

April 22, 2002

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

DOCKETED
USNRC

Before the Atomic Safety and Licensing Board

May 2, 2002 (10:00AM)

In the Matter of)
)
PRIVATE FUEL STORAGE, L.L.C.)
)
(Private Fuel Storage Facility))

Docket No. 72-22-ISFSI
OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

**APPLICANT'S RESPONSE IN SUPPORT OF NRC STAFF'S MOTION
TO STRIKE CERTAIN EXHIBITS AND PORTIONS OF THE TESTIMONY OF
DR. MARVIN RESNIKOFF ON UNIFIED CONTENTION UTAH L/QQ**

I. INTRODUCTION

Pursuant to the Order (General Schedule Revisions) of the Atomic Safety and Licensing Board ("Board") dated September 20, 2001 and 10 C.F.R. § 2.730(c) Applicant Private Fuel Storage, L.L.C. ("Applicant" or "PFS") files this response in support of the NRC Staff's motion to strike certain exhibits submitted by the State of Utah and portions of the pre-filed direct testimony of Dr. Marvin Resnikoff¹ on Unified Consolidated Contention Utah L/QQ ("Contention Utah L/QQ"). See NRC Staff's Motion in Limine to Exclude Certain Exhibits and Portions of the Prefiled Testimony of Dr. Marvin Resnikoff Concerning Unified Contention Utah L/QQ (Geotechnical), dated April 15, 2002 ("Staff's Motion"). As further described below, Applicant generally agrees that the exhibits that the Staff seeks to exclude are inadmissible. PFS also believes that Dr. Resnikoff is not qualified by training or prior experience to testify on the matters which are subject to the Staff's Motion, and the opinions he purports to tender are not

¹ State of Utah Testimony of Dr. Marvin Resnikoff Regarding Unified Contention Utah L/QQ (Seismic Exemption - Dose Exposure) ("Resnikoff Testimony") (April 1, 2002).

supported by facts or analysis, and therefore lack probative value. For those reasons, Applicant supports the Staff's Motion.²

II. DISCUSSION

A. Utah Exhibits 100, 102, 104, 115, 124, 125, 128 and 133

The Staff's Motion seeks to exclude eight proposed exhibits included with the State of Utah's prefiled direct testimony on seismic issues. Utah Exhibits 115, 124 and 128 are challenged as duplicative of exhibits tendered by the Staff with its direct testimony. The Staff asserts that it intends to introduce these exhibits as part of its direct case at the hearing. Based on the Staff's representations, Applicant agrees that these three State exhibits are repetitious and should not be admitted into evidence.

The other five challenged exhibits (Utah Exhibits 100, 102, 104, 125 and 133) contain, for the most part, materials that are irrelevant to the issues in this proceeding. For the reasons pointed out in the Staff's Motion, PFS believes that these exhibits should be stricken.³ In particular, Utah Exhibit 133 is a portion of the application submitted in December 2001 by Pacific Gas and Electric Company for a site-specific license under 10 CFR Part 72 to build an Independent Spent Fuel Storage Installation ("ISFSI") at the Diablo Canyon Nuclear Power Plant. This exhibit is irrelevant to the instant proceeding and is not being sponsored by the document's author (or anyone else). Therefore, it lacks probative value and should be stricken.

² Applicant is also moving to strike certain portions of the Resnikoff Testimony. See Applicant's Motion to Strike Portions of the Testimony of Dr. Marvin Resnikoff on Unified Contention Utah L/QQ dated April 15, 2002 ("Applicant's Motion"). The portions of the proffered Resnikoff Testimony subject to the Applicant's Motion relate to his allegation that PFS has calculated inappropriately the radiological dose rate at the site boundary for *normal operating conditions*, a subject obviously outside the scope of the seismic issues that are the subject of Contention Utah L/QQ.

³ As the Staff's Motion points out, exclusion of these materials from evidence does not mean the State can not use them for cross-examination purposes, if appropriate, nor does it preclude experts from relying on them in formulating their opinions.

