

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of:)
) Docket No. 72-22-ISFSI
)
PRIVATE FUEL STORAGE, LLC) ASLBP No. 97-732-02-ISFSI
(Independent Spent Fuel)
Storage Installation) July 22, 1999

**DECLARATION OF DR. MARVIN RESNIKOFF REGARDING MATERIAL
FACTS IN DISPUTE WITH RESPECT TO CONTENTION K**

Under penalty of perjury, I, Dr. Marvin Resnikoff, declare as follows:

1. I am the Senior Associate of Radioactive Waste Management Associates, a private consulting firm based in New York City. I have researched radioactive waste issues for the past 25 years and have extensive experience and training in the field of nuclear waste management, storage, and disposal. I also have considerable training and experience in the field of risk assessment involving nuclear and hazardous facilities. For the States of Nevada, New York and Idaho, I prepared several reports that estimated the probability and consequences of transportation accidents involving irradiated fuel or plutonium transportation casks. A copy of my resume is attached.
2. I am the State of Utah's expert witness on Utah Contention K, regarding credible accidents involving risks related to impacts to the proposed ISFSI. I participated in the drafting of the contention and the development of the State's position regarding the contention, including the preparation of discovery against the Applicant.
3. I am familiar with Private Fuel Storage, L.L.C.'s ("PFS's") license application and Safety Analysis Report in this proceeding, as well as the applications for the storage and transportation casks PFS plans to use. I am also familiar with NRC regulations, guidance documents, and environmental studies relating to the calculation of aircraft hazards, including NUREG-0800.

4. I am also familiar with PFS's February 10, 1999 response to RAI SAR 8, in which PFS provided further information regarding accident risks at the proposed ISFSI.
5. I have reviewed the Applicant's Motion for Partial Summary Disposition of Contention K - Inadequate Analysis Credible Accidents, as well the Statement of Material Facts Not in Dispute and materials submitted in support of the motion, including the Declaration of James L. Cole, Jr.
6. General Cole asserts that the probability aircraft crashes into the PFSF restricted area, including commercial, private and military aircraft, is extremely low. I strongly disagree with the methodology he uses, and believe that the probability is greater than $1.E-7$. Under NRC guidance in NUREG-0800, Section 3.5.1.6, Aircraft Hazards, this would require that the facility be appropriately protected or that "suitable airspace or airway relocation be implemented." (NUREG-0800, Section 3.5.1.6).
7. In calculating the aircraft hazard for the Private Fuel Storage Facility (PFSF), the aircraft hazard probability "equals the sum of the individual probabilities." NUREG-0800 at 3.5.1.6-5. The total risk must include the sum of the risks from military aircraft flying to or from Michael Army Air Field, Dugway Proving Ground, from military or private aircraft flying in the Sevier B Military Operating Area other than to or from Michael Army Air Field, from commercial aircraft flying in airways V257 and J-56, from Cruise missiles and from aircraft parts or munitions (inert and live) being intentionally or unintentionally dropped on the PFSF.
8. It is my understanding that discussion of the risks from military aircraft flying in the Sevier B Military Operating Area (other than to or from Michael Army Air Field) has been postponed until another date. Therefore, in this Declaration I will address the risks from private and commercial aircraft, and the risks of aircraft parts or munitions being dropped on the PFSF. However, these risks are only partial elements of the overall risk, and must be considered in the entire context of the risks identified in paragraph 7.
9. As discussed in General Matthews' Declaration, the two commercial airline airways that pass in the vicinity of the PFSF are V-257 and J-56. In analyzing the risk from airways V257 and J-56, the Applicant's expert, General Cole argues that "the odds of an aircraft falling out of the sky and crashing on the proposed PFSF site [are] too small to compute." Applicant's Motion, Cole Dec., Exhibit 2 at 6. I

disagree with his conclusion. The methodology for conducting such an analysis is provided in NUREG-0800, and could have been used by the Applicant.¹

