STAFF
September 25, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
PORTLAND GENERAL ELECTRIC CO., ET AL.	)	Docket No. 50-344 OLA (SFP Amendment)
	)	
(Trojan Nuclear Plant)	)	

TESTIMONY OF BERNARD TUROVLIN
REGARDING OREGON CONTENTION 1

Q1. What is your name and employment affiliation?

A1. My name is Bernard Turovlin. I am a Chemical Engineer in the Chemical and Corrosion Technology Section, Chemical Engineering Branch, Division of Engineering, U.S. Nuclear Regulatory Commission. A statement of my professional qualifications is attached.

Q2. What is the purpose of this testimony?

A2. The purpose of this testimony is to address Oregon Contention 1 which states:

> The licensee has not adequately demonstrated that the expanded capacity of the storage facility is designed to maintain discharges of radiation within the limits specified in the Nuclear Regulatory Commission license.
>
> Bases:
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> A. The full impact of failed fuel cladding is not addressed. The existing documentation does not address how much failed fuel cladding can be tolerated by the clean-up system and the impact of failed fuel upon discharges as a result of handling operations.
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> B. The clean-up system may be used to process the existing radioactivity in the cask loading pit. If so, the impact on the clean-up system of

additional radioactivity from the expanded capacity of the storage facility coupled with the existing radioactivity in the cask loading pit has not been addressed.

Q3. What are the limits in the Trojan license on radiological releases from the operation of the Trojan plant?

A3. Appendix B, Section 1.1 of Trojan Operating License Technical Specifications contains the limits and conditions for the controlled release of radioactive materials in liquid and gaseous effluents. The Technical Specifications ensure that releases do not exceed the NRC Standards for Protection Against Radiation Hazards set forth in 10 CFR Part 20. The design objective radioactive material release rates are based on an annual dose (1) not in excess of 5 mrem to the total body or any organ of any individual in an unrestricted area, (2) less than 10 mrad in air due to gamma radiation at the exclusion boundary and (3) less than 20 mrad in air due to beta radiation at the exclusion boundary. There are no specific Technical Specifications, however, that govern radioactive releases from the spent fuel pool alone.

Q4. How is radioactivity introduced into and removed from the spent fuel pool water?

A4. Radioactivity in the pool water comes primarily from the introduction of reactor coolant water into the pool during refueling, the dislodged crud from the surface of the spent fuel assembly during handling of the assemblies and some lesser impact from the leakage of fission products from within the fuel assembly.

Radioactivity is removed from the spent fuel pool by a subsystem of the Spent Fuel Pool Cooling and Demineralizer System (SFPCDS). This subsystem is described in Section 2.6 of the Staff Safety Evaluation related to this second modification of the Trojan spent fuel pool (Amendment No. 88), dated June 8, 1984, and consists of one circulating pump, two cartridge filters and a demineralizer.

Q5. Will increasing the storage capacity of the pool burden the cleanup system so as to exceed the system's capacity?

A5. No. The spent fuel pool (SFP) cleanup system capacity is not a static capacity like a tank where the capacity is limited by the configuration or physical dimensions. The SFP cleanup system, when operating, has a dynamic capacity for removing radioactivity and other contaminants from the SFP. This is generally stated as a decontamination or cleanup-factor per period of time or pool recycle. If no or very little new radioactivity is introduced into the pool, recirculation of the pool water through the cleanup system will decontaminate the water with every cycle until the entire pool water is at an acceptable level of cleanliness.

Redesign of the SFP racks increases only the storage capacity of the pool and not the frequency or the amount of newly discharged fuel to be placed in the pool during each fuel cycle. As stated above, the major introduction of radioactivity into the pool occurs during the refueling operation. Thus the amount of fission products and activated corrosion product nuclides released into the pool during any year will be about the same regardless of the length of time or the number of assemblies stored in the pool.

Q6. What effect will the increased storage capacity of the Trojan spent fuel pool have upon the operating capacity of the cleanup system?

A6. Storing additional spent fuel in the storage pool may increase the amount of corrosion products and fission product nuclides in the SFP water. Before this amendment authorizing the increased storage capacity of the Trojan spent fuel pool was issued, the pool had the capacity to store 651 fuel assemblies. The first spent fuel was discharged to the Trojan pool during the 1978 refueling. After the 1982 refueling outage there were 260 elements stored in the pool. Based upon the estimated number of fuel elements to be discharged in future refuelings, the present authorized capacity (excluding reserve for full core discharge) will not be exceeded until 1992. The oldest discharged elements, which in other circumstances would have been sent away for reprocessing, will in 1992 be stored in the expanded capacity and will have aged at least nine years. This rerack allows the storage of an additional 757 assemblies which will provide adequate storage capacity until the year 2003. Experience in many spent fuel pools worldwide and in particular the Trojan pool has shown that the contribution rate of contaminants to the spent fuel pool water decreases as the assemblies age during storage. The Trojan cleanup system has already demonstrated the system's ability to handle the contaminants that were produced by refueling fuel element discharges and the presently stored assemblies, including the loose pellets. The system was able to maintain acceptable activity levels even though the system was not operated full time in recycling the spent fuel pool water.