B. The Cited Excerpts from Dr. Resnikoff's Testimony

Dr. Resnikoff has proffered testimony on behalf of the State of Utah on a wide variety of matters since the inception of in this proceeding in 1997.⁴ In his testimony on Contention Utah L/QQ, he voices a number of opinions, including: (1) that "the HI-STORM 100 casks will likely tipover under peak ground accelerations for a 2,000-year mean annual return period earthquake" (Resnikoff Testimony at A13); (2) that "PFS's starting premise of zero initial angular velocity" in a postulated storage cask tipover event "is unfounded" (*Id.* at A16.a); (3) that "[i]f cask tipover results from earthquake accelerations, the initial angular velocity may be greater than zero" (*Id.* at A16.b); (4) that "the top of the canister will decelerate at greater than 45 g ... thereby damaging the fuel assemblies" (*Id.*); (5) that "[s]ince the initial angular velocity may be greater than zero as the cask center of gravity passes the pivot point, the HI-STORM 100 cask will also flatten more than contemplated by PFS." (*Id.* at A17); (6) that "PFS has not correctly quantified the amount of concrete flattening or the resultant reduction of gamma and neutron shielding" in the event of a tipover (*Id.*); (7) that in a tipover event, there will be stretching of the cask's metal outer surface and cracking of the cask's "cement" [sic] (*Id.* at A19); (8) that cracking of the cask's concrete "will lead to an increased gamma dose at the fence post and an increased neutron and gamma dose to PFS workers;" (*Id.*); (9) that in a tipover event the cask lid plate will strike the ground "and send a strong dynamic impulse to the cask wall and canister" (*Id.* at A21); (10) that in a cask tipover situation the "chimney effect" through which the cask is cooled "is reduced dramatically and this is equivalent to the intake vents being blocked" (*Id.* at A22); (11) that the temperature in the concrete in a tipped over cask will cause water to evaporate from the concrete, reducing the amount of hydrogen available for neutron capture and causing an increase in the

⁴ In a recent deposition (excerpts of which are attached as an Exhibit), Dr. Resnikoff testified that he has worked on "many of the contentions" propounded by the State of Utah, including transportation cask vulnerability; aircraft accidents; sabotage; radiation doses from normal plant operations; and the instant seismic contention. Deposition of Marvin Resnikoff ("Resnikoff Dep. Tr.") (October 29, 2001) at 5-6. He has also provided testimony in quite a number of other cases involving a wide variety of matters. *Id.* at 32-40. His academic background and area of professional concentration, however, are in elementary particle physics. *Id.* at 35; State Exh. 134.

neutron doses to on-site workers (*Id.*); (12) that all storage casks will tip over during a 2000-year return period design basis earthquake (*Id.* at A23); (13) that “PFS could not upright all casks within the time limits imposed by the CoC [Certificate of Compliance for the casks] and this will result in the potential increase in neutron dose[s] to the workers” (*Id.*); (14) that even if the casks do not tip over, they will “collide with each other” during a 2000-year return period earthquake (*Id.* at A24); (15) that the casks “will likely” be lifted up 27 inches if subjected to the peak ground accelerations induced by a 2000-year design basis earthquake (*Id.*); (16) that if casks are dropped at an angle, “the shear stresses, particularly on the welds, would then be considerably more severe than in a vertical drop” (*Id.* at A26); and (17) that in the event of an angle drop the canister welds may be impaired, “exposing the canister contents to the external environment” (*Id.*).

None of the seventeen opinions is supported by any calculations, analyses or citation to facts;⁵ nor is there any basis on which Dr. Resnikoff could hold himself qualified to offer them. To the contrary, as set forth below, Dr. Resnikoff testified in his deposition that he had no previous experience with the types of analyses that would be required to render these opinions, and acknowledged that he had no idea as to how the various analyses would be conducted.

Thus, with respect to whether the cask concrete would crack upon tipover, Dr. Resnikoff acknowledged that he has never investigated concrete cracking or concrete thermal degradation outside of this proceeding. Resnikoff Dep. Tr. at 42-45, 47. He has never done any calculation involving the strength of steel or concrete. *Id.* at 46. Nor has he even given testimony on those matters. *Id.* at 50-51. Other than perhaps “sometime ago” as a college student taking Statics, he has never calculated the angular velocity of a tipping over cask, and had “not worked out the details yet” of how he would do it. *Id.* at 70-71. He also had no idea as to how he would go

⁵ Dr. Resnikoff offers certain additional opinions based on a calculation of increased neutron doses due to reduced shielding, which he states he has conducted (Utah Ex. 143). Those opinions, whatever their merit, are at least backed up by an analysis.

about calculating the extent of cracking of the concrete (*Id.* at 71), or how to establish the relationship between the size of the crack and the amount of radiation released through the crack (*Id.* at 72-73), or how to use a Monte Carlo simulation to estimate the radiation doses at the site boundary from a cracked concrete cask (*Id.* at 73-74), or to how to take into account the orientation of the casks, the number of cracked casks, and the shielding of one cask to another (*Id.* at 75). He also did not know how he would calculate the thinning or flattening of a tipped over cask and had never done any such calculation (*Id.* at 80-81). He did not know whether such thinning or flattening would be accompanied by concrete cracking (*Id.* at 81), or what effects any such flattening would have on the canister (another matter he had never calculated before) (*Id.* at 81-82). With respect to the effect of having a cask remain tipped over for a significant period of time, Dr. Resnikoff acknowledged that he had no idea as to how to calculate the thermal degradation of the cask's concrete over time (*Id.* at 90-93), and had never used programs that computed the temperature of concrete over time (*Id.*). He also did not know how he would go about estimating the reduction in shielding due to concrete heating up over time (*Id.* at 93).