10. A significant deficiency in General Cole's analysis is that he only considers the probability of an airplane crash during in-flight/cruises. As General Matthews points out, however, planes coming into the Salt Lake City airport are in a descending mode when they pass the PFSF. When planes are making descents or ascents, they have a higher risk of crashing than when they are in-flight.
11. General Cole should also have considered "plans for future utilization of the airport, including...increased traffic." Salt Lake City International Airport is presently undergoing a major \$1 billion expansion of its facilities.
12. The Holtec HI-STORM cask is designed to withstand a tornado missile strike of a 1,800 kilogram object at a speed of 126 mph. Topical Safety analysis Report for the Holtec International Storage and Transfer Operation Reinforced Module Cask System, Holtec Report HI-941184 at Table 2.2.5. However, military aircraft transiting Skull Valley carry 2,000, 1,000 and 500 lb concrete bombs. Matthews Declaration, ¶ 15. The Holtec HI-STORM cask is not designed to withstand a strike by an inert 2,000 lb concrete bomb with a steel nose cone moving at a speed of 600 mph.²
13. The likely consequences of a strike by an inert 2,000 lb concrete bomb with steel nose cone at a speed of 600 mph is to overturn and shatter the concrete overpack of the HI-STORM cask, with all likelihood leading to a release of a fraction of the radioactive contents from the inner canister. Whether the bomb is live or inert, such a strike is likely to have significant consequences.

¹ I would also note that subsequent to the filing of PFS's Motion for Summary Disposition of Contention K, PFS did perform a risk analysis for commercial aircraft, which is reported in PFS's June 30, 1999, Submittal of Comment Resolution Letter # 7. Thus, General Cole's conclusion is contradicted by PFS's own actions. However, because that document is not included in the materials submitted by PFS in support of its motion, I have not analyzed it.

² As discussed above in ¶ 8, this Declaration does not address the frequency of military flights in the PFSF area or the probability of accidents during military flights. Those issues will be addressed at an appropriate later date, after the NRC Staff takes its position.

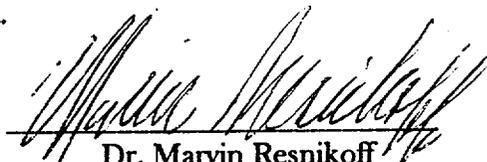
14. Further, an impact with an F-16 jet engine is likely to overturn a storage cask and shatter the concrete overpack. The cask is designed to withstand an impact with a 1,800 kilogram object at a speed of 126 mph. The Pratt & Whitney engines employed by F-16 jets weigh between 3300 lbs and 3700 lbs (see attached Exhibit A) and the F-16 can be moving at 600 mph.
15. I disagree with General Cole's conclusion in paragraph 21 of his Declaration that cruise missile launches would not pose a significant hazard to the PFSF. General Cole argues that cruise missile launches "are infrequent, their intended target areas are far from the PFSF, and special precautions are taken to ensure that the missiles do not cause harm outside their intended target areas." *Id.* According to Mr. James Bishop, cruise missile program manager, Hill AFB and UTTR, cruise missile exercises are flown in Sevier A, B, C and D portions of the MOA. Missiles traverse the entire MOA for approximately two to five hours, at heights as low as 300 feet AGL in the MOAs and 100 feet in the restricted airspaces.
16. According to General Cole's report at page 23, (Exhibit 2 to his Declaration), there are approximately six cruise missile launches per year on the UTTR. General Cole asserts that since 1983, there have been 21 class A missile mishaps in the entire State of Utah.³ He also states that at least 10 of these missiles impacted within the confines of the UTTR. Initially when the Air Force first decided to test long range cruise missiles, it identified the UTTR as the most advantageous site because of the ranges isolation. Applicant's Motion, Cole Dec., Exhibit 3 at 6. If the proposed ISFSI is built the advantageous isolation of the range will be diminished. At any rate, in evaluating risk, one must look at both the probability and the consequences of an accident. In my view, six cruise missiles per year is a significant number, especially considering the extreme potential consequences of an accident involving such a missile. An explosive impact with a Cruise missile could easily destroy a storage cask. The multiple warhead system of a Cruise missile uses a shape charge and a follow-through penetrator designed to perforate reinforced concrete targets in excess of 10'. (See attached Exhibit 2) The HI-STORM and Transtor casks have concrete thicknesses on the order of 3'.
17. General Cole also states that the cruise missiles are not tested near the ISFSI. However, the range of a cruise missile is extremely great, and an errant cruise missile could easily land on the PFSF. As pointed out above, Cruise missiles

