to
16 Exhibit 2, and page 24 of that exhibit.

17 A Yes.

18 Q Paragraph AA, if you can read that on page
19 24.

20 A Yes. Yes.

21 Q In support of your conclusion -- do you
22 agree with this paragraph?

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1 A Yes.

2 Q In support of your conclusion that a site
3 such as Envirocare, e.g. Envirocare, will probably be
4 unable to demonstrate compliance with Commission
5 release limits for low-level waste disposal, you
6 reference back to pages, among other things, pages 22
7 through 24 of -- you reference back to the November
8 24, 2004, report in that discussion. Do you see the
9 November 2004 report, 3 through 29, 47 through 51?

10 And if I'm interpreting your report
11 correctly, this paragraph on the screening calculation
12 is the basis, including all the assumptions that you
13 make, for concluding that Envirocare will probably be
14 unable to demonstrate compliance with Commission
15 release limits.

16 And, therefore, my question is: in all of
17 these assumptions that you make, which you relate
18 directly to the ability of Envirocare to meet the
19 release limits, not some generic site, but by virtue
20 of this statement, my question is: do you know
21 whether Envirocare disposes of material in the manner
22 that you have assumed with all of these various

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1 assumptions in your screening calculation?

2 MR. LOVEJOY: Object to the form of the
3 question. There is other sources cited. You can go
4 ahead and answer.

5 THE WITNESS: Yes, that's what I was about
6 to say is in our July 2004 -- 2005 report, on pages 7
7 to 16 and 22 to 24, I have cited in a sentence
8 actually in the November 2004 report we -- we refer to
9 Envirocare's specific calculations that were done
10 based on the 1990 environmental estimates that were
11 done in the process of licensing -- licensing the
12 site.

13 And so the -- the November screening
14 estimates are to be seen in that context, and also in
15 the context that we actually look at the doses on page
16 24. These doses are in the tens and hundreds of rem
17 per year, whereas the -- whereas the dose limit was 25
18 millirem per year.

19 There is no shallow land burial packages
20 that could be done in 55-gallon drums, which do rust
21 as time goes on and in that oxidizing environment,
22 that could be expected, or even grouted 55-gallon

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1 drums, that could be expected to contain the depleted
2 uranium for the periods of time that -- for which we
3 are estimating the environmental impact.

4 And given the fact that the environmental
5 impact, say from radium, as well as from internal
6 doses would be from depleted uranium after whatever
7 packaging it has or matrix it has been put in, is
8 degraded or largely degraded.

9 I think the combination of the
10 calculations, the screening calculations, the fact of
11 the specific activity of depleted uranium, the
12 external dose radiations from -- from radium, all of
13 these things put together make this a very solid
14 statement in terms of all of the work that was done,
15 including the work in November but not only.

16 BY MR. CURTISS:

17 Q Well, what was surprising -- I did go back
18 and look at your July 2005 report --

19 A Yes.

20 Q -- and if you'd turn to page 8, the
21 references in this paragraph, you correctly note,
22 "Include references to the July 2005 report" on both

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1 Envirocare and WCS. Some of these references are on
2 WCS, and I'm focused on Envirocare.

3 But if you look at page 8, the paragraph
4 that begins, "The results of our November" -- this is
5 Exhibit 6 -- "of our November 2004 screening
6 analysis," so forth and so on, directly references
7 back to the screening calculation that if I'm not
8 mistaken is set forth on page 23 of your November
9 report.

10 A Is there anything wrong in referring to a
11 prior --

12 Q No. I --

13 A I don't understand the question.

14 Q Yes, there is. And I'll repeat my
15 question, because I understood, Dr. Makhijani, you
16 said that there are other references. I believe they
17 are consistent with the point that I'm seeking to
18 make, which is in your November 24, 2004, report on
19 page 23, the basis for your conclusion that the 25-
20 millirem limit would be exceeded by orders of
21 magnitude in this screening calculation you do is a
22 series of assumptions that you make.

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1 And at one point I understood you to say,
2 "Well, it's just a generic calculation." Yet I think
3 in the testimony that -- in the response to the
4 interrogatories you've cited this conclusion for the
5 proposition that Envirocare couldn't meet the
6 regulatory limits.

7 And that has led to the question that I
8 have, which is the assumptions that you've made in
9 this paragraph on page 23, do you have any reason to
10 believe that that reflects the actual disposal
11 practices at Envirocare?

12 A Well, you know, I think I already answered
13 the question, assuming that a 26,000 square meter
14 disposal is -- is a screening calculation. I also
15 just said -- I also just said that in terms of the
16 radiological impact of depleted uranium over the time
17 period that we're talking about, depleted uranium
18 would not be contained in any matrix, and it, along
19 with its decay products, would directly impact the
20 affected environment.

21 We did additional analysis, so the
22 paragraph that you read, the screening -- it says the

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1 screening analysis for shallow land disposal, the
2 results of early performance assessments of the
3 Envirocare site, which are cited in the paragraph just
4 above a whole bunch of calculations there which are
5 specific to the Envirocare site that were used in 1990
6 to support the initial license, they also show that
7 depleted uranium concentrations, in terms of specific
8 activity, would not be compatible with a 25-millirem
9 dose limit, the fact that it's many orders of
10 magnitude.

11 And, finally, the fact that we actually
12 did a site-specific study of WCS, which is in a very
13 similar climate focused primarily on external dose the
14 -- which also showed in a site-specific assessment
15 that doses would be exceeded by many orders of
16 magnitude.

17 I think the statement that we've made that
18 it would be very likely unacceptable is completely
19 defensible. And if Envirocare has -- or the NRC has
20 a different set of calculations to put on the table,
21 they should do so.

22 The NRC actually, in their final

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1 environmental impact statement, indicated in many ways
2 a preference for the Envirocare site, and I've yet to
3 see an environmental impact statement that is devoid
4 of an environmental impact calculation or analysis
5 that -- where an assertion is made about suitability
6 essentially by technical fiat.

7 So I believe that what we've done here,
8 and we've -- we've said likely unacceptability is very
9 well supported. We haven't made a declarative and
10 complete statement. I believe that's the job of the
11 NRC, to show that it is an acceptable option, because
12 the NRC has declared it to be so.

13 We believe that it is likely to be
14 unacceptable based on site-specific calculations
15 presented in July, screening calculations, as well as
16 other work that is in these two reports.

17 Q But your evaluation of whether the
18 Envirocare and the WCS site can meet the regulatory
19 limits of 25 millirem is based in part, would it be
20 correct to say, on the screening calculation?

21 A The WCS -- we did a site-specific
22 analysis.

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1 Q No. I'm asking, is it based in any part,
2 at either site, on the screening calculation?

3 A For the WCS it is not, because we did a
4 site-specific analysis. And when you've done a site-
5 specific analysis, in the detail that we did, you no
6 longer need a screening calculation. And the
7 relevance of the WCS analysis in the case of
8 Envirocare is there. We actually took site-specific
9 parameters for a site that's quite similar.

10 It's in a semi-arid climate with similar
11 rainfall and other parameters. Actually, WCS disposal
12 would be deeper than is typically done at Envirocare.
13 So in terms of erosion and exposure, it would take a
14 much longer time, so it -- it would be much more
15 difficult to give high doses in the manner proposed in
16 the WCS design than at Envirocare, because erosion
17 would take longer at WCS.

18 Given all of these factors, I think a
19 statement that it's likely to be unacceptable is -- is
20 completely scientifically defensible, especially as
21 it's the only set of scientific calculations on the
22 table.

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1 The NRC has completely defaulted on its
2 obligation to put any calculation or any analysis that
3 can be reproduced in the normal textbook scientific
4 sense in its final environmental impact statement.
5 It's, I have to say, frankly shocking.

6 Q Did your ResRad runs on Envirocare employ
7 any of the assumptions in this screening calculation
8 as they're set forth in your report on page 23?

9 A We did not make ResRad runs on Envirocare.
10 This is, as it says in the November report, a generic
11 screening calculation for which we took some of the
12 rainfall and depth parameters from Envirocare as a
13 reference matter for erosion, and so forth, just so
14 there would be some data that would be representative
15 of a semi-arid site.

16 We did not say -- and I did not say today
17 -- that this represents how Envirocare disposes of
18 material. But if the -- if this screening calculation
19 had resulted in a 100-millirem dose result, or even a
20 1-rem dose result, we'd say you have some quibbles in
21 terms of this 26,000 square meters and the manner in
22 which the screening calculation was set up.

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1 But this result of a screening calculation
2 which uses realistic semi-arid data, and also takes
3 into account the fact that the environmental and
4 radiological impact of depleted uranium over tens of
5 thousands of years is for their depleted uranium,
6 grout, and 55-gallon drums, just don't last for that
7 long no matter how much we may wish that they did.

8 Q Let me try one more time, and then I'll --
9 then I'll wrap it up on this. Your screening
10 calculation that you discussed here in your report was
11 a basis in part for how you assessed the Envirocare
12 site.

13 You did plug in some site-specific weather
14 parameters, but it appears, from what you've said in
15 the response to interrogatories, where you have
16 concluded that Envirocare will probably be unable to
17 demonstrate compliance with Commission release limits
18 for low-level waste disposal, cited, among other
19 things, a screening calculation.

20 I have a very simple question, and I think
21 you've answered it, but let me try to frame it as I
22 think you've answered it. These assumptions in here,

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1 in your screening calculations, to the extent that
2 they differ from actual practice at Envirocare, may
3 have an impact upon the conclusion as to whether the
4 25-millirem limit is or is not exceeded.

5 MR. LOVEJOY: Is that a statement or a
6 question?

7 BY MR. CURTISS:

8 Q Is that a correct summary of what you've
9 said? If these --

10 A I don't believe so.

11 Q Well, the question that I'm asking is, if
12 these are not the conditions at Envirocare that you
13 assume in your screening calculation, would that have
14 an impact on your view that the 25-millirem limit
15 would be exceeded by orders of magnitude?