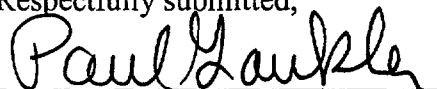
In short, the opinions expressed by Dr. Resnikoff are not supported by his qualifications. Dr. Resnikoff's testimony is thus unreliable and should be stricken in the manner and to the extent sought in the Staff's Motion.⁶

⁶ Applicant also agrees with the Staff that the subject of the last substantive paragraph in the Resnikoff Testimony (Q/A 28) (the amount of fuel stored in the ISFSI at the INEEL facility) is irrelevant to the issues in this proceeding and should be stricken, even if Dr. Resnikoff had established his competence to testify on the subject (which he had not).

III. CONCLUSION

For the foregoing reasons, PFS supports the Staff's Motion and urges that the Board strike the referenced exhibits and the cited portions of the testimony of Dr. Marvin Resnikoff.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Paul Gaukler", written over a horizontal line.

Jay E. Silberg

Paul A. Gaukler

Matias F. Travieso-Diaz

SHAW PITTMAN

2300 N Street, N.W.

Washington, DC 20037

(202) 663-8000

Counsel for Private Fuel Storage, L.L.C.

April 22, 2002

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of)	
)	
PRIVATE FUEL STORAGE L.L.C.)	Docket No. 72-22
)	
(Private Fuel Storage Facility))	ASLBP No. 97-732-02-ISFSI

CERTIFICATE OF SERVICE

I hereby certify that copies of the "Applicant's Response in Support of NRC Staff's Motion To Strike Certain Exhibits and Portions of the Testimony of Dr. Marvin Resnikoff on Unified Contention Utah L/QQ" were served on the persons listed below (unless otherwise noted) by e-mail with conforming copies by U.S. mail, first class, postage prepaid, this 22nd day of April, 2002.

Michael C. Farrar, Esq. Chairman
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: MCF@nrc.gov

Dr. Jerry R. Kline
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: JRK2@nrc.gov; kjerry@erols.com

Dr. Peter S. Lam
Administrative Judge
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
e-mail: PSL@nrc.gov

*Office of Commission Appellate
Adjudication
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001
Attention: Rulemakings and Adjudications
Staff
e-mail: hearingdocket@nrc.gov
(Original and two copies)

Catherine L. Marco, Esq.
Sherwin E. Turk, Esq.
Office of the General Counsel
Mail Stop O-15 B18
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555
e-mail: pfscase@nrc.gov

John Paul Kennedy, Sr., Esq.
David W. Tufts, Esq.
Confederated Tribes of the Goshute
Reservation and David Pete
Durham Jones & Pinegar
111 East Broadway, Suite 900
Salt Lake City, Utah 84105
e-mail: dtufts@djplaw.com

Diane Curran, Esq.
Harmon, Curran, Spielberg &
Eisenberg, L.L.P.
1726 M Street, N.W., Suite 600
Washington, D.C. 20036
e-mail: dcurran@harmoncurran.com

Paul EchoHawk, Esq.
Larry EchoHawk, Esq.
Mark EchoHawk, Esq.
EchoHawk PLLC
P.O. Box 6119
Pocatello, ID 83205-6119
e-mail: paul@echohawk.com

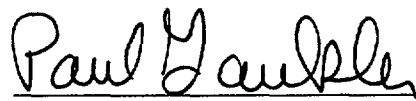
* Adjudicatory File
Atomic Safety and Licensing Board Panel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Denise Chancellor, Esq.
Assistant Attorney General
Utah Attorney General's Office
160 East 300 South, 5th Floor
P.O. Box 140873
Salt Lake City, Utah 84114-0873
e-mail: dchancel@att.state.UT.US

Joro Walker, Esq.
Land and Water Fund of the Rockies
1473 South 1100 East
Suite F
Salt Lake City, UT 84105
e-mail: lawfund@inconnect.com

Tim Vollmann, Esq.
Skull Valley Band of Goshute Indians
3301-R Coors Road, N.W.
Suite 302
Albuquerque, NM 87120
e-mail: tvollmann@hotmail.com

* By U.S. mail only


Paul A. Gaukler

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
THE ATOMIC SAFETY AND LICENSING BOARD

-----X
In the Matter of :
: Docket No. 72-22
PRIVATE FUEL STORAGE L.L.C. : ASLBP No.
: 97-732-02-ISFSI
(Private Fuel Storage Facility) :
-----X

Washington, D.C.

