RAS 4342

April 15, 2002

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

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

APPLICANT'S MOTION TO STRIKE THE TESTIMONY OF DR. MOSHIN R. KHAN ON UNIFIED CONTENTION UTAH L/QQ

Pursuant to the Order (General Schedule Revisions) of the Atomic Safety and Licensing Board ("Board") dated September 20, 2001 and 10 C.F.R. § 2.743(c), Applicant Private Fuel Storage, L.L.C. ("Applicant" or "PFS") files this motion to exclude the proffered testimony of Dr. Moshin R. Khan in its entirety,[1] since Dr. Khan has admitted having no experience in the matters about which he seeks to testify.

I. BACKGROUND

The history of the admission of Contention Utah L/QQ into this proceeding is complex, and is summarized in another motion concurrently being filed by PFS.[2] Dr. Khan's pre-filed testimony purports to demonstrate that the stability analysis performed by Holtec, Inc., the supplier of the storage casks, is inadequate.[3] The stated purpose of Dr. Khan's Testimony is as follows: "To demonstrate the inadequacy of PFS's seismic analysis, I will testify that PFS's HI-

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[1] State Testimony of Dr. Moshin R. Khan and Dr. Farhang Ostadan on Unified Contention Utah L/QQ, Part D (Cask Stability) ("Khan Testimony") (April 1, 2002). Dr. Ostadan's portion of the testimony is not affected by this motion.

[2] *See* Applicant's Motion to Strike Portions of the Testimony of Dr. Farhang Ostadan on Unified Contention Utah L/QQ ("Ostadan Motion") (April 15, 2002).

Template = SECY-041

SECY-02

STORM 100 cask stability analysis results have not been verified or benchmarked with shake table test data to determine their accuracy or usefulness under the high seismic environment. My independent analysis shows that the HI-STORM 100 cask system may excessively slide, uplift, and potentially tipover when subject to the ground motions for a 2,000-year DBE at the PFS facility."[4]

II. DISCUSSION

It is well established that expert testimony is only admissible if it (1) assists the trier of fact and (2) is rendered by a properly qualified witness. Louisiana Power and Light Co. (Waterford Stream Electric Station, Unit 3), ALAB-732, 17 NRC 1076, 1091 (1983). It is also well established that prepared testimony of a witness may be stricken where the witness lacks expertise on the matters as to which he seeks to testify. Georgia Institute of Technology (Georgia Tech Research Reactor), LBP-96-10, 43 NRC 231, 232-33 (1996).

Application of these principles to the Khan Testimony is straightforward. As noted above, in his pre-filed direct testimony, Dr. Khan purports to evaluate and offer opinions on the adequacy of the storage cask stability analysis performed by Holtec. However, Dr. Kahn has no experience conducting evaluations or analyses of the stability of free-standing casks (such as those to be used at the PFS facility) in the event of an earthquake. In fact, Dr. Khan's

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Footnote continued from previous page

[3] *See* Appendix to the Ostadan Motion for the complete text of Contention Utah L/QQ.

[4] Khan Testimony at A. 4. Dr. Khan appears also to be the proponent of the following statement in the first paragraph of the same answer A. 4, which is jointly sponsored by him and Dr. Ostadan: "The assumptions and parameters used in PFS's cask stability analysis for the Holtec International Company ("Holtec"), HI-STORM 100 cask system are unconservative and may underestimate potential cask reaction under seismic ground motion at the PFS facility." This statement, unless independently supported by Dr. Ostadan, should also be stricken.

professional experience has nothing whatsoever to do with such analyses. When questioned at his deposition about his experience, Dr. Khan testified as follows:

> Q. And I gather from what I understood your testimony to be before, you've not analyzed the potential for sliding or tipping of a freestanding object, taking a freestanding object, model it and analyze the potential for sliding and tipping of them?
>
> A. Not the cask. Not the cask, but other sliding analysis studies, yes, I have done.
>
> Q. But you -- if we can go back. The only thing I could gather of what you told me about were two things. I want to make sure I'm correct on this. One, you stated you had looked at or evaluated the freestanding spent fuel racks --
>
> A. That's right.
>
> Q. -- for Diablo Canyon.
>
> A. That's right.
>
> Q. But then you got into and discussed that, and you said you were focusing more on the structural strength and not the sliding or tipping of those elements.
>
> A. Because they were not as critical.
>
> Q. So your study there did not focus on sliding and tipping?
>
> A. No, they were not as critical.
>
> Q. And the only other thing I heard you talk about were evaluating some sliding blocks.
>
> A. That's right.
>
> Q. And I take it, this was kind of like almost hypothetical blocks, correct?
>
> A. Sure. You could call it, sure.
>
> Q. You weren't modeling any real equipment or components, correct?
>
> A. That's right.

