PDR

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

Docket No. 50-155

OCT 21 1980

The Honorable Carl Levin
United States Senate
Washington, D.C. 20510

Dear Senator Levin:

Your staff's request for assistance on the "Chuck Will letter," dated July 16, 1980, was referred to our Division of Licensing within the Nuclear Regulatory Commission. The following represents our staff's response to the several questions posed on what safeguards exist to prevent spent nuclear fuel accidents and specific concerns with the Big Rock Plant being exempt from minimal safety standards.

The Commission has completed rigorous analyses of the major credible spent fuel pool accidents, such as cask drop accidents and fuel handling accidents. In addition, at a recent hearing the Staff presented testimony relating to some of the accidents referenced in the Dr. R. E. Webb Study.[1] The testimony which was presented at that hearing is enclosed here for your information.

With regard to Dr. Webb's study concerning the self propagating zircaloy fire/fuel melt/recriticality scenario, Dr. Webb has testified at the referenced hearing[2] that further refinement of his own calculations is needed and specialists in this field are convinced that recriticality of the spent fuel could not occur. Additionally, Sandia Studies[3] on spent fuel heatup, indicates aged spent fuel

1. Dr. Richard E. Webb, "Contentions Regarding the Accident Hazards of Spent Fuel Storage at the Salem Nuclear Power Plant," Salem, New Jersey, February 1979.

2. Atomic Safety Licensing Board hearing, April 1980, "In the Matter of Public Service Electric Gas Company, Salem Nuclear Generating Station, Unit 1, Docket 50-272, Proposed Issuance of Amendment to Facility Operating Licensing DPR-70." (Attachment.)

3. Benjamin, Allan S., et al, Spent Fuel Heatup Following Loss of Water, NUREG/CR 0649, Sandia Laboratory. (Attachment.)

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(1 year or older) has sufficiently low decay heat such that air cooling (i.e., loss of water) would be sufficient to insure no massive oxidation. Additionally, it is a physical impossibility for the plutonium in molten uranium dioxide to separate and stratify as referred to in Mr. Will's letter. Consequently, it is impossible for an explosion like an atomic bomb to occur.

The letter also raised several concerns specific to the Big Rock Point Plant safety standards. With regard to the Big Rock Point spent fuel pool, the NRC staff is reviewing Consumers Power Company's application for an increase in the spent fuel storage capacity. At the completion of our review, we will issue a safety evaluation which will be the NRC staff's principal testimony before the Atomic Safety and Licensing Board. A copy of our safety evaluation will be placed in the local public document room, Charlevoix Public Library, 107 Clinton Street, Charlevoix, Michigan 49720.

The letter also raised a concern regarding the Big Rock Point containment shielding. One of the Lessons Learned from the TMI-2 accident is that radiation fields resulting from contained radiation sources after an accident may make it difficult to effectively perform recovery operations or may impair safety equipment. As a result, by letter of October 30, 1979, we asked nuclear power plant licensees to perform a design review of plant shielding by January 1, 1980 and to implement needed changes by January 1, 1981. By letter to all licensees dated September 5, 1980 it was proposed that the implementation date be modified to January 1, 1982. Consumers Power Company submitted the design review by letter of December 27, 1979 and identified areas of the plant which would need additional shielding protection if NRC design criteria were to be met. The NRC design criteria assumes a very severe accident with a very large radiation source term and assumes that stringent limits on radiation exposure to personnel would be met. By letters dated February 22, April 2, and May 6, 1980, Consumers Power Company requested a delay in implementation of additional shielding protection requirements, among others, for a year beyond the original implementation date while an overall plant risk assessment is performed to assess the feasibility of continued plant operation. We are presently evaluating this request.

The letter raises the additional concern regarding venting of the Big Rock Point containment. The containment building for Big Rock Point Plant was designed and constructed on the basis that the containment would be continuously ventilated. This design was described in the Preliminary Hazards Summary Report and in the Final Hazards Summary Report and was reviewed by the staff prior to issuance of a construction permit and operating license.

The NRC staff currently has under review a generic concern regarding venting and purging of containments for all light water reactors, including the Big Rock Point Plant. On October 23, 1979, the NRC issued an interim position for containment purge and vent valve operation pending resolution of our concerns regarding isolation valve operability. By letter dated December 17, 1979, Consumers Power Company provided information that indicated they met our interim position for the Big Rock Point Plant. A subsequent change in the position of the containment exhaust and supply valves has been evaluated and meets the NRC interim criteria.