Monday, October 29, 2001

Deposition of

MARVIN RESNIKOFF

a witness, called for examination by counsel
for Applicant pursuant to notice and
agreement of counsel, beginning at
approximately 10:40 a.m. at the law offices
of Shaw Pittman, 2300 N Street, N.W.,
Washington, D.C. 20037, before Marilyn
Feldman of Beta Reporting & Videography
Services, notary public in and for the
District of Columbia, when were present on
behalf of the respective parties:

BETA

1 questions, you will ask me to clarify the
2 question. Will you do that, please?

3 . A Yes.

4 Q Thank you. Please describe for me
5 generally your familiarity with the PFS
6 project.

7 A Well, I have been working on this
8 application since its inception, working on
9 many of the contentions, including work on
10 this earthquake contention.

11 The work has primarily been on
12 transportation cask vulnerability; aircraft
13 accidents; the recent sabotage contention
14 that was introduced; travel to look at the
15 potential -- the proposed site.

16 Q When did you do that?

17 A That was in the beginning; that
18 was -- I don't remember. When did this
19 start? Was it '96?

20 Q The license application was filed
21 June 1997, and the state filed its petition
22 to intervene in September of 1997.

1 A Yes. I don't remember when that
2 trip was, when we all went out there.

3 Q What was the purpose for your trip
4 out to the site?

5 A To look at the site along with
6 others, including the hearing board and, you
7 know, the NRC. I also reviewed a lot of the
8 discovery documents.

9 Q So the record is clear, the trip
10 you are referring to the site is the trip
11 that the licensing board went on with the
12 parties. You were on that trip?

13 A Yes.

14 Q That was approximately
15 January 1998. Does that sound correct?

16 A That sounds right.

17 Q Are you familiar the state's
18 contention in Utah L concerning the
19 geotechnical issues?

20 A I am.

21 Q What is the basis of your
22 familiarity with that contention?

1 recognize what has been marked as Exhibit 4?

2 A I do.

3 Q Is that an accurate summary of
4 your educational and professional background
5 and expertise?

6 A Well, it's not recent. I thought
7 that was going to be the first question, and
8 that's why I wrote this third of a page on
9 the train, thinking about what I had done in
10 the last year.

11 Q Would you please tell me in what
12 respect it's not recent and doesn't include
13 your recent experience?

14 A I'm happy to turn this over to you
15 except I don't think you can read it.

16 Q Just tell us.

17 A Okay. These are the activities I
18 have worked on in the past year or so. I
19 have worked on license termination plan at
20 Connecticut Yankee. I have worked on
21 groundwater contamination at the Department
22 of Energy facilities.

1 We are preparing a book for a
2 coalition of public interest groups who work
3 specifically on the Portsmouth gaseous
4 diffusion plant, and INEEL -- that's
5 I-N-E-E-L, all in caps -- high-level waste
6 tanks, looking at their integrity.

7 We worked for the State of Nevada,
8 and this involved cask response to a
9 potential accident and the consequences. We
10 worked on the Baltimore Tunnel fire in
11 looking at what would be the consequences if
12 a cask from Calvert Cliffs went through the
13 Baltimore tunnel.

14 We worked on a transportation
15 accident analysis for the State of Nevada,
16 looked at emergency response and potential
17 health consequences, and that involved
18 looking at cask response to an accident. We
19 have done similar work for some counties in
20 Nevada, White Pine County, Churchill County,
21 and Clark County.

22 For the State of Utah, in addition

1 to this proceeding, we worked for the
2 governor's office on the timing and capacity
3 of a proposed Yucca Mountain repository. We
4 have worked on aircraft accidents for the
5 attorney general's office.

6 I guess, as I pointed out earlier,
7 we have worked on Utah RR, the proposed
8 contention. We worked for public interest
9 groups in Massachusetts, a group called Crew
10 on Cleanup of the NMI Starmet uranium basin
11 under a TAG grant from the EPA.

12 Finally, we have done work in
13 Texas on personal injury cases involving
14 uranium mining and milling. I should say we
15 have also worked on personal injury cases in
16 Louisiana for oil pipe cleaners. That's
17 what I could think of on the train coming
18 down. I have worked on all of those.

19 Q Your current position is what?

20 A I'm the senior associate at
21 Radioactive Waste Management Associates. It
22 involves five of us in the office. There

1 are two environmental engineers -- one of
2 them you have met, Matt Lamb, and another
3 one, Bayat Hintermann -- Rachel Hawkins, who
4 is a chemical engineer, and an office
5 manager and myself.

6 Q Your academic training as set
7 forth in your resume is in physics; is that
8 correct?

9 A That's correct.

10 Q Did you consult with any other
11 experts in the work you did concerning Yucca
12 Mountain, its timing and capacity?