Q. And what contacts, stiffness, for example, did you use in evaluating those sliding blocks? Do you recall?

A. No, I do not recall.

Q. Other than those two instances, correct me if I'm wrong, have you ever evaluated the potential for sliding or tipping of a freestanding object?

A. That's correct.

Q. Those are the only two instances?

A. Yes.

Khan March 5, 2002 Dep., Tr. at 67-69.[5]

Moreover, when asked to describe what non-linear systems he had ever analyzed,[6] his response was that he had not analyzed any, but only "tested" a number of components for equipment qualification purposes. *Id.* at 63-64. Likewise, when asked how many times he had previously selected a "contact stiffness" value for purposes of analyzing the sliding or tipping of a free-standing object (such as a storage cask), Dr. Khan stated that he had never done so previously:

Q. How many times have you picked a contact stiffness value for sliding, for lift-off analysis?

A. For this case?

Q. No, just in general. How many times have you picked a contact stiffness analysis for purposes of analyzing sliding or tipping?

A. This is the case.

Q. This is the first case?

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[5] Relevant excerpts of the transcript of Dr. Khan's March 5, 2002 deposition are included as an Exhibit to this motion.

[6] The parties agree that the behavior of the storage casks under seismic conditions is non-linear and that an analysis of a non-linear system under seismic loadings must be a non-linear analysis. *See, e.g.,* State of Utah Testimony of Dr. Steven F. Bartlett and Dr. Farhang Ostadan on Unified Contention Utah L/QQ (Dynamic Analyses) ("State Dynamic Analysis Testimony") at A18.

A. Yes.

Q. First time you've done it, correct?

A. That's right.

Id. at 143.[7]

The above excerpts demonstrate that Dr. Khan's qualifications are woefully inadequate to analyze the problem of a storage cask sliding or tipping on its concrete pad during an earthquake. Such an analysis is complex and highly specialized.[8] Dr. Khan has never undertaken anything resembling such an analysis before, and PFS submits that this is too perilous a trip for Dr. Khan to choose as his maiden voyage in this field.

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[7] One of the primary bases on which Dr. Khan challenges the validity of the Holtec cask stability analysis are the contact stiffness values used by Holtec in its analysis. *See,* Khan Testimony at A24, A28, A29, A31, A32.

[8] As stated in the pre-filed testimony of another State witness, Dr. Farhang Ostadan: "The analysis of the casks sliding on the pads is based on a nonlinear time history analysis. Such analyses are very complex and are not common for critical facilities." State Dynamic Analysis Testimony at A18.

In his deposition, Dr. Ostadan also acknowledged that he gave no credence to the actual results of Dr. Khan's analysis:

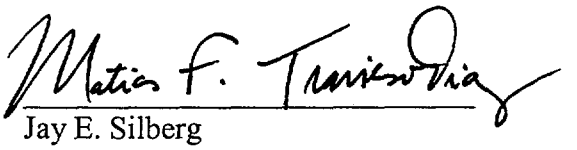
> Q. Would it be fair to say that what you get out of the Altran calculation is a sense that the performance of the cask depends on how much it slides, and is sensitive to what assumptions you make. But you don't give credence to the actual results of their report; do you?
>
> A. I would not take one or the other. I wouldn't take one inch and I wouldn't take 30 feet.
>
> Q. Okay. So what, to you, what the Altran calculation shows is that this is a report whose results are sensitive to what assumption you put in it?
>
> A. That's right.

Ostadan Dep., March 8, 2002, at 169-70.

III. CONCLUSION

For the foregoing reasons, Applicant respectfully requests that the Board strike the testimony of Dr. Khan in its entirety, as not constituting reliable evidence.

Respectfully submitted,



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April 15, 2002

COPY OF TRANSCRIPT

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	Docket No. 72-22
	)	ASLPB No. 97-732-02-ISFSI
PRIVATE FUEL STORAGE L.L.C.	)	DEPOSITION OF:
	)	
(Private Fuel Storage Facility)	)	**DR. MOHSIN R. KHAN**
	)	
	)	(Utah Contention L/QQ)

Tuesday, March 5, 2002 - 12:10 p.m.

Location: Office of Parsons, Behle & Latimer
201 S. Main, Suite 1800
Salt Lake City, Utah

Reporter: Vicky McDaniel
Notary Public in and for the State of Utah

A. The input parameters, what was used in terms of time history, what stiffnesses were used at the base, what coefficient of friction was used, and that's the information I was able to obtain.

