



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

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50-295  
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AUG 6 1979

Docket Nos. 50-295  
and 50-304

The Honorable Charles H. Percy  
United States Senate  
Washington, D. C. 20510

Dear Senator Percy:

This is in response to your letter of June 8, 1979, in which you identified several questions, concerns and observations raised by a group of Illinois constituents regarding the accumulation of spent fuel in pools at reactor sites in Illinois and specifically with regard to the proposal by Commonwealth Edison Company to expand the spent fuel storage capacity at the Zion Station. The responses to the individual questions are given below. Hearings by the Atomic Safety and Licensing Board were held at Zion, Illinois, on the spent fuel pool expansion at Zion Station and completed on June 23, 1979. The Attorney General's Office of the State of Illinois was a participant in the hearings.

1. Commonwealth Edison Company (the licensee) possesses an operating license for each of the Zion Units which includes authorization to receive, possess and use at any time in connection with the operation of the facilities, enriched uranium-235 and byproduct material and special nuclear material produced by the operation of the facilities. This authorization is made pursuant to 10 CFR Parts 30 and 70. The licensee is legally liable for the ultimate removal and deposition of the spent fuel. The refueling process, including ultimate shipment offsite, is described in Section 9.7.2 of the Zion Station Final Safety Analysis Report (FSAR), a copy of which is enclosed.

The licensee is also legally liable for subsequent decommissioning of the Zion facility, which would include the spent fuel pool, under the provisions of the existing licenses. The procedures for application for termination of licenses are stated in 10 CFR Part 50.82.

2. The expiration date for the Zion Station operating licenses which, as indicated above, includes authorization for possession of spent fuel, is December 26, 2008. At the present time, it is not possible to state what the spent fuel storage situation will be in the United States in the year 2008. On October 18, 1977, however, the Department of Energy (DOE) announced that the Federal Government would accept and take title to spent nuclear fuel from utilities upon payment of one time storage fees. As we indicated in our Environmental Impact Appraisal (EIA) of March 29, 1979 relating to the proposed modification of the Zion Station spent fuel pool, the government

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intends to provide interim fuel storage facilities for this purpose. Although such facilities are not expected to be made available until the mid-1980's, it is highly likely if such an option is pursued, that such away-from-reactor storage facilities will be available before 2008. Copies of both the EIA and the Safety Evaluation Report (SER) related to the proposed modification are enclosed.

Should the Zion storage pool become full, the heat removal capability of the spent fuel pool cooling system is more than adequate to remove the decay heat generated. Also, the heat generated decreases quite rapidly after removal from the reactor core, and as discussed in Section 2.2 of the staff's Safety Evaluation Report (SER) dated March 29, 1979, for the Zion Station spent fuel pool expansion, the incremental heat load resulting from the proposed modification will not alter the safety considerations of spent fuel cooling from that which we previously reviewed and found to be acceptable.

3. A thorough study of the hydrology and seismology of the Zion site was done prior to issuing an operating license to Commonwealth Edison Company to operate Zion Station, Units 1 and 2. The results of these studies are reported in Sections 2.4 and 2.5 of the Safety Evaluation Report dated October 1972, Section II.E of the Final Environmental Statement dated December 1972 and Section 2 of the Final Safety Analysis Report for Zion Station, Units 1 and 2. The results of the hydrology and seismology studies are applicable to the proposed spent fuel pool modification at Zion Station.

Pool leakage will be collected and routed to the liquid waste treatment system. The spent fuel pool and auxiliary building are Class I seismic structures. Any liquid accidentally leaked from the pool, the pool leak collection system or the liquid radwaste system will be retained within the lower elevations of the auxiliary building. Eventually this leakage would be pumped to the liquid radwaste treatment system. The pool leak rate is about 20 gallons a day.

Any pool leakage released from the plant will be discharged as part of the normal plant liquid effluents to Lake Michigan. The design is such that there will not be pool leakage to the ground water. All users of ground water in the region are either upgradient from

the site or draw on artesian aquifers which are isolated from surface recharge in the site area. Based on our review of the use of ground water in the region about Zion Station, we concluded in the Safety Evaluation Report dated October 6, 1972, that there is little or no likelihood of contaminating ground water sources used by the area population by the operation of Zion Station. This conclusion would not be changed because of the proposed pool modification.