13 A Oh, we probably talked to Bob
14 Halstead, who works for the State of Nevada,
15 on those issues. He's the transportation
16 adviser to the State of Nevada. We probably
17 talked to him about these issues.

18 MR. GAUKLER: I would like to
19 introduce two other things related to your
20 background. I would like to introduce
21 Exhibit 5, which is entitled "Publications
22 of Marvin Resnikoff, Ph.D., 1985/1998," and

1 as Exhibit 6, "Marvin Resnikoff, Ph.D. Court
2 Proceedings."

3 (Utah L, Part B Exhibit Nos. 5
4 and 6 were marked for
5 identification.)

6 BY MR. GAUKLER:

7 Q Is Exhibit 5 an accurate list of
8 your publications from 1985 through 1998?

9 A It doesn't include the most recent
10 ones. It would have to be updated.

11 Q Are there any recent publications
12 that you believe are relevant to the issues
13 that you are working on with respect to Utah
14 L, Part B, since 1998?

15 A I think the ones that are most
16 relevant relate to cask response to an
17 accident; those are the most relevant. And
18 there have been more recent ones than appear
19 here. So I could update this list for you.

20 Q I would like to have it updated
21 then, particularly in terms of those that
22 you believe are relevant.

1 A I'll put an asterisk next to it.
2 Similarly, the court proceedings, Exhibit 6,
3 there are more recent ones.

4 Q Any recent ones that are relevant
5 to what you are doing on Utah L, Part B?

6 A No, not really.

7 Q Would you mind giving me an update
8 on that in any event?

9 A Sure.

10 Q Going back to Exhibit 5, are there
11 any particular publications that you believe
12 are relevant to the work you are doing on
13 Utah L, Part B?

14 A The publications that are most
15 relevant relate to cask response. There are
16 probably some that are earlier than
17 January '85, since I worked on cask response
18 since 1975. So there are probably some
19 documents that are relevant earlier than
20 this. But you want to know on this list are
21 there some that are particularly relevant?

22 Q That's my question, yes.

1 MS. CURRAN: It makes sense to
2 give Marvin a little time.

3 BY MR. GAUKLER:

4 Q Want to look at that over lunch
5 and get back to me on that?

6 A Okay.

7 Q When you talk about cask response,
8 what do you mean by "cask response"?

9 A The issues that we worked on
10 involve transportation casks, and the other
11 issues that we worked on that pertain to
12 this subject involve some of the issues in
13 this proceeding, and also some other
14 proceedings that we worked on involving
15 heatup of casks.

16 Q What other proceedings are you
17 referring to?

18 A I have to refer to Exhibit 4.
19 Point Beach, Prairie Island, and Palisade
20 reactors are some of the other proceedings
21 we have worked on. Some involved hearings
22 before state commissions. The Palisades

1 reactor involved a federal court proceeding.

2 Q What work did you do with respect
3 to Point Beach?

4 A This is to the best of my
5 recollection, okay?

6 Q Okay.

7 A It was the issue of alternatives.
8 These were hearings before -- Point Beach
9 and Prairie Island were hearings before
10 various state commissions. One, I believe
11 was the Public Utility Commission in the
12 State of Wisconsin, Point Beach reactor, and
13 it involved the cost of one reactor versus
14 another reactor -- excuse me, the cost of
15 one storage cask versus the cost of another.

16 These hearings took place sometime
17 ago so I don't really recall well the exact,
18 you know, the exact discussions that took
19 place. It might have involved sabotage.

20 Q Which one might have?

21 A The Point Beach reactor might
22 have. I think there was a discussion of

1 that.

2 Q What did Prairie Island involve,
3 as far as you recall?

4 A I don't really remember. We were
5 working on behalf of the Sioux tribe. I do
6 remember that.

7 Q What did Palisades involve?

8 A That involved the issue of whether
9 an environmental impact statement should be
10 prepared for the Nuclear Regulatory
11 Commission.

12 Q What technical issues were
13 involved in that context?

14 A Sorry?

15 Q What technical or regulatory
16 issues were involved in that context?

17 A The potential environmental impact
18 is my best recollection of what we worked on
19 there.

20 Q Do you recall what you identified
21 as potential environmental impacts there?

22 A I have to say I don't.

1 yet done and we are not going to do all of
2 that part of it. The actual size of the
3 crack, there will be other consultants that
4 are going to be looking into that.

5 Then the other issue is heatup,
6 potential heatup of the cask in a horizontal
7 position and the potential degradation of
8 concrete, which also involves the issue that
9 we are working on, radiological
10 consequences. As I said, we are just
11 looking into that now.

12 Q What background or work have you
13 done that's relevant to evaluating the
14 cracking of concrete?

15 A This is a straight physics
16 engineering issue. We are looking into
17 stresses on the steel shell and on the
18 concrete due to an earthquake.