Sincerely,

(Signed) T. A. Rehm
William J. Dircks
Executive Director for Operations

Enclosure:
1. Atomic Safety Licensing Board Hearing, dated April 1980
2. NUREG/CR-0649

CARL LEVIN
MICHIGAN

United States Senate

WASHINGTON, D.C. 20510

July 22, 1980

Dear Steve,

Can you comment on the enlcosed letter? Particularly the encircled points.

Thanks very much,

Reed Morgan

224-6221

Please take note of this. We need all the help you can give us.
Linda Will

July 16, 1980

What safeguards are there to prevent spent nuclear fuel ponds (nuclear waste storage facilities) at nuclear power plants from exploding like an atomic bomb?

We have been told for years and years that a major accident could not happen at a nuclear power plant. Obviously we were lied to. Certainly we have been told a nuclear power plant could not explode like a nuclear bomb. But what about the nuclear waste dumps?

Three recent studies confirm that a nuclear spent fuel pool could indeed meltdown, that the consequences of a fuel pool meltdown would be far worse than a reactor meltdown, and that the likelihood of such an accident happening is significant.

Dr. Richard E. Webb in his February 1979 study entitled "Contentions Regarding the Accident Hazards of Spent Fuel Storage at the Salem Nuclear Power Plant, Salem, New Jersey," states, " . . . the plutonium in the molten uranium dioxide could separate and stratify . . . - or at least a mass of fuel material could form which is rich in plutonium - and create as a result a nuclear fuel mass capable of generating the same kind of atomic reaction which takes place in an atomic bomb - a runaway reaction which could produce a strong nuclear

explosion that would increase the dispersal of the radioactivity, into the environment, especially the plutonium . . . (This nuclear explosion possibly similar to the mechanism which has been speculated to have caused the 'nuclear disaster' in the Soviet Union, namely the concentration of plutonium in a nuclear waste burial trench.)"

A spent fuel pool meltdown is likely to have far more disastrous consequences than a reactor meltdown not just because of the potential of an atomic explosion, but because the spent fuel pool contains far more toxic radioactive material than does the reactor.

According to Dr. Webb "there existes a great number - essentially an infinite number of severe reactor accident possibilities that could result in a loss-of-water incident in the spent fuel storage pool." The spent fuel pool can even go critical by itself without the need for a severe reactor accident.

The U.S. nuclear industry has never adequately studied the hazard of a serious accident at a spent fuel pool. The German industry, however, has. The Institute for Reactor Safety of the Technical Control Association, West Germany, published Report No. 290, "Working Report, Studies Concerning the Greatest Possible Failure Sequences in Reprocessing and Nuclear Power Plants." The report concludes that, yes, spent fuel pool coolant water can boil off, the fuel self-melt, and lethal doses can be delivered to the public. The report

estimates that radiation doses of 47,000 rems or 75 times the lethal dose are possible 62.5 miles from the spent fuel pool. Lethal doses of radiation could be spread even further depending upon the wind.

A third study, of the Prairie Island Nuclear Power Plant in Minnesota done by Dr. Thompson from Princeton University arrives at similar conclusions.

According to the Atlantic Chapter of the Sierra Club in a paper called "The Waste Paper," in the Spring of 1979, "there is an alarming possibility of a reactor meltdown precipitating a fuel pool meltdown . . . causing an additional massive release of radioactivity."

What makes a spent fuel pool especially likely to go critical, according to Dr. Webb, is the presence of uranium dioxide. The uranium dioxide could break down and form a mass of fuel material rich in plutonium which could cause a strong nuclear explosion.

The Big Rock Nuclear Power Plant located near Charlevoix, Michigan is the only nuclear power plant in the U.S. which uses plutonium as a fuel. As a result, the spent fuel pool at Big Rock probably has a higher concentration of plutonium than any other nuclear power plant spent fuel pool in the U.S. The spent fuel pool, according to Consumer's Power Co. documents, is 10-15 times more radioactive than it is supposed to be. Also, Big Rock uses as part of its fuel uranium dioxoide!

Big Rock has also, according to Consumer's Power Co. documents, been enriching its' fuel rods beyond the legal limit.

Consumer's Power has received an ERDA grant for $15 million dollars to experiment with radioactive fuels. The research is supposed to last another 8 years.

The Big Rock Plant is exempt from minimal safety standards. The plant itself has a grossly inadequate backup water supply. The spent fuel pool heat exchangers have no backup power supply whatsoever. Monitors on the spent fuel pool monitor radioactive levels only. There is no monitoring of water levels in the spent fuel pools.

The containment shielding at Big Rock is so inadequate that if a 3 Mile Island type accident were to occur, most workers inside and outside the plant would be killed by massive radiation exposure. Only the workers in the control room would experience less exposure. But Big Rock is such an antique that many of its controls are manual and are not located in the control room.