16 A The conclusion that we reached in regard
17 to Envirocare in the July 2005 report relied in part,
18 as you said -- you did characterize that correctly --
19 but you have to go to the other parts. You have to go
20 to the site-specific WCS calculation. You have to go
21 to the 1990 licensing site-specific calculation, and
22 you have to recognize the fact that we're talking

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1 about exceedances of dose by thousands and even tens
2 of thousands of times.

3 I do not -- and for the technical reason
4 that I have given you, that the lifetime of 55-gallon
5 drums and grout in shallow land burial is not expected
6 to be tens of thousands of years. Otherwise, spent
7 fuel disposal would be a cinch. We'd just put it at
8 Envirocare.

9 The reason we worry about spent fuel so
10 much is it's very -- or even transuranic waste so much
11 is that it's very radioactive, and it is very long-
12 lived. And so the environmental impact of these
13 materials are always assessed in the context that
14 their containers will not be durable.

15 In that context, I do not -- I believe
16 that the statement that the 25-millirem dose limit
17 will not likely be demonstrated to be met at
18 Envirocare is very, very robust indeed, given the
19 numbers.

20 May the -- the final numbers when the NRC
21 does do its job and calculate the Envirocare limits,
22 that the final numbers be five times or ten times

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1 different than in the screening calculation? They
2 could well be.

3 Q One other question on this, and then I'll
4 move on. In your July 5, 2005, report, Exhibit 6,
5 among the things that you cite is the results of the
6 early performance assessments for the Envirocare site.
7 Did you independently evaluate those?

8 A No. We just took them at face value and
9 said these were the early performance assessments.
10 This is what -- this is the basis on which the site is
11 licensed, and the basis on which the site is licensed
12 doesn't indicate the specific activity. We didn't
13 actually evaluate all of the dose calculations, and so
14 on, that were done on this basis.

15 Q And those performance assessments, the
16 ones that are referred to as the early performance
17 assessments, were in part a basis for your conclusion?

18 A Yes, as stated here. We took those at
19 face value. We have not -- we may well find when we
20 take a closer look that -- that they may have
21 underestimated doses or whatever. I don't know. I
22 have no basis one way or -- maybe they have estimated

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1 doses very accurately. I don't know.

2 Q Okay. We'd ask, then, between the two of
3 you if you would provide as a part of your mandatory
4 disclosures at your earliest opportunity the
5 performance assessments that were evaluated and that
6 are the basis in part for the conclusions that are set
7 forth in the interrogatories. The interrogatories ask
8 for all the documents that serve as the basis for the
9 conclusion.

10 So if you can provide us a list, if
11 they're publicly available, or the actual documents of
12 the early performance assessments that are referenced
13 in your report of July 5, 2005.

14 A They are referenced here, and it -- the
15 early performance assessments I think are referenced
16 in -- in Exhibit 7. But we'd be happy to --

17 Q Yes. I think it's important for us,
18 knowing that there are a lot of references and a lot
19 of documents, to know which documents you reviewed and
20 upon which you based your -- base your conclusions
21 relative to both Envirocare and WCS.

22 Did I understand you to say that you had

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1 undertaken some sort of written evaluation of the WCS
2 site as well?

3 A Yes. It's in our July report.

4 Q Okay. So the extent of the written
5 analysis is set forth in the July report.

6 A Yes.

7 Q Okay. I have just one other -- we can
8 finish in about five or ten minutes, so we can either
9 take a break or -- depending upon what the staff would
10 like to do, or just proceed.

11 If I could have the document which is your
12 cost estimate that you provided at the deposition in
13 November. This is going to Exhibit Number 10.

14 (Whereupon, the above-referred
15 to document was marked as
16 Makhijani Deposition Exhibit
17 No. 10 for identification.)

18 You'll recall, Dr. Makhijani, this was the
19 document that you shared with us at the deposition in
20 November that, as you indicated at the time, was draft
21 subject to change. Have you updated the document?

22 A Yes. The update to this with slight

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1 changes only was in our November 2004 report. It's on
2 page 51. And the numbers are very similar, but
3 they're not exactly the same.

4 Q Okay. So, and what I wanted to ask you,
5 then, based upon the draft and what's in the November
6 report, does this reflect your -- no longer labeled
7 draft -- your -- the basis for your estimates that
8 you, in turn, will be relying upon in your testimony
9 in this proceeding?

10 A Yes.

11 MR. LOVEJOY: Are you referring to page 51
12 of the November report?

13 MR. CURTISS: Yes, I'm sorry. Of Exhibit
14 9, page 51 of Exhibit 9.

15 THE WITNESS: Yes.

16 BY MR. CURTISS:

17 Q So the version in the November report is
18 your final analysis of this?

19 A Yes. And it's very, very close to --
20 just, you know, changes in a sense.

21 Q Could you highlight any of the changes
22 here that you think are notable?

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1 A I don't believe there -- and let me just
2 take a brief look. I don't believe there are any
3 notable changes. The LES assumptions calculation has
4 gone down somewhat. I think that's the most
5 significant change.

6 Q I'm trying to identify here where in this
7 document you have incorporated what were identified as
8 notes in Exhibit 10. For example, is this -- do you
9 have an assumed exchange rate here, which previously
10 was identified as 1 to 1.3 dollars to euros?

11 A You know, I'd have to -- I'd have to go
12 back and -- and look at the -- look at the -- on
13 page 48, I think all the assumptions are given. I
14 think for the LES case we have simply used LES
15 numbers, the 1 to 1, the 550 I think, or the 1 to 1 --

16 Q I'm sorry. Please say that again.

17 MR. LOVEJOY: He's talking about the
18 column LES assumptions.

19 MR. CURTISS: Yes.

20 THE WITNESS: In the other cases, I think
21 we derived those numbers either from WIPP or Lawrence
22 Livermore, and provided an exchange rate risk. And

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1 the method for doing that exchange rate risk is
2 specified on page 48. So the source of our numbers
3 was generally dollars, and so no euro -- no euro to --
4 no euro to dollar conversions were involved in the
5 other three estimates.

6 For the LES assumptions, we simply took
7 the numbers provided by LES, and actually I think
8 that's probably why the disposal cost went down. We
9 reviewed the LES materials and used the lower value.

10 BY MR. CURTISS:

11 Q And what is in Exhibit Number 10, the
12 draft dated November 15, 2004, where it says IEER
13 greater than Class C, 1 to 1.3 dollars per euro, is
14 that the same estimate or a different estimate
15 incorporated in the table on page 51? Or is the
16 exchange rate not relevant to what you've presented?

17 A Well, I think that that -- that number is
18 used in the contingency exchange rate risk
19 calculation. The dollar numbers, if I remember
20 correctly, are derived from WIPP and in terms of
21 disposal.

22 Excuse me. Can we go off the record,

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1 please?

2 MR. CURTISS: Yes.

3 (Whereupon, the proceedings in the
4 foregoing matter went off the record at
5 11:09 a.m. and went back on the record at
6 11:10 a.m.)

7 MR. CURTISS: Back on the record.

8 THE WITNESS: Yes. The way these
9 calculations for Case 1 and 2 were done is 1.3 dollars
10 per euro was applied to the conversion parts, and the
11 conversion would come from Cogema, and the Cogema
12 dollar -- Cogema figure was given in euros.

13 All of the other estimates for WIPP and
14 for -- for the sot of the waste forms, etcetera, were
15 originally in dollars, and so no conversion -- no
16 exchange rate conversion issues were in the direct
17 costs.

18 And then, there is -- the contingency for
19 exchange rate was at 30 percent of the -- in addition,
20 that the dollar could go down by an additional 30
21 percent. I believe I gave some reference to
22 International Monetary Fund opinions, etcetera, at the

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1 time.

2 BY MR. CURTISS:

3 Q On the first half of what you just said,
4 do I understand you to say that once you established
5 the exchange rate that you've used, once you've
6 translated it into U.S. dollars, the exchange rate is
7 no longer relevant?

8 MR. LOVEJOY: Object to the form of that
9 question.

10 THE WITNESS: Well, it's no longer
11 relevant for that piece of arithmetic. It is
12 financially relevant in that the exchange rate varies,
13 and so some contingency provision has to be made.

14 And since the situation internationally
15 regarding exchange rates is -- is rather unstable and
16 risky and regarded to be so by I believe the authority
17 a couple of blocks down from here, and by many others,
18 the -- I think some provision for the downside
19 exchange rate risk has to be made in terms of
20 contingency explicitly, since that risk could be quite
21 severe, and a very major part of this operation will
22 be carried out by a French company, which does all its

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1 calculations in euros and reports to the French
2 government, to which it largely belongs.

3 MR. CURTISS: I don't have any other
4 questions at this point. Does the staff want to take
5 a break or --

6 MS. CLARK: Yes. What time is it?

7 MR. CURTISS: It's quarter past.

8 MS. CLARK: Perhaps we can take a break,
9 have lunch, and then come back.

10 MR. CURTISS: Yes.

11 (Whereupon, at 11:13 a.m., the proceedings
12 in the foregoing matter recessed for lunch.)

13 MS. CLARK: Okay. We're going to go back
14 on the record. Good afternoon, Dr. Makhijani. I have
15 a few more questions for you.

16 BY MS. CLARK:

17 Q I'd like to start by going back to talk
18 about some of the statements you made about Part 61
19 and how it applies to DU. As I recall, you said
20 something to the effect that the Commission decided to
21 take DU out of Part 61 and my question is whether you
22 believe that depleted uranium is covered by

1 regulations of Part 61.

2 A As I understand Part 61, depleted uranium
3 is not currently classified under Part 61 because in
4 creating the final rule based on the draft and the
5 comments it was in the draft but it was dropped from
6 the final rule and so no concentration limits specific
7 to depleted uranium appear in Part 61 unlike other
8 radionuclides which are covered like plutonium or
9 cesium. And further the Commission this year in its
10 January ruling about depleted uranium did not choose
11 to put it in Part 61 but ruled about it more generally
12 as a low-level waste without saying that whether it
13 was part of Part 61 or not.