19 We have essentially in this case
20 taken the calculations that have previously
21 been done by PFS and Holtec and are updating
22 them to put in the new numbers. So this is

1 not different than other issues that I have
2 taken courses on at college, like statics.

3 Q Since college, what work have you
4 done involving cracking or potential
5 cracking of concrete?

6 A This is the first time we have
7 worked on the potential cracking of
8 concrete. Excuse me, maybe I should say the
9 second time.

10 We looked also into -- for the
11 aircraft contention K, we looked into the
12 issue of an MK84, inert bomb or -- not an
13 inert bomb -- canister striking the
14 concrete, and we looked into that issue of
15 whether the MK84 would penetrate the
16 concrete. So we previously looked into that
17 issue.

18 Q That was also in the context of --

19 A Those are the two times. Right
20 now, looking into cracking, and this
21 previous analysis that we did.

22 Q The previous analysis was also

1 part of this PFS licensing proceeding,
2 correct?

3 A Yes, that's right.

4 Q What work have you done previously
5 with respect to thermal degradation of
6 concrete from heat?

7 A Previous to this PFS proceeding,
8 or looking at Utah H, heating up of
9 concrete?

10 Q Let's go first to the PFS
11 proceeding.

12 A Coursework on thermodynamics in
13 college, computer work, understanding
14 computer programs that were used -- Fluent.
15 That's the previous work.

16 Q So there would be nothing since
17 college up to the PFS proceeding; is that
18 correct the way I interpret your answer?

19 A No.

20 Q In what way am I interpreting
21 incorrectly?

22 A No. I have worked on heatup of

1 casks for a long time, heatup of
2 transportation casks. So I have looked into
3 heatup of casks.

4 Q What about transportation casks,
5 they don't involve concrete, do they?

6 A No, they don't involve concrete.

7 MS. CURRAN: Paul, it's been about
8 two hours --

9 MR. GAUKLER: Hour and 15 minutes.

10 MS. CURRAN: Can we take a break
11 sometime soon?

12 MR. GAUKLER: Sure. Why don't we
13 take a break and have another short session
14 before lunch. That sounds reasonable to me.

15 (Recess)

16 BY MR. GAUKLER:

17 Q Have you ever done an original
18 calculation of the strength of steel or
19 concrete when subjected to stresses,
20 external stresses?

21 A Original calculation? So far, our
22 calculations have been to use the procedures

1 part of the original design of a structure
2 or component?

3 A Design work, no.

4 Q Have you ever done any calculation
5 of the thermal degradation of concrete other
6 than what you have done in this case here?

7 A Other than what we have done in
8 this proceeding?

9 Q Yes.

10 A No.

11 Q Looking at Exhibit 6, this is your
12 list of court proceedings. What area of
13 expertise were you qualified for in these
14 proceedings generally?

15 A For these court cases, generally,
16 they have involved dose calculations.

17 Q Have you ever been qualified as an
18 expert in any other area other than what you
19 have described as dose calculations?

20 A What do you mean?

21 Q Have you ever been certified to
22 testify and have you testified in an area

1 Q Let me ask the question
2 differently then. Have you ever testified
3 as an expert in any court proceeding or
4 administrative proceeding involving the
5 stresses and strains on concrete and the
6 cracking of concrete?

7 A No, but --

8 Q The answer is no?

9 A "No, but" is the answer.

10 Q What do you mean by the "but" in
11 that answer?

12 A I'm glad you asked me that. Some
13 of these are just elementary engineering and
14 physics calculations that we did to involve
15 the extent of concrete cracking.

16 Q When you say "some of these," you
17 are referring to Exhibit 2?

18 A Yes.

19 Q My question wasn't that. My
20 question was, have you ever testified
21 concerning the cracking of concrete in any
22 court or administrative proceeding? That

1 was my question.

2 A I think a fair answer is no.

3 Q Have you ever testified in
4 previous court or administrative proceedings
5 concerning the thermal degradation of
6 concrete?

7 A Other than the PFS proceeding
8 where we drafted testimony, the answer is
9 no.

10 Q You understand that you have been
11 identified by the State of Utah as a witness
12 with respect to Utah L, Part B?

13 A Yes.

14 Q What do you expect to be the
15 general topic of your testimony?

16 A Gee, I thought we covered this. I
17 thought this has been asked and answered.

18 Q Is it fair to say radiological
19 dose calculations?

20 A Yes. But to take it from the top,
21 we are calculating whether the concrete will
22 crack --

1 Q The .67 and .69 G?

2 A Yes.

3 Q Going back to what you were
4 talking about before, you are going to
5 calculate the angular velocity at which the
6 cask tips over?