Q. So you looked at these Holtec reports for the potential input parameters for your model?

A. That is correct. And the results were what kind of displacements we obtained.

Q. And then reference 4 is the Geomatrix report. What information did you get from reference 4?

A. Input time histories and corresponding spectra.

Q. Okay. Anything else from the Geomatrix report?

A. No.

Q. And then you reference a SAP2000 users manual?

A. Yes.

Q. And an ANSYS version of a computer code?

A. Yes.

Q. What were those documents?

A. These are two computer codes that we used to analyze or study the cask dynamics.

Q. So those were basically the instructions for running those particular computer codes?

A. Yeah. These are large manuals and provides how to use those.

Q. Did you review any other documents in the preparation of this report?

A. No.

Q. In paragraph 10 of the declaration identified as Exhibit 4. Go back to Exhibit 4, please. In paragraph 10 you say that you have "extensive experience designing and interpreting non-linear finite element models to show the structure, systems, or component performance under seismic forces." What do you mean by non-linear in that sentence?

A. Well, I think things which are not anchored down, you know, it's a -- give you an example, a relay, okay. That has an open contact and closed contact, and they're very sensitive to seismic motion. If they close it in a seismic environment, you may shut down the plant or you may have a trip. So we do all this testing to ensure that systems and equipment perform their intended safety function as they are going through seismic motion.

Q. Are you saying that anything that's not anchored is a nonlinear system? Are you saying anything that's not anchored is a nonlinear system?

A. It depends on the analysis that you're

performing.

Q. What makes a system nonlinear as opposed to linear?

A. A linear is if we have in a linear fashion, and a nonlinear is at a given point it does not behave in a linear fashion. So it may be sitting here, apply small force, it's not doing anything. You apply forces, it starts sliding. That's a nonlinear system. So the behavior with respect to the load application is not a linear function of code application.

Q. What components have you done nonlinear analysis for?

A. I did a lot of testing.

Q. What type of components?

A. These are cabinets containing switch gears, electrical items, mechanical items. You could have a pump, for example, you know, running, and it has clearances. So you want to make sure that when it's going through a seismic excitation the shaft does not bend enough to create unnecessary deformations so that it could become a potential problem while it's going through motion.

Q. And is this part of your work doing equipment qualification with respect to -- for PG&E?

A. Yes.

Q. And what type of nonlinear behavior did you model for these components?

A. We -- every time there was an issue that we have a nonlinear problem, in general we try to test it. Because we couldn't really analyze the nonlinear system in a realistic way, so we went and shook it.

Q. Did you analyze sliding of these components?

A. Which component?

Q. These --

A. No, we anchored them, most of them.

Q. So these are not -- the nonlinear system or the nonlinear type of phenomena that you were evaluating was not sliding, then?

A. It was impact.

Q. Impact?

A. Impact.

Q. So it was not --

A. Yes, that's right.

Q. And what size, how large were these components that you worked with, generally speaking?

A. It was very small to where they would fit in the room, maybe a few thousand pounds.

Q. Couple thousand pounds?

A. Yeah.

Q. Like a cabinet?

A. Yeah. In nonlinearity it is relevant, mass, how it is anchored and what kind of mounting conditions. So mass --

Q. I was asking about the size. So irrelevant, mass is irrelevant, do you think?

A. Well, it -- you know, if an earthquake comes, it's going to move a 500-pound item the same way it's going to move a 1,000-pound item or 2,000-pound item. It all depends on how it is anchored to the floor and what kind of boundary condition exists.

Q. In Exhibits 5 and 6 you're evaluating the nonlinear behavior of the HI-STORM cask, correct?

A. Yes.

Q. And you're evaluating the sliding and tipping potential of the HI-STORM cask?

A. (Witness nods head.)

Q. Prior to this case have you ever evaluated -- undertaken a simulation and evaluated the sliding and tipping for a dry cask storage system?

A. No.

Q. And I gather from what I understood your testimony to be before, you've not analyzed the potential for sliding or tipping of a freestanding object, taking a freestanding object, model it and analyze the potential for sliding and tipping of them?

A. Not the cask. Not the cask, but other sliding analysis studies, yes, I have done.

Q. But you -- if we can go back. The only thing I could gather of what you told me about were two things. I want to make sure I'm correct on this. One, you stated you had looked at or evaluated the freestanding spent fuel racks --

A. That's right.

Q. -- for Diablo Canyon.

A. That's right.

Q. But then you got into and discussed that, and you said you were focusing more on the structural strength and not the sliding or tipping of those elements.

A. Because they were not as critical.

Q. So your study there did not focus on sliding and tipping?

A. No, they were not as critical.

Q. And the only other thing I heard you talk about were evaluating some sliding blocks.

A. That's right.

Q. And I take it, this was kind of like almost hypothetical blocks, correct?

A. Sure. You could call it, sure.

Q. You weren't modeling any real equipment or

components, correct?

A. That's right.

Q. And what contacts, stiffness, for example, did you use in evaluating those sliding blocks? Do you recall?

A. No, I do not recall.

Q. Other than those two instances, correct me if I'm wrong, have you ever evaluated the potential for sliding or tipping of a freestanding object?