14 Q So in the context of how to classify DU,
15 is it your view that one would not apply Part 61?

16 A No, actually I myself have looked at Part
17 61 in terms of its own definition of greater than
18 Class C waste for the radionuclides that are in Part
19 61. So Tables 1 and 2 have specific radionuclides and
20 limits for ABC and Part 61 says that beyond those for
21 those radionuclides the waste will be greater than
22 Class C waste and using that as a guide and

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1 specifically the parts of 61.455 that talk about the
2 limit of 100 nanocuries per gram for transuranic
3 alpha-emitting radionuclides, I've said that you can
4 infer that based on the characteristics of depleted
5 uranium and the radionuclides that are covered in Part
6 61 that depleted uranium should be classified as
7 greater than Class C waste or something equivalent to
8 the EPA definition of transuranic waste and suitable
9 for geological disposal.

10 Q So in your assessment, you used the
11 criterion for Part 61. Is that correct?

12 A I looked --

13 MR. LOVEJOY: Object. I think you need to
14 identify the criteria referring to --

15 THE WITNESS: If I could have a copy of
16 Part 61, I'll tell you exactly what I did. We had a
17 copy I think. So Part 61 Table 1 has a limit for
18 alpha-emitting transuranic radionuclides with half-
19 life greater than five years and the limit for that in
20 curies per cubic meter is 100 which is 100 -- Sorry.
21 In terms of nanocuries per gram is 100 and since I've
22 argued that the radiological characteristics of

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1 depleted uranium are similar in essential respects,
2 that if you use Part 61 as a guide, that particular
3 element of Part 61 a guide, scientifically and for the
4 purpose of radiological protection, then you can infer
5 that depleted uranium should be similarly classified
6 although it is not currently classified.

7 So I've used this as a radiological guide
8 and also the fact that EPA similarly classifies it and
9 those wastes that are classified, the Defense waste
10 that are classified, TRU waste, which have almost the
11 same, slightly different materially, not different,
12 are now being disposed of in WIPP. So obviously a lot
13 of our reference calculations for the proper way to
14 dispose of DU come both from here and the EPA
15 definition of transuranic radionuclides which are
16 similar.

17 BY MS. CLARK:

18 Q Isn't it true there are two tables in that
19 section that you're looking at?

20 A Yes.

21 Q Do either of those tables list uranium?

22 A No.

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1 Q And then actually I believe it's
2 subsection A6 states "classification of waste with
3 radionuclides other than those listed in Tables 1 and
4 2. If radioactive waste does not contain any nuclides
5 listed in either Table 1 or 2, it is Class A." In
6 your opinion, does that provision apply to uranium?

7 A Well, it might apply to small amount of
8 uranium, but I do not believe that it applies to bulk
9 uranium waste because it is without reference to the
10 other parts of Part 61 which have an explicit dose
11 limit. I believe that we have shown in a number of
12 different ways and the Nuclear Regulatory Commission
13 itself has opined in a prior environmental impact
14 statement dealing with uranium enrichment as well as
15 National Labs Sandia in doing its calculations that
16 depleted uranium is not suitable for shallow land
17 burial and Class A waste is generally disposed often
18 in shallow land burials.

19 So I don't believe that depleted uranium
20 should belong here. I don't believe that Part 61
21 actually covered depleted uranium because it was
22 explicitly dropped. It was mentioned and then

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1 explicitly dropped. So I don't believe that a blanket
2 provision like this could cover an element that was
3 dropped because it was not foreseen to be disposed off
4 in large quantities. That's why it was dropped. So
5 I don't believe this exemption could cover that.

6 Q I think in the beginning of your answer
7 you referenced other regulations in Part 61.

8 A The 25 millirem limit.

9 Q Could you tell me what regulation you're
10 referring to and I'd like to ask you if you believe
11 any other regulations apply to classification of
12 waste?

13 A Of course, there's the high-level waste
14 regulation. There's 11(e)2. There is a number of
15 regulations that apply and laws that apply to the
16 classification of waste.

17 Q But aside from 61, do any other
18 regulations determine whether waste should be
19 classified as level A?

20 A No, I mean in terms of what should be
21 Class A, B and C it is 61.55. But as I've testified,
22 bulk, large quantities of depleted uranium are not

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1 covered by 61.65 because they were explicitly dropped
2 from consideration in the final rule.

3 Q Okay. I think that's all I have on Part
4 61. Next, I'd like to talk about Envirocare and
5 specifically I'm going to talk about the Envirocare
6 license and of course as we've been talking about
7 Amendment 22. But first, I'd like to talk a little
8 bit about your understanding of the way Envirocare
9 fits into the regulatory scheme. I believe as you
10 discussed before, you know that Envirocare is an
11 agreement state licensee. Correct?

12 A Yes.

13 Q In view of that fact, what is your opinion
14 -- How do you see the NRC's role in determining
15 whether Envirocare can be a site to accept DU for
16 disposal?

17 A Well, the NRC's role in an agreement state
18 as I understand it is to do oversight of the state
19 authority to see whether it is conducting its affairs,
20 licensing oversight and so on in accordance with the
21 NRC regulation and their intent for public health
22 protection as well as the specific dose limits and so

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1 on. As I understand it today, Envirocare is licensed
2 to accept Class A waste only with certain restrictions
3 according to state law as well as its own license.

4 If the state agency -- And the disposal is
5 covered by the dose limits of 25 millirem per year and
6 that if the state agency allowed things to happen that
7 would result in a violation of those limits or license
8 condition and the NRC would intervene. Otherwise, it
9 would leave it up to the state to carry out its
10 affairs.

11 Q So the matter of whether Envirocare's
12 license is licensed to accept DU for disposal is up to
13 the state. Is that correct?

14 A No, I don't think so. I think the
15 Commission hasn't yet ruled that depleted uranium is
16 Class A waste. In fact, the Commission explicitly
17 said it wasn't making a ruling in January about that.
18 Envirocare is only licensed to dispose of Class A
19 waste.

20 The Commission hasn't done any
21 calculations to indicate that the 25 millirem limit
22 would be met. Based on the state's calculations in

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1 1990, we have shown that depleted uranium is not
2 suitable for disposal. So I believe that the
3 Commission would not, should not, sit back in the
4 event that the state allowed depleted uranium in bulk
5 to dispose of at the site because it would be at
6 variance with a number of decisions that had been made
7 as well as that remained to be made.

8 Q The decision of whether DU qualifies as
9 Class A waste and can be disposed of at Envirocare, in
10 your view is that a decision of the state or the
11 Nuclear Regulatory Commission?

12 MR. LOVEJOY: Object to the form of the
13 question. The two matters you've stated don't follow.
14 You deal with the question if you can.

15 MS. CLARK: Answer them independently.

16 THE WITNESS: Well, depleted uranium is
17 not the problem of a single state. The lacuna of the
18 depleted uranium not being in 61.55 was created by the
19 Commission. It is a problem that involved many
20 states. The transportation of depleted uranium would
21 happen across state boundaries. There would be
22 contracts between parties operating in one state and

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1 disposing it off in another state.

2 I do believe that in this matter the
3 initiative rests and the obligation rests with the
4 Nuclear Regulatory Commission to determine what form
5 and how it should be disposed off and classified and
6 whether shallow land burial is appropriate or not. To
7 date, the NRC hasn't done it and either to my
8 knowledge has Envirocare.

9 Q Okay. I'd like to talk a little bit about
10 the Envirocare license.

11 A Okay.

12 Q You talked about 19 -- You talked about
13 site-specific calculations that were conducted in
14 1990. Could you please describe what those are?

15 A Yes. In -- Let me find the page here. On
16 page eight of the July 5, 2005 report that Dr. Smith
17 and I did, we described using the literature from 1990
18 that was part of the performance assessment used for
19 the initial licensing support documentation and this
20 documentation contains a number of coefficients for
21 various radionuclides millirem per year per picocurie
22 per gram of waste and those are the figures that we

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1 used from 1990 and as part of those radionuclides,
2 each one of the three constituents of depleted uranium
3 is listed, 234, 235 and 238.

4 Q Could you please tell us who did those
5 calculations and why they were done?

6 A Yes. The calculations were originally
7 done by my colleague and coauthor Brice Smith. They
8 were done to see, and I went over them, whether
9 depleted uranium disposal would in the concentrations
10 of nanocuries per gram, that it is present, would meet
11 the criteria set forth in those early licensing
12 arrangements so that we could arrive at some kind of
13 conclusion about that. That's why they were done. As
14 these calculations indicate, depleted uranium, the
15 site does not meet the criteria for depleted uranium
16 disposal at a 25 millirem per year dose permit.

17 Q Dr. Makhijani, are you aware of any
18 calculations that were done for the licensing of the
19 Envirocare site?

20 A Yes, these are part of the calculations
21 that were done pursuant to obtaining the license in
22 1990.

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1 Q They were done?

2 A Yes.

3 Q That's what they were for. In terms of
4 the assumptions that supported these 1990
5 calculations, did you use -- Was an agricultural
6 scenario used?

7 A Well, I think we considered -- It
8 describes there the intruder agriculture, the intruder
9 construction, as well as the worker, those limits. We
10 considered several different -- They had several
11 different scenarios for 30 years and 1,000 years.
12 Unfortunately, they did not go beyond 1,000 years. So
13 we just took it at face value. As I testified
14 earlier, we didn't actually evaluate how the
15 calculations were done. We just took the results of
16 the calculations at face value.

17 Q Okay. In the calculations that you
18 provide, did you use an assumption that this would be
19 an agricultural site?

20 A No, actually these calculations on page
21 eight were the scenarios that were originally done and
22 it did include one agricultural scenario. It also

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1 includes a non-agricultural scenario which is the
2 intruder construction scenario where agriculture would
3 not be carried out and then also simply includes a
4 worker scenario. So there were different scenarios
5 that were considered.

6 Q Would an agricultural scenario be
7 reasonable for this site?

8 A Well, you know when we're talking about
9 very long periods of time in the context of climate
10 change and bounding calculations, agricultural
11 scenarios are always more generally the conservative
12 assumption to use. If you ask me whether it is today
13 very likely that somebody is going to set up a
14 subsistence farm there, I would say no. But that is
15 not the purpose of subsistence farmer calculations as
16 you know. Subsistence farmer calculations are done as
17 bounding calculations, not likely calculations for
18 very long periods of time. They're kind of a
19 screening calculation to assure safety for future
20 generations.

