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)	)	

DECLARATION OF BRUCE BRUNSDON

Bruce E. Brunsdon states as follows under penalties of perjury:

1. I am a Lead Mechanical Engineer for Stone & Webster Engineering Corp. In that position I analyze the dynamic responses of mechanical systems in nuclear facilities. I am providing this declaration in support of a motion for partial summary disposition of Contention Utah K in the above captioned proceeding to show that accidents at the Tekoi Rocket Engine Test Facility, including potential explosions of rocket motors and rocket motors potentially escaping their test stands during firing, would pose no significant hazard to the Private Fuel Storage Facility (PFSF).

2. My professional and educational experience is summarized in the curriculum vitae attached as Exhibit 1 to this declaration. I have extensive experience since 1980 in the dynamic response analysis of mechanical systems, structures, piping systems, and vessels in the commercial nuclear power industry and DOE weapons programs. I am familiar with techniques for evaluating barrier penetration and impact effects using energy balance and ductility ratio considerations. I have over twelve years experience in directing project activities for DOE facilities at Rocky Flats, Lawrence Livermore National Laboratory, Idaho National Engineering Laboratory and the Savannah River Site.

3. I am knowledgeable of the location of the PFSF and the Tekoi test facility and of the design of the PFSF and the spent fuel casks that will be used there. I am also knowledgeable of the means of estimating the effects of explosions on structures of nuclear facilities and the means for estimating the likelihood that an accident-generated missile would strike a facility. I am also knowledgeable of the capability of structures, systems, and components important to safety at the ISFSI, including the spent fuel casks, to withstand explosions and potential impacts from missiles.

4. In the bases for Utah Contention K, the State alleged that PFS inadequately considered the potential for credible accidents at the Tekoi Rocket Engine Test Facility to harm the PFSF, in that PFS failed to consider the possibility that the PFSF could be harmed by an explosion or by a rocket motor that escaped from its test harness.

5. The Tekoi test facility is owned by Alliant Techsystems, Inc. (Alliant) and is located on the Reservation of the Skull Valley Band of Goshute Indians. Tekoi encompasses two operational areas: a high hazard explosive test area and a static test range. The static test range includes three test bays. The PFSF is located over two miles from the Tekoi test facility. Specifically, the closest part of the PFSF Restricted Area, in which the spent fuel casks and all systems important to safety at the PFSF will be located, is 2.3 miles (12,100 ft.) north by northwest of the Tekoi test bay in which the largest rocket motors are tested. That bay is the location closest to the PFSF at which explosives or rocket motors are tested at Tekoi. (The relative locations of the Tekoi test facility and the PFSF are shown on the portions of the USGS topographical maps attached as Exhibit 2 to this declaration). The PFSF canister transfer building is located 2.4 miles (12,700 ft.) from the same test bay. The closest storage pads on which the spent fuel storage casks will be located will be 2.5 miles (13,200 ft.) from the bay.

6. Both operational areas at Tekoi—the high hazard explosive test area and the static test range—are sited for explosive test operations, in accordance with the safe offset distances for the quantity of explosives to be tested, as prescribed by the

Department of Defense Contractors' Safety Manual for Ammunition and Explosives (DoD 4145.26M). Rocket motor explosions in testing are rare because of the design of the rocket motors and the safety precautions that are taken during testing. Nevertheless, the siting of explosive test operations assumes that an explosion will occur sometime in the life of the facility. Therefore, safe offset distances are established to protect against the effects of overpressure, fragments, and heat that could be produced by an explosion.

7. The Tekoi high hazard explosive test area tests all classes of explosives, and intentional detonations are an inherent part of the testing. The high hazard test area currently has an explosive limit of 200 lbs. Class 1.1 explosives. The "class" of a hazardous material indicates its hazard class and division designator under the United Nations Organization system. Class 1.1 consists of mass detonating material, which can detonate almost instantaneously upon ignition. Class 1.1 includes bulk explosives and some propellants. Class 1.3 (material of which class is contained in rocket motors tested at Tekoi) consists of mass fire material, which burns vigorously with little chance of being extinguished in storage. Explosions involving Class 1.3 material, however, are normally confined to pressure ruptures of containers and do not produce propagating shock waves or damaging blast overpressure at ranges as long as those at which explosions involving Class 1.1 material produce such effects.