7 A Yes, and we are also going to look
8 into the potential cracking if it tips over.

9 Q How do you plan on calculating the
10 angular velocity if the cask tips over?

11 A I haven't worked out the details
12 yet.

13 Q Have you ever calculated that
14 before?

15 A I probably have, yes, sometime ago
16 in statics.

17 Q Do you recall when?

18 A Well, we are probably going to
19 look into the time history of earthquakes,
20 you know, the amount of time that a force is
21 applied, certain accelerated force, to see
22 what potential angular velocity is. That's

1 my initial off-the-top-of-my-head feeling as
2 to how I would do it.

3 Q How are you going to calculate the
4 cracking of the concrete, the extent of the
5 cracking of the concrete?

6 A I don't know the answer to that
7 off the top of my head, as we sit here.

8 Q Have you done that before?

9 A That calculation, I haven't done
10 before, no.

11 Q Once you have that information,
12 what is the next step in your calculation?

13 A The next step, in consultation
14 with some of the state engineers, is to
15 determine the size of the crack and then to
16 do a Monte Carlo calculation to determine
17 what the dose is at the boundary. That's
18 the procedures that we would use.

19 Q When you do this, are you
20 following established procedures from some
21 document that you could reference me to?

22 A The document that I looked at -- I

1 have looked through quite a few NRC
2 documents to see whether there's any
3 guidance on this, and the only one that I
4 could find so far -- and this isn't a
5 complete, exhaustive search yet -- is the
6 True study, Transportation of Radionuclides
7 in Urban Environments, that was done
8 in 1980.

9 In that one, they looked at
10 material released, but they also have a
11 scenario where the cask is cracked, a
12 transportation cask is cracked, and then
13 they do a calculation as to what the dose
14 would be. Under various accidents, they
15 have various size cracks. That's the one
16 that I saw that was most relevant.

17 Q Do you know what the relationship
18 is between the size of the crack and the
19 amount of radiation released through the
20 crack?

21 A Off the top of my head? The
22 larger the crack, the more released. I

1 don't have a view off the top of my head as
2 to how much that would be. The effective
3 shielding would be removed or reduced.

4 Q How does the Monte Carlo method
5 come in to play?

6 A The Monte Carlo method would trace
7 rays, gamma rays coming out of the canister
8 in the various ways they could go through
9 the canister.

10 I know the court transcriber can't
11 catch my fingers, but I'm trying to show
12 that the rays that go directly through the
13 crack will not be attenuated compared to
14 those that go at an angle through the crack.
15 If the crack is larger, more rays can go
16 through directly, and also, more rays will
17 be less attenuated, and one has to sum over
18 all these rays. That's what the Monte Carlo
19 calculation will do.

20 Q Is there a document you can direct
21 me to where a Monte Carlo has been used in a
22 similar type of application?

1 A We would go back to the True
2 report to see what they used, and of course,
3 that was done in 1980. I'm sure there is
4 something more recent that we could use.
5 That's the general procedure that we would
6 follow. I am sure you will want it as soon
7 as we have it done.

8 Q This assumes no damage to the
9 canister, I take it?

10 A It assumes no damage to the
11 canister, right. That was another scenario
12 that you hadn't discussed yet.

13 Q Have you used the Monte Carlo
14 technique in this manner before?

15 A We haven't. I have just read of
16 them, but I haven't actually used it.

17 Q Anything else involved in the
18 scenario involving concrete cracking if the
19 cask tips over; any step in the process we
20 haven't discussed or that we have missed
21 that you plan on doing?

22 A Anything else involved?

1 Q Yes.

2 A Well, the orientation of the cask
3 or casks and the number of casks are
4 important as well. The shielding of one
5 cask to another is also important. We would
6 have to take all that into account.

7 Q How do you plan on taking that
8 into account?

9 A I am not sure I have the answer to
10 that right off the top of my head, but the
11 dose right now is right at the limit. If
12 you assume a person stays there for 365 days
13 a year all the time, the dose is right now
14 at the 25 millirem per year limit, and
15 that's why any of these other analyses are
16 important if they increase the dose.

17 Q Have you reviewed those
18 calculations that have been done in the PFS
19 SAR for the fence limit?

20 A Yes.

21 Q What limit did those come up with?

22 A My best recollection is they

1 Q Do you have anything else to add
2 in that scenario, talking about concrete
3 cracking when the cask tips over; again,
4 what we have discussed?

5 A No, that's what we would do as our
6 general procedure.

7 Q Let's go to the next scenario. We
8 were talking about the cask tipping over and
9 the concrete deforming or flattening. How
10 do you go about calculating deformation or
11 flattening of the concrete; have you decided
12 that?

13 A I'm not certain how that would go.
14 We know what the acceleration is as the cask
15 hits the pad, and then the next relates to
16 the stresses. I don't off the top of my
17 head know how this calculation would go.