The Palisades nuclear power plant was fined hundreds of thousands of dollars for having some valves open which could vent radiation to the atmosphere. At Big Rock essentially the same valves, Containment and Isolation Valves, are open all the time and have never worked. Big Rock has what is called a "Controlled Pathway to the Outside." Not only does Big Rock have inadequate shielding, but it vents directly to the outdoors

The NRC has exempted the Big Rock Plant from minimal safety standards under what is called the Defense in Depth Exemption Source. In laymen's language, Big Rock is necessary for our defense against the Russians, etc. Yet all that Big Rock really supplies us with is less than 1% of Michigan's electricity, and Michigan has an excess electric capacity of about 20%. Two research groups, the Institutefor Policy Studies and the South West Research Group have designated Big Rock as one of the most dangerous nuclear power plants in the U.S.

A few citizens who live near Big Rock, calling themselves The Concerned Citizens of Charlevoix, filed an intervention with the NRC asking that Big Rock be prevented from expanding its spent fuel pool storage, and that it be required to make it's containment structure adequate. The intervention was filed in August of 1979.

The Concerned Citizens of Charlevoix have very little money for the intervention. They have had several break-ins during which sensitive documents were stolen. A break cable on one of their cars appears to have been cut. People who have financially supported the Concerned Citizens locally have been blacklisted; one person who owned a business was boycotted and run out of business. People active in Concerned Citizens of Charlevoix have been followed by cars who's license numbers were later traced to Big Rock employees.

The Michigan Attorney General's Office has been asked to join the Concerned Citizens of Charlevoix in their intervention; but the office has not done so.

This past January Governor Milliken established a special committee on Nuclear Waste Disposal, all of the members of which freely admit their pro-nuclear biases, and connection; none are public citizens or legislators. In January, also, the Governor's Science Advisor, Dr. Taylor, testified that Michigan has agreed to re-open discussion of nuclear repositories in Michigan. On June 12 the Governor's Committee on Nuclear Waste asked that Michigan's waste law be revoked.

I recently asked the Public Interest Research Group in Michigan's energy director, Ron Wilson, if he had been showing Dr. Beyea's research on the probability and consequences of a nuclear melt down to members of the Michgian Legislature. (Dr. Beyea is an international expert on nuclear power plant melt downs from Princeton University who shows that both the probability and consequences of a meltdown are far greater than the industry is willing to admit.) Ron responded that he had not been presenting Dr. Beyea's research because the legislators simply would not believe it. He went on to say that it is crazy that he has to present himself as a super-rational and somewhat conservative lobbyist in order to make any progress at all with the legislature. It is crazy, he said, that he has to withhold many facts because they are too frightening, and so inconsistent with the peaceful cheap atom

that the industry has taught people to believe in for so many years.

"It's Crazy!"

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ENCLOSURE 2 1

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
PUBLIC SERVICE ELECTRIC & GAS COMPANY	)	Docket No. 50-272 Proposed Issuance of Amendment
	)	to Facility Operating License
(Salem Nuclear Generating Station, Unit No. 1)	)	No. DPR-70
	)	

DIRECT TESTIMONY OF WALTER F. PASEDAG
IN RESPONSE TO BOARD QUESTION NO. 5

Question:

In the event of a gross loss of water from the spent fuel storage pool at Salem 1, what would be the difference in consequences between those occasioned by the pool with the expanded storage proposed by the Licensee and those occasioned by the present pool?

Answer:

The Staff has reviewed the potential for a gross loss of water from the present and expanded spent fuel pool at Salem. Our review has identified no credible mechanism for a loss of water from the pool which would result in any substantial off-site dose consequences. The spent fuel pool consists of a reinforced concrete basin of wall thickness exceeding 8 feet on all sides and 24 feet at the bottom. The entire pool is lined by a 1/4 inch steel liner. The pool integrity under all postulated accident conditions was reviewed at the time of licensing. The additional structural loading resulting from the pool expansion is well under 1% of the total lumped mass in the fuel handling building analytical model, and, therefore, does not appreciably change the structural response of the spent fuel pool. The walls have been investigated for the seismic effect of the heavier racks and stored fuel. The high density racks have no appreciable effect on the structural stability and seismic

response of the spent fuel handling building. Therefore, the leaktightness of the expanded pool under all postulated accident conditions is assumed, and no appreciable change in the margin of protection arises from the pool modification.