21 Q Do you think there is any possibility that
22 this site might be used for agricultural purposes?

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1 A Oh, I can't forecast the climate change.

2 The climate change parameter is given --

3 Q Under current condition.

4 A Well, I think that we cannot reasonably --

5 It is unreasonable to assume that current conditions

6 will persist in terms of climate for extended periods

7 of time. I think that's not at all realistic.

8 Q Well, let's assume that they do. Would

9 this site ever be used for agriculture?

10 A Well, if we freeze time, then I've already

11 said that today is highly unlikely. So if you say

12 that current conditions will persist forever, then it

13 follows that it is unlikely that people will farm

14 there. But current conditions are unlikely to persist

15 forever. So it's kind of a circular argument.

16 Q Are you familiar with the Envirocare

17 license other than Amendment 22?

18 A In a general way, I am, but I haven't

19 studied the whole license in detail. I've looked at

20 the issues just in connection with this specific

21 matter at hand. I haven't studied Envirocare in

22 detail.

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1 Q Are you aware of any prohibition or any
2 limitation on Envirocare's ability to accept DU for
3 disposal in the license?

4 A Yes, as I've said that Envirocare is
5 prohibited from accepting anything other than Class A
6 waste. That's the only thing that its license covers.
7 License Amendment 22 as I said very likely, it's not
8 certain, because but very likely, would prohibit
9 acceptance of large quantities of depleted uranium
10 even in oxide form. I think the state law also
11 prohibits anything other than Class A waste. Depleted
12 uranium is currently not classified as Class A waste
13 and the Commission has refused to classify it that way
14 in January. It could have done it but it did not.

15 Q With the exception of the item that you've
16 discussed in Amendment 22, are you aware of any limits
17 on quantities of DU that could be accepted for
18 disposal?

19 A As I said, DU cannot be accepted for
20 disposal in bulk because it is not Class A waste and
21 Envirocare is only licensed to accept Class A waste
22 both under the conditions of the license and under

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1 state law.

2 Q Okay. Well, let's assume that it's Class
3 A waste. Are you aware of any limitations on
4 quantities?

5 A I can't -- It isn't. I don't know. If
6 the matter is going to go away by definition, then
7 and besides if it were accepted, I believe that under
8 Part 61 25 millirem per year dose limit it would not
9 be accepted because I don't believe that that
10 Envirocare site can meet the 25 millirem irrespective
11 of its classification. So even if it were classified
12 as Class A waste, Envirocare would not meet the 25
13 millirem and therefore would violate Part 61.

14 Q But does the license have any quantity
15 limitations other than what you've cited in Amendment
16 22?

17 A So far as I know, Amendment 22 is the
18 quantity limitation.

19 Q That's the quantity.

20 A Yes, I believe that that's right.

21 MS. CLARK: All right. Well, I have an
22 exhibit. I guess this should be identified as Exhibit

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1 11. This is Amendment 21 to the Envirocare license.

2 (Whereupon, the above-referred
3 to document was marked as
4 Makhijani Exhibit No. 11 for
5 identification.)

6 MS. CLARK: Would you like some time to
7 look at this?

8 THE WITNESS: Yes. I haven't looked at
9 this.

10 MS. CLARK: Okay.

11 THE WITNESS: Is there any particular part
12 that you want to ask me about to shorten this time?

13 MS. CLARK: Yes, on the cover page, Item
14 2; page 2 of 3, Item 2; and page 4 of 31, Item J.

15 MR. LOVEJOY: Page 4 of 31.

16 THE WITNESS: Thank you.

17 (Pause.)

18 THE WITNESS: I'm sorry. The next page?

19 MS. CLARK: Which one are you on?

20 THE WITNESS: I looked at the first item.

21 MS. CLARK: Page 4 of 31?

22 THE WITNESS: Oh, four.

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1 MS. CLARK: Item J.

2 THE WITNESS: Thank you.

3 (Pause.)

4 THE WITNESS: Okay. I think I've looked
5 at those.

6 MS. CLARK: Okay.

7 BY MS. CLARK:

8 Q Let's start with the cover page and this
9 is a discussion of a summary of the changes which were
10 incorporated into Amendment 21 and Item 2 reads,
11 "Incorporated portable gauge radioactive material
12 license" and then identifies it by number.

13 A No, I see it. I don't know that there's
14 a question.

15 Q Okay. Not yet. I thought we'll go
16 through the items.

17 A Yes.

18 Q And then we can talk about their
19 significance. The next section is the statement of
20 basis for the license amendment and I directed your
21 attention to page two of three, Item 2 which again
22 says it's incorporating the portable gauge radioactive

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1 material license.

2 A Right.

3 Q Following that, there's the license
4 amendment and I direct your attention to Item K. Is
5 that the same item we were discussing with Amendment
6 22, the depleted uranium custom source?

7 A Yes, it appears to be. Yes.

8 Q And then under Section 9, Authorized Use,
9 Item J, it says, "License material in Item 6(e)
10 through 6(l) for operational checks and efficiency
11 determinations of radiation detection
12 instrumentation." Now, Dr. Makhijani, having seen
13 this license amendment, what is your view of the
14 identification of the custom source?

15 A It hasn't changed. I don't believe that
16 the gauges refer to Item K. I think the gauges refer
17 to Item L, Calibration and Reference Sources. They
18 are not to exceed 5 nanocuries as I can tell. As I
19 said, I haven't seen this amendment before, but best
20 that I can tell that's what it would refer to and
21 those would not be allowed to exceed 5 nanocuries per
22 source whereas -- I don't see that it changes my

1 opinion about Item K at all.

2 Q Okay.

3 A I think it still limits, Item K still
4 limits, the amount to be possessed at 250 pounds or
5 56.8 millicuries.

6 Q Okay. Well, let me ask you first of all.
7 I believe you testified before that all of the items
8 listed in this table were items that were being
9 accepted for disposal. Do you still hold that view?

10 A Well, I don't believe I said that. I
11 actually think I said that I haven't looked at all the
12 various items, but generally yes and Envirocare as a
13 disposal site, they do some processing before
14 disposal. But they accept materials that they dispose
15 off of the site ultimately.

16 Q Well, going back to the cover page, Item
17 2 says they have incorporated portable gauge
18 radioactive material license into this license. In
19 light of that, does it seem reasonable that this table
20 lists portable gauges as well as items for disposal?

21 A Yes, it seems reasonable that it does.
22 Actually, it talks about these sealed sources and

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1 consources (PH), calibration or reference combined
2 sources, but depleted uranium shavings is not a gauge.

3 Q Directing your attention back to page 4 of
4 31, Item J which says "licensed material in Items 6(E)
5 through 6(L) for operational checks and efficiency
6 determinations of radiation detection
7 instrumentation." Do you believe that 6(K) is
8 included under Item J?

9 A Yes.

10 Q Doesn't Item J indicate that these are
11 radiation detection instruments?

12 A Uranium shavings is not a radiation
13 detection instrument I can assure you.

14 Q How would you explain Item J then? Do you
15 think there was a mistake?

16 A I don't know. Maybe it is to check
17 radiation detection instrumentation before disposal
18 but uranium shavings in homogenous concrete mix is not
19 a radiation detection instrument. It's a radiation
20 source.

21 Q If this were to be a detection instrument,
22 would you still be of the view that this would be

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1 applicable limit for disposal of DU?

2 MR. LOVEJOY: Object to the form of the
3 question. I don't think that's a realistic
4 assumption.

5 THE WITNESS: This is a radiation source,
6 not a detection instrument. Sorry.

7 BY MS. CLARK:

8 Q Could it be -- Dr. Makhijani, would it be
9 more accurate to say it's a calibration source for a
10 radiation detection instrument?

11 A Yes, if it were standardized, it could be
12 used as a calibration source. However, the form of
13 the language does not indicate in any way that it is
14 a calibration source because it does not specify an
15 exact amount of material to be contained in it. It
16 says not to exceed 250 pounds. A calibration source
17 always have a precise amount of material and
18 radioactivity specified. Otherwise, you can't
19 calibrate instruments with it.

20 Q Are you testifying that this could be a
21 calibration source, but you can't say for certain?

22 A No, I'm saying that this as I read it, it

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1 is not a calibration source as it is written because
2 calibration sources are always specified in exact
3 amounts of radioactivity. That's why they can be used
4 for calibration. If you don't have an exact amount of
5 radioactivity, you cannot use it for calibration.

6 Q Well, as I read the last column, it says
7 "This table gives the maximum radioactivity and/or
8 quantity they may possess."

9 A That's right and that's why I came to the
10 conclusion that I did that the maximum amount that
11 they can possess at one time is 250 pounds. If it
12 were a calibration source, it would say 0.1 microcurie
13 or 1 millicurie or whatever. It does not say that and
14 you would not put a uranium source in a 55 gallon drum
15 because uranium is alpha-emitting.

16 There would be no alpha rays that would
17 get out of the 55 gallon drum. So you could not use
18 this to measure alpha activity at all and uranium has
19 rather weak gamma rays. So most of the gamma rays
20 would be self-absorbed. I do not believe this is a
21 calibration source. No.

22 MS. CLARK: Okay. I don't think I have

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1 any further questions.

2 MR. CURTISS: Okay. I have some.

3 BY MR. CURTISS:

4 Q Why don't we just start where Lisa Clark
5 left off. Do you consider yourself an expert in
6 calibration sources and in the process of making
7 operation checks for calibration sources of the type
8 of facility that Envirocare operates?

9 A Well, I know enough about nuclear
10 engineering matters to know what a calibration source
11 is and as I have testified, a calibration source
12 always has a precise amount of radioactivity. You
13 should be able to detect that radioactivity with an
14 instrument. Otherwise, you can't use it to calibrate
15 an instrument. This is a matter for elementary
16 physics.

17 Q Are you familiar with and have you
18 examined the extent to which Envirocare uses
19 calibration sources in their operations?

20 A I have not.

21 Q Is it possible that the reference to a
22 homogenous mixture through a concrete mix in a 55

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1 gallon cylinder to make sure that it can serve for
2 exactly the function that's been just described here?