4. In general, spent fuel buildings are designed to withstand the effects of tornadoes. Depending on the location of a particular facility and the proximity of airports, a spent fuel building may also be designed to withstand the effects of airplane crashes. With regard to the Zion Station, the spent fuel pool is a Class I structure and affords protection against loss of integrity from postulated tornado missiles. During our review of the Zion Station Units for operating licenses we considered the location of all airports in the vicinity, and in particular, the Waukegan Memorial Airport. A reassessment of the potential interaction from that airport with the Zion Station was performed. Both the licensee and the staff concluded that the consequences of an aircraft (the size of which is expected to routinely use the Waukegan Airport) would not be significant. The staff also evaluated the probability of a larger commercial-type aircraft crashing into the Zion Station and concluded that the probability is so small that no additional design provisions are warranted.
5. At the time of issuance of the staff's SER related to the proposed spent fuel pool modification, the estimated leak rate of the spent fuel pool liner was 50 gallons per day. Testimony provided by the licensee during hearings conducted at Zion, Illinois June 11-15 and June 20-22, 1979, indicates that the above rate is now somewhat less. The pool leak rate is now estimated at about 2 quarts per day.

In a letter dated April 19, 1979 to Ms. Catherine Quigg of Palatine, Illinois (copy enclosed) we addressed the questions you have raised with regard to this matter.

6. The staff has concluded that an accident similar to that which occurred at Three Mile Island Unit 2 (TMI-2) would probably not have a significant impact on the spent fuel pool itself, or on support systems such as the spent fuel pool cooling system. Enclosed is a copy of the staff's June 19, 1979 responses to questions raised by the Atomic Safety and Licensing Board (ASLB) for the proposed expansion of the Salem Unit No. 1 spent fuel pool storage capacity. These responses discuss the basis for the above stated conclusion for the TMI-2 and Salem Unit No. 1 facilities. The Zion Station design is similar in the pertinent aspects discussed

in our responses and therefore we do not believe that workers would be unable to maintain the Zion Station spent fuel pool.

If an explosion or meltdown occurred in the Zion reactor, the amount of spent fuel in the pool would not affect the consequences of that accident. Such an accident, if it should occur, would not be expected to impact on the spent fuel pool because of the structural integrity of the reactor building containment. Also, once removed from the reactor, the gaseous activity in spent fuel decays rapidly such that, by the time of the subsequent refueling, the amount of gaseous activity that could be released is insignificant.

The design basis accidents for the spent fuel pool are a spent fuel handling accident and a shipping cask drop accident. The spent fuel handling accident is the accidental dropping of a newly discharged single spent fuel assembly and the resultant release of gaseous activity from all fuel pins. The cask drop accident is the accidental dropping of a cask into the pool. Neither accident would have an affect on the operation of the Zion reactors.

7. Hydrogen gas is generated from the reaction of Zircaloy with water (or steam). Since the spent fuel rod power is so low it would be impossible for the Zircaloy clad temperature to reach the threshold temperature required to cause significant chemical reactional hydrogen generation as long as the fuel is covered with water.

If the spent fuel were to be uncovered, the cladding temperature might reach the threshold temperature for significant Zircaloy-Steam reaction. This would depend on the level to which the spent fuel were uncovered.

Such an uncovering of the fuel, however, is extremely unlikely due to: (1) the amount of time it would take (approximately 50 hours) which would permit alternate sources of makeup water to be supplied to the spent fuel pool and, (2) the redundant sources of water available to the spent fuel pool at the Zion Station.

These points are addressed in the testimony of Commonwealth Edison at the recent hearing on the Zion Spent Fuel Pool Expansion.

The spent fuel is in a building equipped with a ventilation system and fans which can be powered from the emergency power sources at the Zion site. Therefore, the situation is not comparable to the Three Mile Island Unit 2 hydrogen explosion which took place in a sealed containment building.



The staff's position, therefore, is that the uncovering of the spent fuel pool is an extremely unlikely event, but if its occurrence is postulated, the ventilation system in the auxiliary building makes the possibility of a hydrogen explosion less likely than was the case at Three Mile Island Unit 2 where the hydrogen was released to a closed containment.