³ The most recent mishap occurred last month, June 1999.

traverse the entire MOA. I also disagree with General Cole's assessment of an accident involving an errant Cruise missile in the UTTR on December 10, 1997. After releasing its dummy warhead, the missile crashed into a trailer containing a cosmic ray observatory. In paragraph 23 of his Declaration, General Cole states that the missile flew its programmed course, and that the range personnel erroneously programmed the missile to fly into the ground at the point at which the trailer was located. According to General Cole, the "only error that occurred" was "the failure of a test engineer to communicate with an airborne missile controller in time for the controller to steer the missile off its programmed course, as had been the plan." *Id.* His Declaration gives the impression that the missile was intended to hit the area where the observatory sat, and the only problem was that the missile's course could not be changed at the last minute. However, the U.S. Air Force's report on the incident shows that it was part of the "mission plan" for test team members of the Airborne Range Instrumentation Aircraft ("ARIA") to "take control of the missile." Accident Investigation Board Report, United States Air Force AGM-129, Advanced Cruise Missile, Serial Number 96-0061, 10 December 1997, Dugway Proving Ground, Utah, Volume I of III at page 2. *See* Exhibit 3 to General Cole's Declaration. They were unable to do this because of failed radio communications. The time chart of the accident events (page 15) shows that a crucial 21 seconds elapsed in which communications could not be established and no one had the required control over the missile. For a cruise missile, 21 seconds corresponds to many miles off course. Thus, the accident involved significant human error and lack of control of the missile.

18. General Cole also fails to note another crucial factor, the location of the incident: Cedar Mountain, which borders the PFSF. Since the missile was out of control when it struck the ground, it could have easily overflowed Cedar Mountain and struck a target in Skull Valley.
19. Regarding the Tekoi rocket facility, the Applicant claims that neither an explosion on the pad, nor an overpressure caused by an explosion along Skull Valley Road could compromise the integrity of a storage cask, which is designed to withstand much greater overpressures. The Applicant has not addressed the issue of flying objects due to an explosion during transport of rocket motors, the Trident rocket engine contains 40,000 lbs of explosives.

20. The technical facts presented above are true and correct to the best of my knowledge, and the conclusions drawn from those facts are based on my best professional judgment.


Dr. Marvin Resnikoff

Dated: July 21, 1999

Dr. Marvin Resnikoff

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EXPERIENCE:

- April 1989 - present **Senior Associate**, Radioactive Waste Management Associates, management of consulting firm focused on radioactive waste issues, evaluation of nuclear transportation and military and commercial radioactive waste disposal facilities.
- 1978 - 1981; 1983 - April 1989 **Research Director**, Radioactive Waste Campaign, directed research program for Campaign, including research for all fact sheets and the two books, *Living Without Landfills*, and *Deadly Defense*. The fact sheets dealt with low-level radioactive waste landfills, incineration of radioactive waste, transportation of high-level waste and decommissioning of nuclear reactors. Responsible for fund-raising, budget preparation and project management.
- 1981 - 1983 **Project Director**, Council on Economic Priorities, directed project which produced the report *The Next Nuclear Gamble*, on transportation and storage of high-level waste.
- 1974 - 1981 **Instructor**, Rachel Carson College, State University of New York at Buffalo, taught classes on energy and the environment, and conducted research into the economics of recycling of plutonium from irradiated fuel under a grant from the Environmental Protection Agency.
- 1975 - 1976 **Project Coordinator**, SUNY at Buffalo, New York Public Interest Research Group, assisted students on research projects, including project on waste from decommissioning nuclear reactor.
- 1973 **Fulbright Fellowship** at the Universidad de Chile, conducting research in elementary particle physics.
- 1967 - 1972 **Assistant Professor of Physics**, SUNY at Buffalo, conducted research in elementary particle physics and taught range of graduate and undergraduate physics courses.
- 1965 - 1967 **Research Associate**, Department of Physics, University of Maryland, conducted research into elementary particle physics.