18 Q Are you assuming that the concrete
19 is going to crack in this instance in this
20 type of analysis?

21 A There are two scenarios that we
22 would look at. One is cracking. But then

1 you asked me about flattening --

2 Q Right.

3 A And I answered I didn't know how
4 that would go.

5 Q I guess my question is, in this
6 scenario, which is one of the scenarios you
7 are going to talk about, deforming and
8 flattening, are you assuming in this
9 scenario as well that there is cracking of
10 the concrete in addition to deformation and
11 flattening which might affect the canister?

12 A Yes, both may happen, and I don't
13 know what the answer is as we sit here.

14 Q Have you ever done a calculation
15 for deformation or flattening of the
16 concrete cask?

17 A No.

18 Q How are you going to figure out a
19 way to calculate the effect of the
20 flattening or deformation of the concrete
21 cask on the canister?

22 A As we sit here, I don't know how

1 that calculation would proceed. We would be
2 in consultation with the engineers. The
3 state has to discuss how that would go.

4 Q Are these the three experts we
5 talked about before or somebody else?

6 A We would first go to those.

7 Q Have you ever done a calculation
8 on the effect of a steel canister in this
9 type of scenario?

10 A No. I should say that that
11 calculation hasn't been done either by
12 Holtec. Other than this qualitative
13 statement that appears in the final safety
14 analysis report, that calculation is not at
15 Holtec either. It just says "flattening."

16 It's sort of a qualitative
17 argument, and the dose argument is also
18 qualitative, no effect. You are asking me
19 quite detailed questions about something
20 which Holtec just has qualitative answers
21 to. But we intend to do it quantitatively.
22 It also hasn't been done by the NRC and it

1 calculation the same as done by PFS in the
2 SAR, do you know?

3 A Would I assume? I didn't
4 understand the question.

5 Q Other than the amount of time that
6 the individual spends at the fence, will you
7 do the calculation the same as done by PFS
8 in the SAR?

9 A We have looked over those
10 calculations and they seem to be right.

11 Q Let's go to the next scenario you
12 mentioned, which is thermodegradation of the
13 concrete if it's on the horizontal position
14 for an extended period of time. How do you
15 plan to go about doing the calculation for
16 this scenario?

17 A As we sit here, I am not exactly
18 certain how we are going to do this. This
19 calculation was not done by Holtec and was
20 not done by the NRC in their SER.

21 What Holtec did was take a
22 bounding case of soil that was mounded over

1 the cask. Essentially, it's called an
2 adiabatic heatup situation; just looking at
3 all the heat and the heat is not lost and
4 looking at the temperature rise over time.

5 In other words, they bounded the
6 case, and that's where they came to the
7 conclusion it would take 33 hours before it
8 got to a temperature where concrete would
9 degrade.

10 To do more exact calculation,
11 where earth is not mounded over, where one
12 does not take a bounding case but a more
13 realistic case -- off the top of my head, I
14 don't have an answer right now as we sit
15 here.

16 It's a thermodynamic calculation
17 where one part is insulated, the bottom
18 part, where there's no -- cooling would
19 ordinarily occur for a standing cask.

20 I don't know the answer to that as
21 we sit here today. One has to develop a
22 thermodynamic model, you know, using one of

1 the more sophisticated programs like Fluent
2 or ANSYS.

3 Q Have you used those programs to
4 develop a model in the past?

5 A We haven't, but I have talked to
6 some people who might be able to do them for
7 us, but we haven't done those yet.

8 Q What people have you talked to?

9 A I talked to a fellow named
10 Dr. Tony Hirt, who is in Santa Fe, New
11 Mexico; happens to be an officemate of mine
12 in graduate school.

13 Q Where is he now?

14 A I think, as I said, in Santa Fe.
15 I don't have his card with me right now.
16 But he has run these models, and that's why
17 I have talked to him about it.

18 Q So you need to calculate the
19 temperature of the concrete over time?

20 A Yes.

21 Q Assuming you did that, how would
22 you calculate any reduction in shielding?

1 A What?

2 Q How would you calculate any
3 reduction in shielding, assuming you would
4 calculate the temperature over time of the
5 concrete?

6 A I'm not certain how we would do
7 that right off the top of my head. If we
8 reached a temperature where the concrete
9 would degrade, I'm not sure how I would
10 calculate that either as we sit here.

11 That's one question that has to be
12 answered. The other is whether this is a
13 question that has actually been reviewed or
14 whether this is an unreviewed safety
15 question. That's another issue we are
16 addressing, which I mentioned earlier.

17 The certificate of compliance, in
18 other words, has in it a 33-hour time
19 period; that number appears in the
20 certificate of compliance. So that's the
21 number that -- so our concern is can the
22 casks be righted, can the situation be