8. The premise that "all spent fuel storage research" is outdated, because it is based on low burnup spent fuel and because of recent permission granted to the Zion Station, Unit 2 to irradiate four fuel assemblies for two additional cycles, is incorrect. First, it should be noted that there is experience with Westinghouse fuel irradiated to burnups comparable to the burnup which will be attained after the fourth cycle irradiation in Zion Unit 2. (At present fuel is normally exposed for three fuel cycles.) This experience indicates that corrosion and hydriding were within the limits of current fuel experience and that no problems were reported in the handling of this fuel. In addition, early Shippingport fuel which was Zircaloy clad was irradiated for a time period of 11.2 calendar years with no adverse conditions noted.

The nuclear industry is taking a rather slow step-by-step approach to extended burnup fuel and no core reloads will be undertaken until the results from small scale irradiation programs, such as that at Zion Station, are known.

With regard to Dr. Peter Lang's comments, it should be kept in mind that his interests are in the area of research. His job, therefore, entails identification of subjects which could benefit from further information. A list of a subject by Dr. Lang as a technical issue "to be addressed" in the development, design and use of high burnup fuel as he did in the referenced article does not mean that there is not presently available sufficient knowledge to provide reasonable assurance that irradiation for two additional cycles will or will not have an adverse safety effect, either in the reactor or in the spent fuel pool. The NRC staff has made such a finding in this case. The Staff's Safety Evaluation Report and Environmental Impact Appraisal dated March 29, 1979 support the issuance of a license amendment to allow the increased irradiation of a maximum of four fuel assemblies for a maximum of two fuel cycles, are enclosed.

The NRC has limited Commonwealth Edison to only four high burnup assemblies in the core for only two additional cycles. Any use of extended burnup fuel beyond this, especially the use of a full reload of fuel rods designed for extended burnup operation, would require a full safety analysis by the licensee and review and approval by the NRC staff.

9. In December 1972, the NRC staff issued its Final Environmental Impact Statement (FES) for the Zion Nuclear Station. This FES addressed the environmental impacts that were expected as a result of the construction and operation of Zion Units 1 and 2.

10 CFR Part 51.5 implements NEPA and identifies the types of actions for which an environmental impact statement will be prepared and circulated. In its consideration of the proposed modification of the Zion spent fuel pool, the staff evaluated the increased environmental impacts that would be expected and concluded that they are not significant. Pursuant to 10 CFR 51.5(C), we therefore issued an environmental impact appraisal and negative declaration. In an earlier, similar action, an Atomic Safety and Licensing Appeal Board confirmed this evaluation of expected impacts resulting from the expansion of the storage capacity of a spent fuel pool indicating that an environmental impact statement was not necessary.

10. and 11. Spent fuel, unless it is irrevocably put into long term storage or otherwise disposed of, will always be available for reprocessing or other use. Because of the large amount of potential energy still available in spent fuel, and the associated value of that energy, retrievable storage seems prudent. Therefore, storage of spent fuel in any location (at reactor pools, in new away-from-reactor pools, or whatever) provides the potential for reprocessing. The storage location is logically to be determined based on economic considerations providing that all alternatives are judged safe.
12. and 13. Because of the design and construction of the Zion spent fuel pool, we have concluded that it is not necessary to postulate the loss of water from the pool. These design features were discussed at some length by the licensee and the NRC staff during the recent Zion spent fuel pool hearings and are discussed in the Staff's Safety Evaluation Report dated March 29, 1979 for the Zion Station spent fuel pool expansion. The Sandia Report you reference addresses

the cooling mechanisms for spent fuel in a pool given that the fuel is without water but does not discuss how the water would be lost from the pool.

Because of the very low probability of loss of water from a spent fuel pool, the availability of makeup water and the stability of spent fuel pool in a spent fuel pool water environment, no research or experimentation has been performed specifically with regard to the separation of plutonium in a hypothetical loss of water accident.

I trust that this letter and enclosures provide the information you have requested.

Sincerely,

Original signed by R. G. Smith



**Lee V. Gossick**  
**Executive Director**  
**for Operations**

Enclosures:

1. Zion Station FSAR
2. EIA and SER dated 3/29/79
3. Letter to Ms. Catherine Quigg from V. Stello dated 4/19/79
4. Staff's 6/19/79 responses to questions on Salem raised by ASLB