IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLUMBIA

Beyond Nuclear, *et al.,*	)	Case No. 1:16-cv-01641
Plaintiffs,	)	Judge Chutkan
-vs-	)	
U.S. Department of Energy, *et al,*	)	
Defendants.	)	
	)	

* * * * *

NOTICE OF FILING OF DECLARATION OF MARVIN RESNIKOFF, Ph.D.

Notice is hereby given of the filing of the declaration of Marvin Resnikoff, Ph. D., attached.

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CERTIFICATE OF SERVICE

I hereby certify that on November 22, 2016, I electronically filed the foregoing document and its attachments with the Clerk of the Court using the CM/ECF system, which will send notification of the filing to all parties.

/s/ Terry J. Lodge
Terry J. Lodge, Esq.
Co-Counsel for Plaintiffs

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* * * * *

DECLARATION OF MARVIN RESNIKOFF, Ph.D.

I, Marvin Resnikoff, declare as follows:

1. I am the Senior Associate at Radioactive Waste Management Associates and an international consultant on radioactive waste management issues. I am the Principal Manager at Associates and the Project Director for dose reconstruction and risk assessment studies of radioactive waste facilities and transportation of radioactive materials. I have concentrated exclusively on radioactive waste issues since 1974. I have authored or co-authored four books on radioactive waste issues, including one on the subject of transportation of nuclear materials. In June 2000, I was appointed to a Blue Ribbon Panel on Alternatives to Incineration by DOE Secretary Bill Richardson. I was an invited panelist to the President's Blue Ribbon Commission on Nuclear Safety in August 2011.

2. I am a 1965 graduate of the University of Michigan with a Doctor of Philosophy in Theoretical Physics, specializing in group theory and particle physics. I am a member of the Health Physics Society. I have specialized on the transportation of nuclear materials since 1975 when I testified on behalf of New York State General Lefkowitz before the Federal District Court in New York on the subject of transportation of liquid plutonium through JFK Airport from the United States to Germany. I have since testified before the Federal Court several times. I have presented papers on nuclear transportation before the American Nuclear Society and presently serve as a consultant to the State of Nevada on proposed shipments of high level waste to the proposed waste repository at Yucca Mountain, Nevada.

3. To prepare this declaration, I reviewed the Nuclear Regulatory

Commission's Safety Evaluation Report for the NAC-LWT cask and the Technical Assessment by the Canadian Nuclear Safety Commission related to the proposed transportation of liquid target residue material, which is liquid highly-radioactive waste, from the Chalk River facility in Canada to the Savannah River Plant in South Carolina, some 1,100 miles. These shipments are unique in that the highly-radioactive waste will be in liquid form, which differs from historical shipment practice.

4. A so-called "regulatory fire" involves a 30 minute fire at 1475°F with the cask fully immersed in the fire and is based on the heat generated by a flaming house. However, most fires which would occur in radioactive waste shipment are hydrocarbon fires involving diesel fuel and would have a flame temperature of 1850°F. Some flammable materials that are in commercial use have burn temperatures even higher than 1850°F. No casks for hauling solid or liquid target residue material in the United States have actually been physically tested for their resistance to these temperatures. The tests have been by computer simulation or have been of scale models. This introduces a level of uncertainty in the computer simulations.

5. A regulatory fire at 1475°F or a hydrocarbon fire at a temperature of 1850 °F each could potentially cause the release of the liquid waste and the serious accidents in ways that solid material would not. E.g., DOE software that is used to estimate radiation doses from radioactive releases, such as Hotspot and Riskind, considers Pu and Sr as particulates with a minor release fraction, and Cs-137 as a semi-volatile material, with a much greater release fraction. But in the case of a liquid release, all radionuclides would be released from the cask quantitatively as a liquid or steam in a fire.

6. I have reproduced below the only previous analysis that remotely approximates the proposed transport this case. It involved shipments of solid waste in a cask containing liquid in 1978. In a regulatory fire, seals and valves of the cask would be damaged within one half hour of the regulatory fire, and liquid would be expelled from the cask.[1] With that generation of transportation casks, the pressure valves in the cask were expected to open, even if the fire duration was as short as 15 minutes, according to a DOE contractor, Pacific Northwest Laboratory[2].

[1] Pacific Northwest Laboratory, for the U.S. Department of Energy, "Assessment of the Risk of Transporting Spent Nuclear Fuel by Truck," PNL-2588, November 1978.

[2] *Ibid.*

TABLE 6.3. Thermal Failure Thresholds

Type of Failure	Minimum Duration of Fire(a) to Cause Failure
Loss of Coolant from Rupture Disk	15 min.
Closure Seal	30 min.
Drain Valve Seal	30 min.
Vent Valve Seal	30 min.

(a) All fires assumed to be 1010°C (1850°F).

7. All discussion of thermal matters in the NAC-LWT Safety Evaluation Report (SER) are redacted for proprietary reasons. All assumptions and calculations have been blacked out. I have not been able to locate any non redacted versions. Therefore it is impossible for scientists and the informed public to review the calculations by NAC which have been accepted by the Nuclear Regulatory Commission.

8. Answers to questions the NRC put to NAC about thermal issues and pressure calculations have been redacted[3], including most of the section on thermal evaluation. I count at least 54 of 83 pages fully or partly redacted.