8. The Tekoi static test range consists of three bays. Bay 1 is used for machining of large rocket motors containing Class 1.1 and 1.3 propellants. Bay 3 is used for static testing of full scale rocket motors containing both explosive Class 1.1 and 1.3 propellants. Bay 2 is not currently used. Static firing includes rocket motors under development and in production. Test limits are set in terms of Class 1.1 propellants because they produce explosion damage at ranges greater than those at which Class 1.3 propellants produce such damage. Bay 1 of the static test area has an explosive limit of 100,000 lbs. of Class 1.1 propellants. Bay 2 has an explosive limit of 50,000 lbs. of Class 1.1 propellants. Bay 3 has an explosive limit of 1.2 million lbs. of Class 1.1 propellants.

The limits are fixed by the designs of the test bays and Department of Defense regulations and may not be exceeded.

9. The Department of Defense Contractors' Safety Manual for Ammunition and Explosives provides means to calculate the effects of explosions as a function of the amount of explosives involved and the distance from the explosion. Based on this Manual, Alliant has calculated, as shown in the chart attached to this declaration as Exhibit 3, that to be reasonably protected from the overpressure, fragments, and heat that would be produced by an explosion of 1.2 million lbs. of Class 1.1 propellant (the maximum amount that can be tested at the Tekoi facility) the nearest inhabited building or the nearest property line must be at least 5,313 ft. away. Furthermore, based on the DOD Safety Manual, Alliant has calculated that an explosion of 1.2 million lbs. of Class 1.1 propellant would produce an overpressure of 0.5 psi at a distance of 7,970 ft. Exhibit 4 (Figure 1 from the Baseline Risk Assessment for the Tekoi High Hazard Test Area, Alliant Techsystem Bacchus Works (March 1996)) shows that the buffer zone established by Alliant around the Tekoi facility extends to a distance of 1.5 miles (7,920 ft.) from the facility.

10. As stated in Regulatory Guide 1.91, Evaluations of Explosions Postulated to Occur on Transportation Routes Near Nuclear Power Plants (Revision 1 (for comment) Feb. 1978), blast overpressure is the explosive effect most likely to cause significant damage to a nuclear facility. According to Reg. Guide 1.91, an overpressure of 1.0 psi is a safe threshold below which the damage from an explosion would likely not be significant. The guide states:

> The effects of explosives that are of concern in analyzing structural response to blast are incident or reflected pressure (overpressure), dynamic (drag) pressure, blast-induced ground motion, and blast-generated missiles. It is the judgement of the NRC staff that, for explosions of the magnitude considered in this guide, and the structures, systems, and components that must be protected, overpressure effects are controlling.

> This regulatory guide describes a method for determining distances from critical plant structures to a [point] beyond which any explosion that might occur . . . is not likely to have an adverse effect on plant operation . . . .
>
> A method for establishing the distances referred to above can be based on a level of peak positive incident overpressure . . . below which no significant damage would be expected. It is the judgement of the NRC staff that, for the structures, systems, and components of concern, this level can be conservatively chosen at 1 psi (approximately 7 kPa).

11. According to the PFSF Safety Analysis Report (SAR), section 3.3.6, no structures, systems, or components important to safety at the PFSF (which include the canister transfer building and the spent fuel casks) would suffer significant damage from an explosion that produced an overpressure of 1 psi or less at the facility. More specifically regarding the spent fuel casks, as described in SAR sections 4.2.1.5.1.I and 4.2.2.5.1.I, respectively, the Holtec HI-STORM 100 storage cask and the BNFL TranStor storage cask are designed to withstand overpressures of greater than 1 psi. Under 10 C.F.R. § 71.71(c)(4), spent fuel transportation casks must withstand an external overpressure of 5.3 psi (20 psi absolute). Therefore, explosions that produced 1 psi or less at the PFSF would cause no significant damage to structures, systems or components important to safety.