A. That's correct.

Q. Those are the only two instances?

A. Yes.

Q. Going to paragraph 30, you talk about -- it's in Exhibit 4. You say, "During the course of my work associated with dry cask storming projects for Pacific Gas and Electric ('PGE'), NRC staff has not granted a license for unanchored vertical casks at any sites with peak ground accelerations greater than 0.4 g due to the greater potential for sliding and tipping of these casks containing irradiated fuel assemblies."

What is the basis for that statement?

A. I guess -- back in those days we were going back to, I guess with various vendors and looking at that time what cask has been licensed. And most of the casks which had been licensed were I guess east of the

A. We use stiffness values all the time, every time we analyze the structure. For an anchored cask it could be zero in the upward direction.

Q. So how many times have you picked a contact stiffness value for sliding analysis?

A. A program --

Q. How many times have you picked a contact stiffness value for sliding, for lift-off analysis?

A. For this case?

Q. No, just in general. How many times have you picked a contact stiffness analysis for purposes of analyzing sliding or tipping?

A. This is the case.

Q. This is the first case?

A. Yes.

Q. First time you've done it, correct?

A. That's right.

Q. Okay. Dr. Khan, you say in paragraph 70, I believe it is, "The Altran analysis did not take into account for the amplification due to soil structural interaction in the 2,000-year earthquake input time histories." Then you go on to say, therefore, the vertical input motions at the base of the cask should be higher. I'm confused what you're saying in that paragraph 70. I think you also have something in your

COPY OF TRANSCRIPT

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of	)	Deposition of:
	)	Farhang Ostadan
PRIVATE FUEL STORAGE, LLC,	)	
	)	Docket No. 72-22
(Private Fuel Storage Facility)	)	ASLBP No. 97-732-02-ISFSI
	)	

March 8, 2002 - 10:30 a.m.

Location: Parson, Behle & Latimer

201 South Main Street, #1800

Salt lake City, Utah 84145

Reporter: Diana Kent, RPR

Notary Public in and for the State of Utah

few inches to a few feet, easily, then I do not know.

Q. I'm sorry, when you say a few inches to --

A. My answer to your question is I do not know. It could be very important.

Q. I apologize, but when you say a few inches to few feet, what are you referring to?

A. Altran's calculations.

Q. Are you talking about displacement or moving of the cask?

A. Cask over the pad, yes.

Q. How familiar are you with Altran's calculations?

A. I have read their report. I think I understand the basics of what they have done.

Q. And your view that there is great sensitivity in the motion with the potential motion of the cask is based on what you have seen Altran compute?

A. I'm sorry. Repeat that.

Q. Your assessment that there's great sensitivity, does that depend on the results of the Altran analysis that you have reviewed?

A. That's correct.

Q. Okay. I'm certainly not going to be as familiar with Altran's analysis as you are. I won't pretend to be. But I thought that one of the results of

the Altran analysis was a situation where they predicted the cask would take off vertically off the ground a couple feet and move horizontally 30 feet, bouncing up and down. Do you consider that to be a realistic result?

A. No. My reading, and they may have a different view on this and you need to talk to them, but my understanding of all the work Altran did, prediction of the movement of a cask on the pad is a very sensitive evaluation. And one can get any numbers, virtually, from an inch or two to several feet, depending on what you assume for this interface condition. I have not seen any justification data, tests, shaking-table tests from PFS that would suggest these stiffness and these damping and these range of values are appropriate. Their guess is as good as Altran's guess. I suppose.

Q. Would it be fair to say that what you get out of the Altran calculation is a sense that the performance of the cask depends on how much it slides, and is sensitive to what assumptions you make. But you don't give credence to the actual results of their report; do you?

A. I would not take one or the other. I wouldn't take one inch and I wouldn't take 30 feet.

Q. Okay. So what, to you, what the Altran

calculation shows is that this is a report whose results are sensitive to what assumption you put in it?

A. That's right.

Q. Okay. Why don't we move to D1(c)iii, which is the next one down that says, "The variation of the coefficient of sliding friction between the bottom of the casks and the top of the pads due to local deformation of the pad at the contact points with the cask." Is this number different from number two?

A. Yes.

Q. How is it different?

A. The flexibility of the pad, as I indicated, has to do with it the way the soil spring and dash spots were calculated. And we discussed that.

Q. Right.

A. Now, this has to do with the assumption they have made of the bonding condition between the pad and the cask. The slide and smooth surface, the friction within the body. As I said, we may have hard spots. You already indicated in one of the tables you presented here from ICEC, Exhibit Number 32, that if one point is loaded and you see this variation of displacement on top of the pad, it's shown here. So, therefore, you could have a surface which is no longer smooth for the cask to slide on. You have a surface

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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 Motion To Strike The Testimony Of Dr. Moshin R. Khan 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 15th day of April, 2002.

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