9. The NAC-LWT consists of massive amounts of steel and lead. The lead serves to shield workers and the public from gamma radiation emanating from the enclosed radioactive material. Steel adds structural integrity. Casks also contain neutron absorbing material, such as a chemical form of boron. In a potential fire, the exterior of the cask heats up rapidly to the temperature of the external fire; the interior of the cask heats up more slowly and continues to heat up even after the fire is extinguished. It is impossible to know, since the calculations are redacted, whether this thermal inertia has been taken into account.

10. It is also impossible to know whether the O-rings and pressure relief valves have been predicted to withstand either the 1475°F regulatory fire or the more realistic hyrdrocarbon fire of 1850°F. It is impossible to know whether NAC and the NRC have taken

[3] (NRC, 2014a) ML 1407 a 423

into account more serious fires such as the Macarthur MAZE fire[4] or the Caldecott Tunnel fire.[5] Neither are mentioned in the unredacted parts of the SER.

12. According to NUREG/CR-7209, the MacArthur Maze fire involved an overturned tanker truck carrying 8,600 gallons of gasoline which caught fire and weakened the girder holding the highway above, which subsequently collapsed on the tanker truck below. The intense heat from the fire weakened the steel girders and two sections of Interstate 580 fell. An accident with a cask with liquid target residue waste on similar roadway, fully engulfed in fire for 37 minutes and exposed to a flame temperature of 2012°F (1100°C) is certainly conceivable, but not addressed in the SER. The girders began to sag in the Maze fire after 5 to 10 minutes, and collapsed completely at approximately 17 minutes. The fire continued to burn intensely for about 102 minutes.

13. What would befall the LWT cask in such circumstances? The peak cladding temperature would exceed burst rupture conditions for a spent fuel rod. While the seals in the cask would be expected to degrade, the peak clad temperatures, 845°F (452°C) - less than a regulatory fire - would easily cause the water in the NAC-LWT to boil away, exploding the 4 containers, causing steam or radioactive vapor to leak from the cask as it destroyed the cask seals and pressure relief valves.

14. In the Caldecott Tunnel fire near Oakland, California, a tank trailer with 8,800 gallons of gasoline overturned and burned about a quarter mile from the end of a tunnel for four lanes of traffic. The fire lasted about 2.7 hours, and the intensely hot gasoline-fueled portion of the fire is estimated to have lasted about 40 minutes. The maximum temperature at the ceiling, 935°C, about 80 meters downwind, was reached only 10 minutes into the fire. NUREG/CR-7209 does not discuss the deformation of thick metal grates in the tunnel. The NRC did not consider this fire, either. The intense heat would also vaporize much of the liquid radioactive contents and cause steam or vapor leaks.

15. The Technical Assessment by the Canadian Nuclear Safety Commission explains that the internal temperature of the contained liquid will reach 97°C, that is, almost to the boiling point, but again we don't know whether the calculations have been cut off at 30 minutes, the regulatory time period, or if the fire exceeded the regulatory fire temperature. In any case, in a real fire that could occur on the highway at 1850°F or 1000 °C, it is likely that the liquid in the NAC-LWT would boil, burst the containers and enter the external environment.

16. The issue of criticality is also not clearly spelled out in the Technical Assessment or Safety Analysis Report. The full HEUNL cask contains 1.6 kg of U-235 and a fraction of a kg of Pu-239. The cask is broken into four containers to avoid a critical reaction, but in a serious accident all containers may be broken, mixing all the contents into the entire cask

[4] NUREG/CR-7209

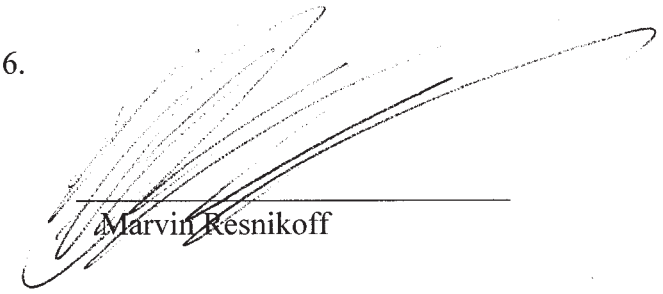
[5] *Ibid.*

volume. DOE and CNSC should clearly discuss that the full cask itself will not go critical. Criticality means, like a nuclear reactor, the cask contents would fission and gamma products like Sr-90 and Cs-137 would be produced along with a strong neutron field. This would be an extremely serious accident.

17. In conclusion, it is impossible to verify the calculations by the Nuclear Regulatory Commission regarding the safety of the proposed shipments of liquid target waste material. Even if the NAC-LWT transport cast satisfies the modest NRC cask regulatory requirements, this will not guarantee the cask would withstand actual thermal conditions in the event of accident. If a cask carrying the proposed highly-radioactive liquid waste were present in a high temperature fire of long duration, the cask contents could likely boil and overpressurize the cask, leading to the release of radioactive material containing cesium 137 and strontium 90. This would not be likely to happen if the cask contents were solid spent nuclear fuel. An accident involving liquid waste would have serious public health and economic consequences. I conclude that the NRC's SER is seriously deficient.

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on November 22, 2016.



Marvin Resnikoff