3 A No, as I said, first of all, uranium is
4 primarily alpha-emitting with weak gamma rays
5 associated with it. U-238 decay products will build
6 up which would be thorium-234 and protactinium-234.
7 They are primarily beta-emitting products. So such as
8 source would have very little radioactivity that would
9 actually escape the drum and the principal
10 radioactivity would not at all escape the drum.

11 Q Item K on page 4 of 31 which is
12 encompassed under J, 6(E) through 6(L) "for
13 operational checks and efficiency determination of
14 radiation detection instrumentation." What do you
15 interpret that to mean? "For operational checks and
16 efficiency determination of radiation detection
17 instrumentation," this source, this 55 gallon barrel
18 with uranium shavings homogeneously mixed in that
19 barrel is used for operational checks and efficiency
20 determination of Envirocare's radiation detection
21 instrumentation.

22 It seems plain on the face of it. And do

1 you still in view of the questions that the NRC staff
2 has asked believe that they prepared this homogenous
3 mixture of uranium shavings for disposal?

4 A There's a difference between operational
5 checks and efficiency determinations in calibration
6 sources. As I understand it, Envirocare has
7 restrictions as regard to what amounts of external
8 radiation it can handle and not handle in terms of
9 containerized and noncontainerized waste.
10 Conceivably, when it receives waste for disposal that
11 particular form would be one of the wastes that it
12 could use for checking whether its instrumentation for
13 external radiation is functioning properly.

14 You wouldn't expect much external
15 radiation from this source. You might expect a little
16 bit of gamma I believe from protactinium-234. But I
17 don't believe on the face of it that this can be a
18 calibration source. No.

19 Q You testified --

20 A Maybe for operational -- It may be for
21 operational purposes you could see whether it's
22 meeting the 5 millirad or 40 millirad limit as to

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1 which part of the waste site you would put it.

2 Q You testified that you don't have any
3 knowledge whatsoever about the practices that
4 Envirocare employs with respect to its radiation
5 detection instrumentation and the purpose it might use
6 this for. Do you have any basis as an expert just
7 reading this paragraph to know what the purpose of
8 this is?

9 MR. LOVEJOY: Object to the form. That's
10 not what he testified.

11 THE WITNESS: I've said that I haven't
12 made a study of Envirocare practices, but I do know
13 the different types of instruments that are used to
14 detect radiation. I imagine Envirocare uses them to
15 inspect the materials and classify them and see which
16 part of the site is going to dispose them off because
17 it does have two broad categories in terms of external
18 radiation. So I imagine that they have Geiger
19 counters that they use, specialized Geiger counters
20 that they use, for this purpose.

21 BY MR. CURTISS: If I could back to the
22 question of the scenarios that were employed in

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1 evaluating the Envirocare site and in particular the
2 agricultural -- farmer scenario.

3 THE WITNESS: Sure.

4 MR. CURTISS: Do you still have Exhibit 7
5 before you?

6 THE WITNESS: Yes.

7 MR. CURTISS: If you could turn to page
8 two of that document under Question 3.

9 THE WITNESS: Yes.

10 MR. CURTISS: And read the NRC staff
11 question and the DRC staff answer.

12 (Pause.)

13 THE WITNESS: Yes.

14 BY MR. CURTISS:

15 Q Based upon that and in particular upon the
16 extreme salinity of the soil and high
17 evapotranspiration rates of 40 to 50 inches a year,
18 is there any reason to believe on the basis of your
19 expertise that the state regulator, the agreement
20 state regulator, has improperly evaluated, employed
21 the wrong scenario for purposes of evaluating the
22 site?

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1 A Which -- Where would the state regulator
2 have employed the wrong scenario?

3 Q Yes.

4 A I don't know which calculation of the
5 state you are referring to. There's no calculation
6 here.

7 Q -- asks about the residential and
8 agricultural intruder pathways. I understand you've
9 testified that there ought to be a resident farmer
10 scenario employed here and this answer that explains
11 the state's view about that --

12 A I didn't say that actually.

13 Q Okay. It's not in your testimony?

14 A No, I said that for the long term the
15 resident farmer scenario in the context of climate
16 change provides a screening or bounding analysis
17 generally. I also said that under present conditions
18 I actually said pretty much the same thing as the DRC
19 staff that under present conditions it would be
20 unlikely that somebody would set up a farm there.
21 However, ranching and grazing, the exposure of the
22 waste by erosion and high external doses, there are a

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1 number of pathways through which people could be
2 exposed to high-levels of radiation from depleted
3 uranium disposal.

4 And actually our July 2005 report in
5 considering the 1990 analysis, I refer to three
6 different scenarios and agriculture was only one of
7 them. It's something that the State of Utah itself
8 considered at the time even though unrealistic at
9 present.

10 Q And in view of the extreme solidity of the
11 soil in the area you nevertheless believe ranching and
12 grazing is a use that ought to be considered for this
13 site.

14 A Well, let me repeat myself. I think I've
15 said that ranching under present -- ranching and
16 grazing have been done there in areas surrounding the
17 Envirocare site if I refer you to page 11 of the July
18 5th report toward the bottom. It says, "However poor
19 quality in an arid climate cannot be relied on to
20 prevent all types of inadvertent inclusion upon the
21 site. The areas surrounding the Envirocare site have
22 been used in the past for 'grazing of sheep, jack

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1 rabbit hunting and occasion recreational vehicle
2 driving' prior to placement of the disposal facility."

3 So it's not all agriculture activities
4 that are excluded. It's also true of the WCS site.
5 So semi-arid sites in the west are widely used for
6 grazing and ranching.

7 Q I have just three or four clarifications
8 on issues that I want to ask about.

9 A Sure.

10 Q I wasn't sure in the response to the NRC
11 staff's questions whether you indicated that you have
12 done or with the assistance of Brice you have done any
13 calculations regarding the Envirocare site. Did you
14 perform any calculations regarding the performance
15 assessments in the early 1990s?

16 A As I said, we took the results of the
17 analyses that were done to produce the coefficients
18 for millirem per year, for picocurie per gram in the
19 waste and simply applied that to the mixture of
20 radionuclides that go to make up depleted uranium. So
21 we did some calculations specific to the Envirocare
22 site which used the data radionuclide by radionuclide

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1 from 1990 which is referenced in the report and we
2 will send you the citations. But we did not do actual
3 ResRad calculations on the Envirocare site.

4 Q The report reflects the results of those
5 calculations?

6 A Yes, on page eight I believe.

7 Q And there is an underlying document or
8 calculations that have been done which you will
9 provide to us?

10 A Yes, they are the 1990 references which we
11 will send you.

12 Q Okay. Thank you. On the scaling issue,
13 if I could refer you to two documents, Exhibits 2 and
14 3 which respectfully are the Applicant's -- Let's
15 begin with Exhibit 3 on page 18 and the response to
16 Question 22. Do you have that there, Dr. Makhijani?

17 A Yes.

18 Q Could you describe what the nature of your
19 scaling concern here is?

20 A Yes.

21 Q It's also, I should say just for purposes
22 of completeness, addressed on page 37 of Exhibit 9,

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1 the November report, which may be the original source
2 of the filing.

3 A Let me find it.

4 MR. LOVEJOY: It should be the big fat one
5 here.

6 THE WITNESS: Page 30, sorry.

7 BY MR. CURTISS:

8 Q Yeah. Perhaps if you start with your
9 Exhibit 9, your November report, page 37.

10 A Yes.

11 Q Under paragraph 2, Scaling issues.

12 A Yes.

13 Q Could you take a minute just to read that
14 passage?

15 (Pause.)

16 A Yes.

17 Q Would you describe based upon what you
18 have presented here what the nature of your scaling
19 concern is?

20 A It's the Cogema facility is a much bigger
21 facility than what is proposed for the deconversion
22 plant. And according to the Lawrence Livermore

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1 analysis, when you build a smaller plant, the cost per
2 unit of processing goes up and that's sort of a basic
3 premise of any idea that when you build a smaller
4 plant you lose some economies of scale. So you're per
5 kilogram cost will go up.

6 Q And would the converse then be true if you
7 had a smaller plant and build a bigger one those
8 economies of scale would be reversed?

9 A Yes.

10 Q Okay. On the subject of CaF_2 , which is
11 also addressed in your November report I believe on
12 the previous page 36, at the bottom of the page 36 in
13 all three scenarios. Do you see where I am?

14 A Yes.

15 Q We assume that HF will be neutralized to
16 CaF_2 and disposed of as low-level radioactive waste.

17 A Yes.

18 Q What's the basis for your assumption that
19 the CaF_2 that would be produced as a result of this
20 process would be contaminated at levels that would
21 require that they be disposed of as low-level
22 radioactive waste?

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1 A Well, true release of HF or CaF₂ has never
2 been ruled on and it is slight, somewhat contaminated.
3 We agree that unless there's an affirmative ruling
4 otherwise that it should be assumed for financial
5 calculations and environmental matters that it will be
6 disposed off as low-level waste and in this we are in
7 complete accord with the final environmental impact
8 statement produced by the NRC which makes the sole
9 assumption that CaF₂ would be disposed off as low-
10 level radioactive waste. There's no alternative
11 scenarios considered actually so far as I read the
12 FEIS.

13 Q And do you know whether in practice at
14 commercial facilities that perform this that CaF₂ is
15 produced is in fact contaminated at the levels that
16 would require it to be disposed of as low-level
17 radioactive waste?

18 A Well, you know this -- The table here we
19 have to go to 61.55. Table 1 does not contain a lower
20 limit that says that there's re-release below this
21 limit. As you know, the low regulatory concern has
22 been a long-running and still unsettled argument. In

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1 view of the fact that there is no settled lower limit
2 and also the fact that it will have some contamination
3 that this re-release limit must be determined by
4 regulation and the NRC has ruled in the specific
5 context of this case in its own FEIS that it should be
6 disposed off as low-level waste and without
7 considering any alternative scenarios. We're in
8 agreement with that.