12. Figure 1 of Reg. Guide 1.91 considers the effects of an explosion of 5,000 tons (10 million pounds) of TNT equivalent material (the maximum quantity of explosives likely to be transported on a river vessel). The figure shows that the overpressure resulting from an explosion of 10 million pounds of TNT would decrease to 1 psi at a distance of 9,695 ft from the blast location. (See also SAR section 3.3.6 for an indication of the distances at which explosions of various quantities of explosives would produce an overpressure of 1 psi.) Ten million pounds is significantly more explosive material than the 1.2 million pounds that would be contained in the largest rocket motors permitted to be tested at the Tekoi test facility, as indicated in paragraph 8 above. Therefore, the overpressure created by the explosion of the largest rocket motors permitted to be tested at Tekoi would be significantly less than 1 psi at a distance of

9,695 ft from the blast. Calculations using equation (1) in Reg. Guide 1.91 indicate that an explosion of 1.2 million pounds of TNT would produce an overpressure of 1 psi at a distance of 4,782 ft. The table attached as Exhibit 3 indicates that an explosion of 1.2 million pounds of Class 1.1 rocket propellant would produce an overpressure of 0.5 psi at a distance of 7,970 ft. Thus, because the PFSF Restricted Area is over 12,000 ft. from the Tekoi test bay where the largest motors are tested (Bay 3), structures, systems or components important to safety in the Restricted Area would not experience an overpressure of 1 psi from the explosion of such a motor and hence they would not suffer significant damage. This result holds even without considering the reduction in blast overpressure at the PFSF that would result from the presence of Hickman Knoll between Tekoi and the PFSF. Therefore, the potential explosion of a rocket motor at Tekoi would not pose a significant hazard to the PFSF.

13. In addition to explosions in a Tekoi test bay not posing a significant hazard to the PFSF, a hypothetical rocket motor explosion that might take place on the access road to the Tekoi test facility or on Skull Valley Road would also not pose a significant hazard. The Tekoi access road runs due east from the Tekoi facility and intersects Skull Valley Road. At its closest point of approach to the PFSF Restricted Area, the Tekoi access road is 2.25 miles (11,900 ft.) away from the Restricted Area. At its closest point of approach, Skull Valley Road is 1.9 miles (10,000 ft.) from the Restricted Area. Thus, because the explosion of the largest rocket motor tested at Tekoi (1.2 million pounds of propellant) would produce an overpressure of 1 psi only at a distance of 4,782 ft. or less and would produce an overpressure of 0.5 psi only at a distance of 7,970 ft. or less, such an explosion on either the Tekoi access road or Skull Valley Road would not cause significant damage to the structures important to safety in the PFSF Restricted Area.

14. In the bases Contention Utah K, the State also alleged that PFS failed to consider a credible accident in that a rocket motor could potentially escape from a test stand and strike the PFSF. Such a postulated series of events would not pose a significant

hazard to the PFSF because the likelihood that a rocket motor would escape from a test stand, fly the distance between Tekoi and the PFSF, and strike the PFSF and cause a release of radioactivity is extremely low. The Tekoi test facility is carefully designed to prevent rocket motors from escaping from a test bay during testing. The rocket motor firing pad in Bay 3, the bay in which rocket motor test firing takes place at Tekoi, possesses a large thrust block in front of the rocket motor which resists the forward thrust forces of the motor. The static tests are conducted with the rocket motor in a horizontal position or in a vertical position with the front end down and the nozzle up. The rocket motor firing pad is of massive construction, containing approximately 180 cubic yards of heavily reinforced concrete with embedded structural steel restraining members. The structural steel restraining members maintain the alignment between the rocket motor and the thrust block during firing. The members wold also retain large fragments in the unlikely event of a rocket motor explosion. A thick concrete slab is emplaced on each side of the firing pad.