EDUCATION

University of Michigan
Ann Arbor, Michigan

PhD in Physics, June 1965
M.S. in Physics, Jan 1962
B.A. in Physics/Math, June 1959

Resume of Marvin Resnikoff, Ph.D.

Dr. Marvin Resnikoff is Senior Associate at Radioactive Waste Management Associates and is an international consultant on radioactive waste management issues. He is Principal Manager at Associates and is Project Director for risk assessment studies on radioactive waste facilities and transportation of radioactive materials. Dr. Resnikoff has concentrated exclusively on radioactive waste issues since 1974. He has conducted studies on the remediation and closure of the leaking Maxey Flats, Kentucky radioactive landfill for Maxey Flats Concerned Citizens, Inc. under a grant from the Environmental Protection Agency, the Wayne and Maywood, New Jersey thorium Superfund sites and on proposed low-level radioactive waste facilities at Martinsville (Illinois), Boyd County (Nebraska), Wake County (North Carolina), Ward Valley (California) and Hudspeth County (Texas). He has conducted studies on transportation accident risks and probabilities for the State of Nevada and dose reconstruction studies of oil pipe cleaners in Mississippi and Louisiana, residents of Canon City, Colorado near a former uranium mill, residents of West Chicago, Illinois near a former thorium processing plant, and residents and former workers at a thorium processing facility in Maywood, New Jersey. In West Chicago he calculated exposures and risks due to thorium contamination and served as an expert witness for plaintiffs A Muzzey, S Bryan, D Schroeder and assisted counsel for plaintiffs KL West and KA West. He is presently serving as an expert witness for a separate group of plaintiffs in West Chicago, including R Dassion. He also evaluated radiation exposures and risks in worker compensation cases involving G Boeni and M Talitsch, former workers at Maywood Chemical Works thorium processing plant.

Under a contract with the State of Utah, Dr. Resnikoff is a technical consultant to DEQ on the proposed dry cask storage facility for high-level waste at Skull Valley, Utah and proposed storage/transportation casks. He is assisting the State on licensing proceedings before the Nuclear Regulatory Commission. In addition, at hearings before state commissions and in federal court, he has investigated proposed dry storage facilities at the Point Beach (WI), Prairie Island (MN) and Palisades (MI) reactors.

In Canada, he has conducted studies on behalf of the Coalition of Environmental Groups and Northwatch for hearings before the Ontario Environmental Assessment Board on issues involving radioactive waste in the nuclear fuel cycle and Elliot Lake tailings and the Interchurch Uranium Coalition in Environmental Impact Statement hearings before a Federal panel regarding the environmental impact of uranium mining in Northern Saskatchewan. He has also worked on behalf of the Morningside Heights Consortium regarding radium-contaminated soil in Malvern and on behalf of Northwatch regarding decommissioning the Elliot Lake tailings area before a FEARO panel. More recently he completed a study for Concerned Citizens of Manitoba regarding transportation of irradiated fuel to a Canadian high-level waste repository.

He was formerly Research Director of the Radioactive Waste Campaign, a public interest organization conducting research and public education on the radioactive waste issue. His duties with the Campaign included directing the research program on low-level commercial and military waste and irradiated nuclear fuel transportation, writing articles, fact sheets and reports, formulating policy and networking with numerous environmental and public interest organizations and the media. He is author of the Campaign's book on "low-level" waste, *Living Without Landfills*, and co-author of the Campaign's book, *Deadly Defense, A Citizen Guide to Military Landfills*.