9 Q Do you believe NRC said it should be
10 disposed of or that they assume that it would it?

11 A They assert that it will be. Let me not
12 say what the NRC said but just read it. Okay. This
13 is on page 2-29 of the final environmental impact
14 statement. "Because conversion of the large
15 quantities of DUF₆ at the DOE Portsmouth and Paducah
16 Gaseous Diffusion Plant sites will be occurring at the
17 same time the proposed NEF would be in operation. It
18 is not certain that the market for aqueous
19 hydrofluoric acid and calcium fluoride would allow for
20 the economic use of the material generated by the
21 proposed NEF. Therefore, only immediate
22 neutralization of the hydrofluoric acid by conversion

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1 to calcium fluoride with disposal at a licensed low-
2 level radioactive waste disposal facility is
3 considered in this analysis" and I believe this is the
4 basis on which a license is going to be granted you if
5 it is granted. This is the only alternative that had
6 been considered. I'm afraid you're going to have to
7 make a financial provision based on the only
8 alternative that's being considered and I believe that
9 that's right.

10 Q In preparing for this deposition and in
11 preparing the interrogatory responses which in Exhibit
12 3 response No. 22 and in Exhibit 2 on page 21 in
13 preparing those, did you review the experience of the
14 -- plant in Europe and extend the contamination of the
15 CaF_2 that comes out of that plant?

16 A I don't recall. I think we've looked at
17 these numbers before. I don't think we're talking
18 about high levels of contamination.

19 Q What do you mean by high?

20 A It's not like pure depleted uranium for
21 sure. It's much lower than that. It's orders of
22 magnitude lower than that. The question as I have

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1 said is not the actual levels of contamination. The
2 question is the presence of contamination, the lack of
3 any lower limit in 61.55 off for Class A waste and the
4 fact that the Commission itself, the staff in its
5 final environmental impact statement has not
6 considered any other alternative and I personally
7 don't see in calculating the finances.

8 It's just like the contingency provision.
9 If the NRC rules require you to make a 25 percent
10 contingency provision, then you have to make it to get
11 a license. If the NRC hasn't considered the impacts
12 of any alternative other than calcium fluoride, I
13 don't see how you can expect to get a license without
14 factoring the costs of that.

15 Q: Do you know of any experience that a
16 regulator either at the Federal or state level has
17 authorized the disposal of CaF_2 on the basis of low
18 contamination levels in nonlicensed municipal
19 landfills or other similarly nonlicensed sites?

20 A: I haven't comprehensively looked at
21 calcium fluoride disposal from all plants.

22 Q: I have one final question. I want to go

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1 back to make sure I understand your position on
2 greater-than-Class C under Part 61. Is all greater
3 than Class C encompassed within the definition of low-
4 level waste in Part 6?

5 A No, as I've said, the specific things that
6 are defined in Class 61 are in relation to what's in
7 Tables 1 and 2, the radionuclides that are in Tables
8 1 and 2 with the specific concentrations listed there.
9 For those radionuclides when waste contains amounts
10 that are in excess of Tables 1 and 2, Part 61 says
11 that that is greater than Class C waste.

12 It so happens that the specific activity
13 of depleted uranium is bigger than the 100 nanocuries
14 per gram allowed for transuranic waste, but depleted
15 uranium itself is not defined under Part 61. So my
16 position as I have testified is that it should be by
17 analogy with what's in Part 61 be classified as
18 greater than Class C waste or by analogy with EPA
19 rules be classified as a parallel to transuranic waste
20 and similarly treated for deep geologic disposal.

21 Q I understand your position on DU on the
22 Part 61. I'm asking just a simple question.

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1 A Okay.

2 Q Independent of -- Is all greater than
3 Class C waste whatever it is covered by Part 61 or is
4 there a greater than Class C, a type of greater than
5 Class C, that's outside the Part 61 and not regulated
6 under Part 61?

7 A Well, this is one of those circular
8 questions that are bewildering me today, at least as
9 I understand your question. Part 61 defines what it
10 defines. It doesn't define the universe of
11 radioactive waste. It defines the radioactive waste
12 that are in Table 1 and 2 and if you exceed for those
13 radionuclides those concentrations, then for those
14 radionuclides you have greater than Class C waste.

15 Then by analogy in terms of radiation
16 protection, you can made statements about those wastes
17 that are not in Part 61 and the Commission itself is
18 not saying that DU isn't Part 61. So you can make
19 statements about DU by inference by certainly Part 61
20 doesn't cover the universe of waste and I believe I'm
21 just repeating what the Commission said in January.

22 MR. CURTISS: Okay. That's all I have.

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1 MS. CLARK: Well, I have a few more
2 things. I apologize.

3 THE WITNESS: Okay.

4 MS. CLARK: It shouldn't take too much
5 longer.

6 BY MS. CLARK:

7 Q I want to talk a little bit more about the
8 cost estimates and what you'll be testifying to.

9 A Okay.

10 Q Specifically with regard to the DOE cost
11 estimates.

12 A Yes.

13 Q There is a claim in one of the contentions
14 that the operating costs for a deconversion facility
15 must be assumed to increase. This would be of course
16 at one of the DOE conversion plants if the facility
17 operating life is extended presumably to accommodate
18 the NEF material.

19 A Yes.

20 Q Will you be testifying on that issue?

21 A Yes.

22 Q And what will be the substance of your

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1 testimony?

2 A I don't believe that the DOE can be relied
3 on to do anything in regard to lifting wastes that it
4 is committed to lift from any site or can be relied on
5 because of the specific experience of Yucca Mountain.
6 There's a law. There are specific contracts. When
7 those contracts were not met, the Department itself
8 refused to acknowledge that it had legally binding
9 contracts. It is now paying fines under court order
10 but has not lifted a ton of waste from the sites.
11 Department has regular cost overruns on major
12 projects. It has a large amount of waste that remains
13 to be processed through a plant that has not yet been
14 built. So I think it contains a large element of
15 speculation that is not warranted by the past
16 performance of the Department to say that they will do
17 this at the end of a 30-year period when they failed
18 to meet commitments that are a much shorter time frame
19 than that with adequate resources being provided in
20 advance.

21 Q With regard to this claim regarding
22 operating costs, do you have anything specific to

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1 that? It says "Operating costs must be assumed to
2 increase if the facility operating life is extended."

3 A Of course, when you have an old facility
4 to operate and you keep it going, you're going to
5 incur some operating costs. In an older facility,
6 you're going to incur larger maintenance costs.
7 Equipment is going to wear out. It is going to have
8 to be replaced. Things don't have an indefinite
9 lifetime.

10 The Department has a very large amount of
11 depleted uranium as you know. If you take it analogy
12 with much of the equipment in the Defense sector, the
13 Department's spent billions and billions of dollars
14 trying to refurbish its aging nuclear weapons complex
15 but ultimately failed to refurbish a large part of it
16 and then it's had to be dismantled and now we're
17 talking about a new nuclear weapons complex.

18 There is no -- I think to rely on the idea
19 that this equipment could go on beyond its originally-
20 envisioned operating life at least should make
21 provision for some increases in maintenance costs.

22 Q Can you tell from the DOE cost estimate

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1 whether DOE has done that or not?

2 A No, I don't think the DOE has done that.

3 I think the DOE estimates are very low and I think the

4 DOE's history of cost escalations and I have several

5 examples here of very large cost escalations doesn't

6 give me any confidence in DOE initial cost estimate

7 because they have routinely exceeded those estimates.

8 In fact, we've already as I said got delays in

9 construction and I would be willing to give odds

10 anyway that there would be cost escalations in that

11 project.

12 Q For this specific cost estimate, do you

13 know whether they've assumed that there have been no

14 increase, there will be no increases?

15 (Whereupon, the proceedings went

16 immediately into Proprietary Session.)

17

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1 MR. LOVEJOY: Okay.

2 THE WITNESS: Actually, the costs in
3 Exhibit 12 on page 2-4 which include the
4 recapitalization costs are \$2.85. But the capital and
5 operating costs for conversion quoted to LES are only
6 \$2.68 which are less.

7 MS. MAYER: There are several --

8 THE WITNESS: And moreover the
9 transportation --

10 (Discussion off microphone.)

11 THE WITNESS: The transportation costs are
12 only 11 cents whereas LES assumes based on their
13 discussions with a private operator of 85 cents.
14 Their disposal costs are only 55 cents whereas LES
15 assumes on the basis of their discussions with WCS and
16 Envirocare of \$1.14. So since DOE has no firm
17 disposal plan or contract for disposal itself and
18 since these conversion costs are less and in fact
19 don't include most of the recapitalization costs in
20 here, yes I don't believe that this is adequately
21 taken into account.

22 BY MS. CLARK:

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1 Q So I think maybe we need to break this
2 answer down a little bit. You're talking about
3 operating costs that you say must be assumed to
4 increase.

5 A Yes.

6 Q Do you mean by that the recapitalization
7 costs? Would that be encompassed in that?

8 A Well, an old plant will have to be
9 recapitalized. That is you have to go out and borrow
10 money and fix your equipment. But you don't actually
11 replace everything and generally you might replace
12 some big pieces of equipment for the purposes of
13 efficiency, but you're not going to replace your motor
14 control centers and you're not going to replace your
15 integral motors that are integral with pumps and
16 things like that.

17 You're not going to refurbish the whole
18 plant, certainly not for 28 cents per kilogram. And
19 you might replace a few pieces of equipment. That
20 would be covered under recapitalization costs and I
21 haven't examined everything that they say that they
22 will or won't replace. But aside from that, I think

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1 you do have to increase your annual costs in terms of
2 the maintenance that would be required on the old
3 equipment that would be there and that is not done.

4 In fact the estimate that was given to LES
5 is less than the estimate in their own scenario which
6 is \$2.85. Whereas the estimates given to LES are
7 \$2.68. So they don't even include most of the
8 recapitalization cost.

9 Q Well, let's go back to recapitalization.

10 A Okay.

11 Q You said that -- What I hear you saying is
12 recapitalization costs will increase over time. Is
13 that what you're saying?

14 A No, I didn't say that. I said that if you
15 are extending the life of a plant you would need to go
16 and borrow some money and invest in replacing some key
17 pieces of equipment.