The pool design includes a weld channel leak collection system which is intended to collect any leakage of the liner welds. After collection in the weld channels this leakage is piped to the radwaste system via ten (10) one inch diameter leak-off tubes which discharge to a radwaste drain. The largest credible leakage from the spent fuel pool would occur if all 10 leak-off tubes were to discharge at their maximum capacity. This scenario requires multiple punctures of the spent fuel pool liner, and therefore, is considered highly unlikely. A maximum leak rate of no more than 710 gpm could occur in this case, resulting in a rate of decrease in the pool water level of 1.1 inches per minute. This leakage would be detected by the indication and alarm of the leak collection sump in the control room and result in the automatic operation of the sump pump. In addition, prolonged leakage would result in a low spent fuel pool water level alarm. Following detection of this leakage the tubes could readily be capped to withstand the maximum back pressure of 19 psig.

The potential radiological consequences from any accidental release of water from the spent fuel pool would be directly proportional to the fission and activation product concentrations in the water. In our Environmental Impact Appraisal of the Salem spent fuel pool modification (Staff Exhibit 6C, Section 5.3.1) we concluded that the additional release of radioactive material to the spent fuel pool water resulting from the additional stored fuel is insignificant. Consequently, the difference in radiological consequences of a spill of this water would also be insignificant.

We also have evaluated the differences in the liquid pathway between the Salem site and the typical site evaluated in detail in the Staff's Liquid Pathway Generic Study (NUREG-0440) in order to determine whether special site-specific factors might be present at the Salem site. We examined the groundwater transport, surface water transport, and usage of the water bodies surrounding the Salem site and found that the Salem site compares favorably with the typical estuary site of the Generic Liquid Pathway Study. Our evaluation indicates slower dispersion of postulated releases via the liquid pathway compared to the typical estuary site of NUREG-0440. We conclude, therefore, that there are no site-specific peculiarities with respect to the Salem site which would invalidate our conclusions concerning liquid releases stated in the Environmental Impact Appraisal.

In our attempt to define the meaning of a "gross loss of water" we have also considered a hypothetical, non-mechanistic, instantaneous loss of all cooling water in the present and expanded spent fuel pool combined with an inability, for unspecified reasons, of refilling the pool, or providing any other mode of cooling other than natural (convective) air cooling. In view of the thorough review of the integrity of the spent fuel pool, even under design basis earthquake conditions, such an event is considered incredible, and clearly exceeds all design bases. Accordingly, such an event should be classified as a "class 9 accident".

For fresh spent fuel, continued denial of water cooling capability may eventually lead to oxidation and failure of the clad, and to overheating of the UO_2 fuel, with the potential for the release of the fission products in the UO_2 fuel in either the present or the expanded pool. The doses at the site boundary resulting from this postulated release would depend heavily on the postulated scenarios for the mechanism of the water loss, subsequent cooling attempts, building integrity, etc. In order to estimate the differences in the potential consequences of this hypothetical event arising from the pool modification, the onset of self-sustaining clad oxidation may be used as a conservative criterion for the release of the fission products from the fuel. A detailed calculation of the heat up of spent fuel in various configurations is given in a report by Sandia Laboratories (Spent Fuel Heat-Up Following Loss of Water During Storage, NUREG/CR-0649). From this report it is apparent that PWR fuel in the configuration of the modified Salem storage racks cannot reach temperatures for self-sustaining clad oxidation if its age (since removal from the reactor) exceeds 280 days. Since the additional fuel stored in the expanded pool would be at least four years old, as described in section 5.3.1 of the Staff's Environmental Impact Appraisal, no additional clad failures, and hence no additional releases beyond those expected from newly discharged fuel would occur as a result of the SFP modification.

Based on the foregoing considerations we reach the following conclusions concerning the relative effects of the Salem spent fuel pool modification:

(1) The worst credible loss of water from the fuel pool would occur if the spent fuel pool liner were punctured simultaneously in ten locations such that all ten leak-off tubes would discharge water at their maximum capacity. Because of the multiple failures which would have to occur to

realize this scenario, this event is considered highly unlikely. Our evaluation of this event indicates that there are no substantial differences in the radiological consequences arising from the modification of the pool.

(2) A loss of all water from the pool is not considered credible, and would exceed all design requirements for the present and expanded spent fuel pool. If no mitigation of this hypothesized event is assumed, the radiological consequences could be large, as a result of possible overheating and clad failure of any newly discharged fuel in the pool. These consequences could occur either with the present, or with the expanded pool. A detailed comparison would require specification of a scenario for the loss of water and make-up capacity. However, we conclude that any additional fuel in the pool as a result of the pool modification would not contribute to the consequences of this event.

(3) The expansion of the spent fuel pool at the Salem site does not constitute an exceptional case with respect to the liquid pathway or design features of the spent fuel pool resulting in risks substantially greater than for an average plant. Therefore, we conclude that the environmental consequences of Class 9 accidents need not be evaluated.