Between 1981 and 1983, Dr. Resnikoff was a Project Director at the Council on Economic Priorities, a New York-based non-profit research organization, where he authored the 390-page study, *The Next Nuclear Gamble, Transportation and Storage of Nuclear Waste*. The CEP study details the hazard of transporting irradiated nuclear fuel and outlines safer options.

In February 1976, assisted by four engineering students at State University of New York at Buffalo, Dr. Resnikoff authored a paper that changed the direction of power reactor decommissioning in the United States. His paper showed that power reactors could not be entombed for long enough periods to allow the radioactivity to decay to safe enough levels for unrestricted release. The presence of long-lived radionuclides meant that large volumes of dismantled reactors would still have to go to low-level waste disposal facilities. He has assisted public interest groups NECNP and CAN on the decommissioning of the Yankee-Rowe reactor.

Dr. Resnikoff is an international expert in nuclear waste management, and has testified often before State Legislatures and the U.S. Congress. He has extensively investigated the safety of the West Valley, New York and Barnwell, South Carolina nuclear fuel reprocessing facilities. His paper on reprocessing economics (*Environment*, July/August, 1975) was the first to show the marginal economics of recycling plutonium. He completed a more detailed study on the same subject for the Environmental Protection Agency, "Cost/Benefits of U/Pu Recycle," in 1983. His paper on decommissioning nuclear reactors (*Environment*, December, 1976) was the first to show that reactors would remain radioactive for hundreds of thousands of years.

Dr. Resnikoff has prepared reports on incineration of radioactive materials, transportation of irradiated fuel and plutonium, reprocessing, and management of low-level radioactive waste. He has served as an expert witness in state and federal court cases and agency proceedings. He has served as a consultant to the State of Kansas on low-level waste management, to the Town of Wayne, New Jersey, in reviewing the cleanup of a local thorium waste dump, to WARD on disposal of radium wastes in Vernon, New Jersey, to the Southwest Research and Information Center and New Mexico Attorney General on shipments of plutonium-contaminated waste to the WIPP facility in

New Mexico and the State of Utah on nuclear fuel transport. He has served as a consultant to the New York Attorney General on air shipments of plutonium through New York's Kennedy Airport, and transport of irradiated fuel through New York City, and to the Illinois Attorney General on the expansion of the spent fuel pools at the Morris Operation and the Zion reactor, to the Idaho Attorney General on the transportation of irradiated submarine fuel to the INEL facility in Idaho and to the Alaska Attorney General on shipments of plutonium through Alaska. He was an invited speaker at the 1976 Canadian meeting of the American Nuclear Society to discuss the risk of transporting plutonium by air. As part of an international team of experts for the State of Lower Saxony, the Gorleben International Review, he reviewed the plans of the nuclear industry to locate a reprocessing and waste disposal operation at Gorleben, West Germany. He presented evidence at the Sizewell B Inquiry on behalf of the Town and Country Planning Association (England) on transporting nuclear fuel through London. In July and August 1989, he was an invited guest of Japanese public interest groups, Fishermen's Cooperatives and the Japanese Congress Against A- and H- Bombs (Gensuikin).

Between 1974 and 1981, he was a lecturer at Rachel Carson College, an undergraduate environmental studies division of the State University of New York at Buffalo, where he taught energy and environmental courses. The years 1975-1977 he also worked for the New York Public Interest Group (NYPIRG).

In 1973, Dr. Resnikoff was a Fulbright lecturer in particle physics at the Universidad de Chile in Santiago, Chile. From 1967 to 1973, he was an Assistant Professor of Physics at the State University of New York at Buffalo. He has written numerous papers in particle physics, under grants from the National Science Foundation. He is a 1965 graduate of the University of Michigan with a Doctor of Philosophy in Theoretical Physics, specializing in group theory and particle physics.