18 Q Right.

19 A But since you're not going to replace --
20 So that would be covered under some title of
21 recapitalization. However, since you have mostly
22 still an old plant, you couldn't do -- It's very

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1 costly to fix an old plant. It's actually much more
2 costly. It's like repairing a car. If you put all
3 new components in a car in the repair shop, it will
4 cost you much more than buying a new car because
5 you're doing it custom retail.

6 And recapitalizing a plant is the same
7 kind of thing because you're not starting from
8 scratch. It's easier to do it from scratch. So
9 you're replacing only a very tiny fraction of the
10 plant by doing that. You still have mostly an older
11 plant that will require more maintenance and I do not
12 see any provision in here for higher surveillance and
13 maintenance costs which is only 3/10ths of a cent per
14 kilogram.

15 I do not see any higher annual operating
16 costs. So the only higher costs that are here are the
17 costs of borrowing to refurbish the plant to extend
18 its life, but there is no cost additional for the
19 maintenance of the routine operations for the
20 equipment that will be there that will be old and
21 moreover, even the recapitalization costs are not
22 mainly reflected in the quote given to LES.

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1 Q So do you know what's covered in that
2 recapitalization cost?

3 A I haven't studied it in detail, no. I'm
4 just presuming that -- I haven't looked at this
5 document for a long time, for some time. You know
6 this -- I remember looking at this document in terms
7 of the costs provided by DOE and so this Exhibit 13 I
8 mean. So I haven't studied the breakdown of the
9 recapitalization costs, but that's what
10 recapitalization means.

11 Q Right.

12 A It does not mean routine annual operating
13 costs. That would be covered under the item above.

14 Q So it's possible that that cost actually
15 does take into account they'll be lower in the
16 beginning of operation and greater as operation
17 continues.

18 A No, I don't think -- At least as I read
19 it, to the best of my ability admittedly not having
20 studied the details of how that number was arrived at,
21 just from the description of the line item when you
22 say recapitalization, it means you're stopping for

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1 some time refurbishing the plant. You're having some
2 kind of an overall and then start. But that does not
3 cover the increased routine maintenance costs from the
4 older equipment that you have in the plant.

5 And I don't see any provision for
6 increases in annual costs under any item. I would say
7 that there are two items under which such a cost
8 increase should be reflected. That would be in the
9 annual costs which is the first item in the operating
10 costs and in the surveillance and maintenance cost
11 which is the last item.

12 Q But you don't know what those are based
13 on, those costs, what year they might be based on.

14 A No, as I read this, the only new item for
15 extended life is the recapitalization and as I said,
16 I have not made a detailed study of the DOE estimate.

17 Q Okay.

18 A Which I consider in any case as I've
19 testified to be not reliable given the DOE's history.

20 Q Another claim in the contentions is that
21 it's expected that DOE will charge for cost of
22 storage. Are you going to testify on this issue,

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1 storage costs?

2 A I'm going to testify that they should
3 charge for costs of storage. We haven't done a
4 detailed analysis of what those costs should be or are
5 we challenging the actual storage costs as they've
6 been presented by LES or anyone else.

7 Q In your view, does that cost estimate
8 include any costs for storage?

9 A I don't believe it does actually. There's
10 no line item for storage that I see here.

11 Q Do you see a line item for surveillance?

12 A Yes.

13 Q Do you think that could be for storage?

14 A I actually would have to review it. I
15 don't know. I don't see a line item but I'm not sure
16 of what that item includes.

17 Q Okay. What is the cost that it shows for
18 surveillance?

19 A Three-tenths of a cent.

20 Q Could you please look at the March 1st DOE
21 letter? It's right there.

22 MR. LOVEJOY: Exhibit 13?

1 BY MS. CLARK:

2 Q And look at the cost breakdown.

3 A Yes.

4 Q Does that contain an item for storage?

5 A Yes, it's the identical item.

6 Q So do you think they most likely are the
7 same?

8 A I think so. Yes, I do. Thank you.

9 Q Are you going to testify regarding a
10 contingency allowance?

11 A Yes.

12 Q And what will your testimony be with
13 regard to that issue?

14 A Well --

15 MR. LOVEJOY: Are you still talking about
16 the DOE?

17 MS. CLARK: Yes, DOE estimate.

18 MR. LOVEJOY: Okay.

19 THE WITNESS: In regard to the DOE
20 estimate?

21 MS. CLARK: Yes.

22 THE WITNESS: Or our cost estimates?

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1 BY MS. CLARK:

2 Q Well, specifically in regard to the DOE
3 estimate.

4 A I mean the DOE estimate is so much at
5 variance with all the other estimates that have been
6 made in regard to the major cost elements of
7 especially disposal and to some extent of
8 transportation as obtained by LES presuming that it's
9 reliable but let me focus on disposal. I don't think
10 this comes anywhere near the reality. This is a
11 disposal cost which is less than half of what has been
12 presented by LES which is at the lower bound of
13 Envirocare which is one-third the cost of the Class A
14 disposal published in the Atlantic Compact. So I
15 think a very large provision for uncertainty and
16 contingency would have to be made here because I don't
17 think these costs are realistic.

18 Q Do you have a contingency factor that you
19 think that you will testify would be appropriate?

20 A Well --

21 MR. LOVEJOY: Excuse me. With respect to
22 DOE estimates?

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1 MS. CLARK: Yes, I'm sorry. I'm still all
2 talking about the DOE estimate.

3 THE WITNESS: Well, I think the DOE cost
4 estimate is not, especially in regard to disposal,
5 based on anything real, so I don't think that you can
6 actually, that I can see. They have said they don't
7 have a contract. They don't have a proposed plan.
8 They don't have a strategy. They've given an estimate
9 of 55 cents but I don't know how you'll apply a
10 contingency factor to a cost estimate in terms of
11 percentages that doesn't seem real.

12 I think they have to make a more realistic
13 provision for disposal costs before a contingency
14 factor can be applied to it. But in principle you
15 should apply a contingency. Contingency is for
16 unforeseen things, but you have to start with
17 something that is reasonable and foreseeable and then
18 apply a contingency to it. This is not a reasonable
19 cost estimate as I see it. So first, it would have to
20 be made reasonable.

21 Then the three elements or the two
22 elements in the DOE case, two elements of contingency

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1 at 25 percent for licensing and delays and of 19
2 percent in relation to unforeseen risks of uranium
3 should be applied to it. That was in our November
4 2004 report.

5 Q Did you give a percentage? I'm sorry.

6 A Yes, I gave two different percentages. In
7 our November report on page 51, we have three
8 different line items with contingencies. There is a
9 financial exchange rate contingency which would not
10 apply to the DOE. There's an NRC-related contingency
11 which is 25 percent. So that would apply. That would
12 apply to a properly-done cost estimate. Then there's
13 a uranium risk contingency.

14 The uranium risk contingency refers to the
15 considerably long discussion that we have in the
16 November report of the newly emerging risks of uranium
17 mainly research that the Armed Forces Radiobiology
18 Research Institute near here in Bethesda and the fact
19 that the risks of cancer for women are emerging as
20 considerably greater than the risks for men and this
21 has been now reaffirmed since we wrote the November
22 report by the National Academy of Sciences. We can

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1 expect the radiation standards for dose to be
2 tightened in response to that. So this contingency
3 relates to the expectation that based on the things
4 that we can reasonably foresee, some extra provision
5 needs to be made for the higher risks of radiation per
6 unit of dose.

7 Q What percentage do you assign to the
8 uranium risk?

9 A We added 19 percent because currently in
10 the Federal Guidance Report 13 which was the basis of
11 the calculation that we did here and the BR-7 report
12 has come out pretty much in the same place. The
13 Environmental Protection Agency averages male and
14 female cancer risks and instead of using the highest
15 risk of part of the population which is about 38
16 percent higher risk. So 19 percent is half of that.

17 Q You talked a lot about DOE reliability
18 issues. With regard to the conversion facility, do
19 you have any similar issues with regard to UDS?

20 A It's not an issue with regard to a private
21 company, I think, because private companies that have
22 been contractors to the DOE for waste management don't

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1 seem to perform well in that incarnation whereas they
2 might do quite well in their own private capacity. I
3 can give you the example of Dupont which was long the
4 contractor of the Department of Energy at Savannah
5 River site.

6 Dupont built the vitrification plant for
7 high-level waste without building a pilot plant,
8 without even casting a single full-sized radioactive
9 glass log with real radioactive waste, without
10 carrying out any full-scale tests of the in-tank
11 precipitation when they were told from the inside and
12 from the outside by people like me, that this was a
13 very risky course. I know that even in emergency and
14 urgent situations in its own private capacity, Dupont
15 does not proceed in that way and we have an example
16 from about the same time period for the same
17 corporation when chlorofluorocarbons of which Dupont
18 was the largest manufacturer were supposed to be
19 phased out in a very rapid timeframe because of the
20 Antarctic ozone hole and Dupont wanted to replace it
21 with HFC-134a. They still in that emergency built a
22 pilot plant, tested their process, made sure it would

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1 work before they built a large scale pilot plant.

2 So apparently from the poor performance of
3 private contractors under the tutelage of the DOE I
4 would say that there's a management problem of the DOE
5 not being able to exercise and create an adequate path
6 for private corporations to perform and when they
7 don't perform to hold them accountable because the
8 record is very sorry.

9 I can read it to you. National Ignition
10 Facility initial estimate was \$2 billion in 1998,
11 gone up to \$3.26 billion by June 2000. Performance
12 not expected to be as originally advertised as I
13 understand it.

14 Savannah River site Vitrification Plant,
15 \$1.2 billion. Eventually \$3.9 billion. Performance
16 90 percent of the waste cannot be processed in volume
17 and for tank waste, \$4.3 billion September 1996.
18 August 1998, \$8.9 billion. They are facing some
19 difficulties still.

20 Yucca Mountain, \$17.5 billion, 30 year
21 cost estimate. Currently standing at \$58 billion and
22 counting and I think the costs of the fines have not

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1 been included. DOE contractor said cost was
2 understated by \$3 billion. I don't think \$58 or \$60
3 billion is going to cover Yucca Mountain. In all of
4 these cases, the Frenald Vitrification Project
5 completely failed and along with cost overrun. I
6 think in all of these cases performance is nil to far
7 below anticipated. Cost is far greater than
8 protected. One could produce more examples.