Some previous refueling fuel element discharges to the spent fuel pool included failed fuel elements, i.e., elements containing pinhole leaks in the pin cladding or elements with severely ruptured cladding on some pins. The 1982 fuel element discharge during refueling probably contained the maximum gross number of fuel pins with cladding defects. This is so because operation of the reactor is limited in the Technical Specification to a maximum amount of radioactivity in the reactor coolant. The Trojan reactor coolant approached this number prior to shutdown for refueling.

Expansion of the storage capacity does increase the potential for increasing, by a small amount, the fission product released into the SFP from clad defects and loose pellets. This could increase the amount of radioactivity accumulated in the filter and the resins and necessitate more frequent changeout of the filters and resins.

In the last several years, the resin beds have been replaced approximately once each year. The resins have been changed because of chemical exhaustion, principally due to sodium and was not due to the resin's inability to remove spent fuel pool water radioactive contaminants. Sodium was removed from water processed from the refueling water storage tank (RWST). (The spent fuel pool purification subsystem is used to purify the RWST in addition to the spent fuel pool.)

Storing an increased number of aged (longer than 9 years) elements, even if ruptured, will only increase the frequency of resin and filter changes. This would be an economic burden without safety significance. The resulting additional solid radwaste will be small in comparison to the total solid radwaste generated by the plant (50 cu ft/resin bed versus 5400 cu ft/yr for the plant). In sum, as the Staff concluded in Section 2.6 of its Safety Evaluation, because this reracking will result in only a small increase in radioactivity or other contaminants released to the pool water, the spent fuel pool cleanup system is adequate to keep concentrations of radioactivity and other contaminants in the pool water to acceptably low levels.

Q7. Can you give an estimate as to the maximum amount of failed fuel that can be expected to be stored in the spent fuel pool with expanded storage capacity?

A7. Yes. After the 1982 refueling there were 260 elements stored in the pool, including 12 failed elements or about 4.5% failed elements. Of the 12 failed elements presently stored in the pool, ten have severely damaged rods due to a phenomenon called baffle jetting. The reactor internals have been modified and damage due to baffle jetting is not expected to reoccur. Nevertheless, assuming that for whatever reason, half of this number of severely damaged rods will occur in subsequent years, there would be 2.5% failed fuel elements of the total stored to the year 2003 or approximately 37 failed elements.

Q8. Is the present cleanup system adequate to handle discharges from that amount of failed fuel?

A8. Yes. This number would have little effect on the adequacy of the design of the expanded storage capacity because failed fuel elements that have been stored longer than nine years have a very minor impact on the level of radioactivity in the SFP and have no significance to safety. The resin changeout might occur at shorter intervals than at present. The cleanup system has already demonstrated its ability to handle 4.5% failed fuel elements. The increased burden from "old" failed elements is minor.

Q9. Are there loose fuel pellets in the spent fuel pool now?

A9. Possibly. Some may have been dropped during the movement of fuel assemblies with ruptured cladding and, in the future, some may be dropped during the movement of damaged fuel during the rerack.

Q10. Will any measures be taken to preclude the crushing of stray pellets by heavy objects or racks placed in the spent fuel pool?

A10. Yes. Prior to the start of the rerack operation the SFP floor will be thoroughly surveyed, both visually and with radiation detectors, and any pellets found will be removed. In addition, before any heavy object is lowered to the floor during the rerack procedure, the area to be occupied will again be thoroughly surveyed and any loose pellets removed. Thus, once the new racks are installed, there should be no loose pellets that can be crushed.

Q11. In the event that a heavy weight is placed upon a loose fuel pellet and the pellet is crushed, what will be the effect upon the activity level in the spent fuel storage pool and the pool cleanup system?