15. In addition to the facility design, safety procedures at the Tekoi test facility also help to assure that a rocket motor will not leave the firing pad. First, before a motor is tested, it is X-rayed, its manufacturing and inspection records are reviewed, and all deviations from the motor's design are evaluated. Any deviation from design requires engineering and quality approval before the motor is tested. Only motors which are expected to perform successfully are tested at the facility. Second, during a test, should a rocket motor begin to perform in an erratic manner where it appears that the potential exists for it to escape its restraining harness, actions are prescribed that preclude the motor from escaping. See Bureau of Indian Affairs, Uintah and Ouray Agency; Environmental Impact Analysis, Rocket Motor Test Site, Skull Valley Band of Goshute Indians, Skull Valley Reservation, Fort Duchesne, Utah; March 28, 1975, the relevant portions of which are attached to this declaration as Exhibit 5.

16. The design of the Tekoi facility and the safety procedures employed before and during test firings, as described above, make it extremely unlikely that a

rocket motor would escape a test stand while being fired. Mr. Floyd Davis, a Senior Safety Specialist with Alliant Techsystems Inc., who has 37 years experience working with rocket motor and explosives testing, at the Tekoi test facility and the Alliant Bacchus Works plant in Magna, Utah, has informed us that no rocket motor has ever escaped from the harness at Tekoi. A rocket motor escaped from the harness at Bacchus in the early 1960s, but that was before the emplacement of modern safety features at that site. Mr. Davis indicated that in May 1974, a rocket motor exploded in place while being tested at the Bacchus Works, but nevertheless did not escape its test stand. See also Bureau of Indian Affairs; Environmental Impact Analysis, Rocket Motor Test Site, for a description of the May 1974 incident.

17. Moreover, in the extremely unlikely event that a rocket motor would escape its test stand, it would be highly unlikely that the motor would strike the PFSF. First, the PFSF Restricted Area, where the spent fuel would be located, is small compared to the area to which a rocket motor might fly if it were to fly 2.3 miles away from Tekoi (the distance to the PFSF). The Restricted Area is only 2,000 ft. wide. PFS SAR, Fig. 1.2-1. That represents an arc of a width equal to only 2.6 percent of the circumference of a circle with a radius equal to the distance between Tekoi and the PFSF, which represents the potential area to which the motor might fly. Thus, assuming that a motor would fly from the test stand in a random direction, it would have at most a 2.6 percent chance of hitting the facility. Furthermore, if a motor did fly in the direction of the PFSF, it would likely be stopped by Hickman Knoll, a rock formation that is located between the rocket test stand at Tekoi and that is approximately 270 ft. higher in elevation than Tekoi and 400 ft. higher than the PFSF. See PFS Safety Analysis Report (SAR), p. 2.2-1. In order to strike the PFSF, a rocket motor would have to escape the firing pad and take an upward trajectory to clear Hickman Knoll, then rapidly change to a downward trajectory so as not to overfly the PFSF. This would be highly unlikely in that the rocket motor would be unguided after it escaped. The combination of the small size of the PFSF Restricted Area compared to the area to which an escaping motor might fly and the likelihood that any motor headed toward the PFSF would be stopped by Hickman Knoll

make it extremely remote that an escaped motor would hit the PFSF. That, coupled with the extremely low probability that a rocket motor would escape its test stand in the first place, make it not credible that the PFSF would be struck by a rocket motor escaping from the Tekoi facility.

18. In sum, the Tekoi Rocket Test Facility poses no significant hazard to the PFSF. Rocket motor explosions would not cause significant harm to the PFSF and it is not credible that a rocket motor would escape a test stand at Tekoi and fly to and strike the PFSF.

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

Executed on June 2, 1999.

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Bruce E. Brunsdon