9 Q Okay. I believe you said that you had
10 brought these concerns to DOE and DOE was addressing
11 them. Could you explain that?

12 A Well, yes. We produced containing the
13 Cold War mess and did a number of case studies because
14 you do share environmental goals with the Government
15 and I actually sent my draft report to the Department
16 of Energy for review so we would not be publishing
17 information that was out of date and had the best
18 possible analysis for the public. We do separate
19 ourselves in that regard from some other
20 organizations.

21 Before the report was released,
22 Undersecretary Al Alt (PH) called me and said they

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1 would cooperate in reviewing the report and in
2 addressing the concerns and eventually, they did
3 address one major concern of ours. I do not believe
4 that we got satisfaction on most of our concerns.

5 The one major concern that they did
6 address was we felt that the waste data of the
7 Department of Energy in regard to transuranic waste,
8 buried transuranic waste, did not appear to have any
9 scientific basis. The Department agreed that it did
10 not have any scientific basis in writing in a letter
11 to me which is cited in the report and sent us
12 improved estimates. We've worked over a period of
13 three years, had meetings in the IER office in the DOE
14 around the concerns in the report.

15 I did advise the Department of Energy not
16 to proceed with the vitrification contract in the
17 manner that it was then written with the BNFL and
18 unfortunately they didn't listen to me, but eventually
19 wound up cancelling the contract after the cost
20 escalated to \$14 billion. So we tried with some
21 satisfaction to work with the Department of Energy
22 over a period of years.

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1 Eventually, we had a joint press
2 conference. IER held a press conference at which I
3 invited the DOE to discuss the these matters with the
4 public as to how they had been addressed and resolved
5 or not resolved after a three year period.

6 Q For the UDS contract, DOE has hired
7 actually an independent contractor to oversee and
8 manage the contract. Do you think this is an effort
9 to address some of these past problems?

10 A Well, I know that people on the inside
11 would be distressed at this. This is not -- You know
12 when things don't work out. It's obviously not a
13 happy situation for anyone. I do believe the DOE
14 makes continuing efforts to address these issues, but
15 I have concluded that DOE is unable to address these
16 issues despite the efforts that many good people on
17 the inside have made especially in regard to clean-up
18 and waste management. I would hope that they would
19 succeed because deconversion is -- But I wouldn't put
20 much stock in that.

21 MS. CLARK: Okay. Anything else?

22 MR. CURTISS: Two final questions from me.

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1 We're not going to go back and forth all afternoon.

2 THE WITNESS: You're welcome to. It's
3 your time.

4 MR. CURTISS: It's a lot of questions but
5 we are narrowing it down, Dr. Makhijani.

6 THE WITNESS: Okay.

7 BY MR. CURTISS:

8 Q On the question of future operating costs
9 which is a matter that is addressed in the late filed
10 contentions that have been filed and that Counsel for
11 the Staff has inquired about, your point I take it is
12 that the cost estimate of LES to the extent that it
13 would rely on the DOE option and their cost estimate
14 must account for future operational increases.

15 A Yes.

16 Q And I have two questions about that. One,
17 how is that determined in your view because to account
18 for it presently, it presupposes you can quantify
19 that?

20 A Yeah, I think you quantify it by going to
21 real world experience, as I've testified a couple of
22 times today is the best and really only sensible,

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1 reliable way to make cost estimates for deconversion.
2 I do believe that you can do that without having a
3 contract and I've testified is to go to the Cogema
4 plant.

5 They have given you a number. They are
6 paying, Urenco is paying, a specific sum to actually
7 get this job done. We know this number. This is for
8 a certain size of plant. It has been in operation for
9 some time, not for 30 years, but at least you can
10 begin to get an idea of what some of the long-term
11 problems might be. You can certainly have a starting
12 point for deconversion, transport and storage costs.
13 I think we know this number pretty well. We've
14 honored it, I think, in our own report by simply the
15 only thing we did in November 2004. So we actually
16 put our money where my mouth is in that the only thing
17 we did in our November 2004 report to this number is
18 add a Euro to dollar conversion rate because the cost
19 is in Euros and you have to take the exchange rate
20 into account.

21 Otherwise, I think this is a perfectly
22 good basis. If you want to do the same for

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1 maintenance, I believe there's some real world
2 experience and you should simply ask Cogema to
3 evaluate that cost for you.

4 Q As a regulatory matter under the
5 provisions of Part 7, the financial assurance that has
6 to be provided, is it your position in the context of
7 this comment on the future operating costs that an
8 estimate today based upon the best available
9 information of what it costs today, you're referring
10 to the Cogema estimate for example, has to also
11 project what costs will be in the future on operating
12 costs and perhaps other variables?

13 A Well, I think if you were building a new
14 plant, I don't think so because as I've said, we have
15 experience for a new plant for the same technology.
16 It's been built. It's been operating well. It's
17 doing the job. We know the number. If you're going
18 to say I'm going to take a 30-year old plant and tag
19 my stuff on the back end of that, then I think you
20 have a bigger problem in terms of actually calculating
21 your operating costs and that's the thing that we're
22 talking about.

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1 Q And would you describe for us what the
2 purpose of the triannual update is insofar as
3 accounting for cost increases in the future?

4 A Well, the triannual update gives you an
5 estimate, every three years, of what the
6 decommissioning and waste management costs are
7 supposed to be. I think however you are obliged to
8 make the best estimate for each scenario of the costs
9 as you can foresee them. I don't think there's a free
10 pass when you make an estimate every three years of
11 simply dropping that cost that are foreseeable. You
12 have to make the best estimate you can.

13 Q Including predicting the future costs and
14 reflecting those in the financial assurance today?

15 A Well, you know the future is always full
16 of uncertainty and risk and that's what makes it
17 interesting. And we make two kinds of provision in
18 terms of estimating for the future. When you can see
19 things and put a number on them, you make the best
20 effort to do that. When you can't see things, then
21 you put a contingency to the best efforts that you
22 can.

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1 In the case of maintenance costs as I've
2 said, I have not seen any evaluation of the trend in
3 maintenance costs for the one plant that is operating
4 and I believe as time goes on and equipment wears out
5 that it needs more maintenance. If it doesn't in this
6 particular case, that at least should be established
7 by reference to the Cogema plant that has been
8 operating and by reference to the one company that has
9 a lot of experience doing this work and that hasn't
10 been done.

11 Q I'm curious if you have a view in an
12 analogous area of where the licenses of nuclear plants
13 have been extended 20 years and obviously with the
14 intended additional operational costs, capital costs
15 and so forth, do you have a view, an expert view, as
16 to whether the cost per kilowatt hour has gone up when
17 you extend the life of the nuclear power plant?

18 A Well, I haven't done a detailed study of
19 any of the relicensing process, even my view, on the
20 relicensing that the NRC has done would be
21 considerably more informal at this stage that I would
22 be willing to testify in a formal proceeding.

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1 Q Okay. On the contingency factor issue, in
2 your report of November 24th which is Exhibit No. 9 on
3 page 49, you refer to the 25 percent contingency
4 factor that the NRC requires and I take it in the
5 table that you've prepared here reflected on page 51
6 that you have taken that 25 percent contingency factor
7 as you describe it, something reflected at NRC, and
8 then you have added a contingency factor and did I
9 understand you to say 19 or 90 percent?

10 A Nineteen, 1-9 for uranium risk?

11 Q For uranium risk and that 19 percent is to
12 address what you expect will be future changes in the
13 radiation standards as a result of your assessment of
14 the radiation risks associated with depleted uranium.

15 A Yes, as best as we can tell, the risks to
16 women are considerably higher per unit of radiation
17 dose. This science has developed in the last few
18 years. There are numbers of other risks that are not
19 reflected in that 19 percent. They are very uncertain
20 at this time as to whether there are actual health
21 effects in humans at the doses we're talking about.

22 But --

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1 Q So the testimony -- Oh, I'm sorry. Go
2 ahead.

3 A In regard to the established cancer risks
4 that are better studied and where specific numbers are
5 available in Federal Regulatory Guide 13 and now in
6 the BR-7 report from the National Academy, you can
7 actually put a number to how much greater than the
8 average of the population the risk to women is and one
9 can expect that in the workplace of the future and for
10 the general population in terms of waste disposal that
11 radiation standards in terms of dose will be
12 stringent. So it will be more costly to do all these
13 tests.

14 Q So the testimony that you'll deliver on
15 this issue in this proceeding will consist of two
16 points, No. 1, that the 25 percent contingency
17 specified by the NRC should be added to the cost
18 estimate and No. 2, an additional 19 percent should be
19 added for this anticipated, you anticipate, change in
20 the radiation protection standards in the future. Is
21 that a fair assessment of what you're going to testify
22 on?

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1 A I think it would be prudent to anticipate
2 it, a specific provision. I don't know that it's
3 going to happen. I certainly advocate it but I'm just
4 one person. I think it would be prudent in view of
5 the official science. It is not just my opinion.
6 It's what the EPA has published and the NAS has said
7 to make that provision, yes.

8 MR. CURTISS: Okay. That's all I have.

9 MS. CLARK: I think that's it.

10 MR. CURTISS: Thank you. Off the record.

11 (Whereupon, at 2:25 p.m., the above-
12 entitled matter concluded.)

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CERTIFICATE

This is to certify that the foregoing proceedings
in the matter of: The Deposition of
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held on: July 21, 2005
at the location of: Washington, D.C.
were duly recorded and accurately transcribed under my
direction; further, that said proceedings are a true
and accurate record of the testimony given by said
witness; and that I am neither counsel for, related
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I am not a relative nor an employee of any of the
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AUTHENTICATION BY SIGNATURE

I, the undersigned, do hereby certify by my signature hereunder that I have read the foregoing deposition of testimony given by me on July 21, 2005, and find said transcription to be a true and accurate record, as corrected.

Arjun Makhijani

Sworn to and subscribed before me this _____ day
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