A11. The crushing of a pellet will expose new pellet surface area to the pool water and the fission products that had not previously diffused to the surface would escape to the water. However, these pellets will have "aged" in the pool for a minimum of two years since the newest loose pellets came from elements damaged during Reactor Cycle 4 and discharged to the pool in 1982. The cleanup system has demonstrated its ability to maintain the pool activity level within acceptable levels even when many recently discharged loose pellets were stored. The effect of crushing a pellet and the release of all the cesium in the pellet was analyzed by the licensee. It was shown that the increased activity in the SFP will be of no significance. The release of all the cesium in a pellet could increase the concentration in the pool to less than 4×10^{-4} μCi/cc. The increased levels would be comparable to previously measured values and would be of little significance to radioactivity discharges. I agree with this analysis.

Q12. Where is the cask loading pit located and what is the source of the radioactivity in the pit?

A12. The cask loading pit is connected to the spent fuel pool and is separated from the pool by a water tight gate. The radioactivity in the pit is hot trash which was accumulated as a result of reactor modifications and machining.

Q13. Will the Spent Fuel Pool Cleanup system be used to process the water and radioactivity in the cask loading pit?

A13. Yes. The water in the cask loading pit will be processed by an auxiliary cleanup system, in series with the spent fuel cleanup system, prior to opening the gate between the pit and the storage pool. The spent fuel pool cleanup system will be isolated from the SFP during this operation and will only act as a polisher for the auxiliary cleanup system. The pit water will be recycled back to the pit and processed until the water quality in the pit reaches an acceptable level of cleanliness. This processing will be completed prior to the opening of the gate between the pools and prior to the start of the rerack operation.

Q14. Will cleaning the cask loading pit have any affect, either during or after the pit cleanup, on the ability of the spent fuel pool's cleanup system to maintain radiation discharges within the limits specified by the NRC?

A14. No. The temporary isolation of the SFP cleanup subsystem will not affect the ability of the plant to maintain radiation discharges within the limits specified by the NRC. The cleanup system was designed to process water other than spent fuel pool water. Isolation of the cleanup system from the spent fuel pool is a normal operation and has been done before during this interval between refuelings. Since no new radioactivity is being introduced into the pool during this period of isolation, the radiation discharges should be within NRC limits.

Q15. Will the expanded fuel storage capacity affect the Trojan Plant's ability to maintain discharges of radiation within the limits specified in the Nuclear Regulatory Commission license?

A15. The expanded fuel storage capacity will not affect the plant's ability to maintain discharges within the limits specified in the NRC license in accordance with 10 CFR Part 20. In addition, experience worldwide with stored fuel has shown and the Commission has found in its "Waste Confidence Decision," dated August 22, 1984 (49 Fed. Reg. 34658, August 31, 1984), that spent fuel can be stored safely -- either at reactor sites or at independent installations -- for up to 30 years beyond the expiration of reactor operating licenses without significant environmental impacts. The record in the waste confidence rulemaking proceeding indicates that significant releases of radioactivity from used nuclear fuel under licensed storage conditions is unlikely.

To summarize, the major impact to the activity in spent fuel pool and consequently to the radiation discharges comes from the refueling activities (i.e., the discharge of spent and/or damaged fuel elements) and is due to the crud dislodged from the surface of the elements. The cumulative effect of the fission products emanating from the long term stored elements is minor. Increasing the storage capacity of the pool does not increase the frequency or amount of radioactivity introduced into the pool during each fuel cycle. The reracking of the spent fuel pool will result in only a small increase in radioactivity or other contaminants in the pool water.

The spent fuel pool cleanup system can adequately maintain these contaminants at acceptably low levels. In addition, the plant cleanup systems for liquid wastes have the demonstrated capacity to maintain discharges within license limits even if defective fuel elements are discharged from the reactor during refueling up to the year 2003.

PROFESSIONAL QUALIFICATIONS

BERNARD TUROVLIN

PROFESSIONAL ENGINEER - CALIFORNIA #9180 MAY 1949

I am a Corrosion Engineer in the Chemical Engineering Branch of the Office of Nuclear Reactor Regulation, Nuclear Regulatory Commission. I am responsible for safety review and evaluation of the degradation of materials used in the construction and operation of nuclear power plants.

I received a Bachelor of Science degree from the University of Illinois in 1941.

I have been associated with nuclear energy development and construction as an engineer or metallurgist since 1942. I have been employed in these capacities by numerous organizations beginning with the Metallurgical Laboratory of the University of Chicago transferring to Los Alamos Laboratory, Brookhaven National Laboratory, Combustion Engineering Inc., General Atomic, General Dynamics/Convair, U.S. Army Nuclear Power Group. I have spent a minimum of 4 years at each location.

I have been responsible for the development of basic fabrication techniques, non-destructive examination, and failure analysis. I have done engineering design and component testing for various components used in the nuclear energy field.

I have more than 15 patents for various components and techniques used in the above field.

I have published more than a dozen papers related to this field.