RAS 5270 72-22-ISFSI — Applicant Exhibit 86B - Rec'd 6/4/02

April 1, 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

TESTIMONY OF KRISHNA P. SINGH AND ALAN I. SOLER ON UNIFIED CONTENTION UTAH L/QQ

I. BACKGROUND – WITNESSES

A. Krishna P. Singh ("KPS")

Q1. Please state your full name.

A1. Krishna P. Singh.

Q2. By whom are you employed and what is your position?

A2. (KPS) I am President and CEO of Holtec International ("Holtec"). In that position, I bear the ultimate corporate responsibility for the accuracy and correctness of the company's spent fuel storage systems engineered for dry storage under certification by the U.S. Nuclear Regulatory Commission ("NRC").

Q3. Please summarize your educational and professional qualifications.

A3. (KPS) My professional and educational experience is described in the *curriculum vitae* attached as to this testimony. I have a Ph. D in Mechanical Engineering, which I received from the University of Pennsylvania in 1972. I have extensive experience in the design and licensing of nuclear spent fuel systems which extends back to 1979. Over the past twenty-three years, I have personally led the

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$$D \text{ (deflection or penetration)} = \frac{\text{Weight in lbs. (W)}}{\text{Contact stiffness in lbs/inch (K)}}$$

Applying this formula to Dr. Khan's professed "appropriate choice" of contact stiffness leads to a contact interpenetration of approximately 3/8 of an inch, just due to placing the cask on the top surface of the pad. This is computed as follows:

D = (360,000 lb.) / (1,000,000 lb./inch) = 0.36 inch

We have previously calculated the pressure placed by a fully loaded HI-STORM cask on the pad to be 26 psi, which is less than a man standing on the ball of one of his feet. To say that the cask placing that little pressure on the concrete pad would interpenetrate the pad by 3/8 of an inch defies physical reality and common, everyday experience. Objects do not sink into concrete pads just by being placed on them. Dr. Khan's choice or contact stiffness is also directly contrary to the guidance provided by ANSYS that "if you can visually detect penetration . . . the penetration is probably excessive."

Q144. Did Holtec develop the contact stiffness that it used in its cask stability analysis in a manner consistent with the guidance from ANSYS and other available authoritative sources?

A144. (KPS, AIS) Yes. Holtec seeks to use contact stiffness values that produce very small interpenetrations, but yet permit the code to achieve a converging solution. While we may draw upon known physical solutions to obtain a specific value of contact stiffness (i.e., examine some relevant classical solutions), any choice of stiffness we make in real cases must give meaningful results. For example, the Holtec choice of stiffness of 454,000,000 lb./inch used in the DYNAMO model was based on a result from a classical solution of a rigid body on a half space. However, the real reason we used that value is not that it comes from a classical solution, but that the static penetration of a HI-STORM System cask into the

concrete predicted using that value for stiffness is d=360,000 lb/454,000,000 lb./inch = 0.00008," an acceptable, realistic prediction. In our latest analyses for the beyond-design basis 10,000-year return period earthquake, we used an equally valid rationale for the choice of contact stiffness; namely, for a simple vertical vibration of the cask, we set the stiffness so that it was consistent with the assumption that the lowest frequency of vibration was ~~33~~ 22.6 Hz. This requirement yielded a total vertical stiffness value of ~~40,130,000~~ 18,864,480 lb/inch. This different value, however, also met the test of "no visible penetration" as formulated in the ANSYS guideline manual, for it yielded an interpenetration d=360000 lb/~~40,130,000 lb~~ 18,864,480 lb./inch = 0.0~~9~~19", a value sufficiently low to be deemed to be acceptable.

Q145. You appear to have made your choices of vertical contact stiffness values on the basis of some physical principle. Is there any guidance on the appropriateness of doing so?

A145. As stated earlier, the underlying rationale is one of providing no "visible" interpenetration when you place the bodies in contact; to the extent that the value can be chosen from the solution of a physically relevant problem that satisfies the primary test, that is a "plus".

Q146. You stated earlier that there was also a horizontal contact stiffness parameter. What does this parameter measure?

A146. (KPS, AIS) This parameter measures the force at the point of contact between two bodies in the horizontal direction that causes a relative deflection of 1 inch in the horizontal direction between two originally coincident points on the interface.

Q147. Does Dr. Khan's model use reasonable values of horizontal contact stiffness?

A147. (KPS, AIS) No. Dr. Khan assumes that the force in the horizontal direction required to cause a relative deflection of 1 inch in the horizontal direction is 100,000 lbs/in. and that the cask will slide at a coefficient of friction of 0.20. If you apply a force greater than the 20% of the weight of the cask, or 72,000 lb, the cask will slide; a force below 72,000 lb should impart no visible relative movement in the horizontal direction. But if we use Dr. Khan's horizontal

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In the matter of PFS

Staff _____	IDENTIFIED ✓
Applicant ✓	RECEIVED ✓
Intervenor _____	REJECTED _____
Other _____	WITHDRAWN _____
DATE 06-04-02	Witness Singh/Soler
Clerk Susette Snider	