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

ENVIRONMENTAL IMPACT APPRAISAL BY THE OFFICE OF NUCLEAR REACTOR REGULATION RELATING TO THE MODIFICATION OF THE SPENT FUEL STORAGE POOL FACILITY OPERATING LICENSE NOS. DPR-29 AND DPR-30 COMMONWEALTH EDISON COMPANY AND IOWA-ILLINOIS GAS AND ELECTRIC COMPANY QUAD CITIES STATION UNIT NOS. 1 AND 2 DOCKET NOS. 50-254 AND 50-265

APRIL 9, 1982

1.0 Introduction and Discussion

The combined spent fuel storage capacity of the two nuclear units at Quad Cities Station was originally 2280 fuel assemblies, or storage for 1 3/5 cores from each of the two units. This licensed capability was later increased to 2920 assemblies, although little or no actual increase in installed storage capacity was made. This limited storage capability was in keeping with the expectation generally held in the industry that spent fuel would be kept onsite for a period of 3 to 5 years and then shipped offsite for reprocessing and recycling of the fuel.

Reprocessing of spent fuel did not develop as had been anticipated, however, and in September, 1975, the Nuclear Regulatory Commission (NRC, the Commission) directed the NRC staff (the staff) to prepare a Generic Environmental Impact Statement (GEIS, the Statement) on spent fuel storage. The Commission directed the staff to analyze alternatives for the handling and storage of spent light water power reactor fuel with particular emphasis on developing long range policy. The Statement would consider alternative methods of spent fuel storage as well as the possible restriction or termination of the generation of spent fuel through nuclear power plant shutdown.

A Final Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel (NUREG-0575), Volumes 1-3 (the FGEIS) was issued by the NRC in August, 1979. In the FGEIS, consistent

with the long range policy, the storage of spent fuel is considered to be interim storage, to be used until the issue of permanent disposal is resolved and implemented.

One spent fuel storage alternative considered in detail in the FGEIS is the expansion of onsite fuel storage capacity by modification of the existing spent fuel pools. Applications for fifty such spent fuel capacity increases have been reviewed and approved. The finding in each case has been that the environmental impact of such increased storage capacity is negligible. However, since there are variations in storage pool designs and limitations caused by the spent fuel already stored in some of the pools, the FGEIS recommends that licensing reviews be done on a case-by-case basis to resolve plant specific concerns.

In addition to the alternative of increasing the storage capacity of the existing spent fuel pools, other spent fuel storage alternatives are discussed in detail in the FGEIS. The finding of the FGEIS is that the environmental impact costs of interim storage are essentially negligible, regardless of where such spent fuel is stored. A comparison of the impact-costs of the various alternatives reflect the advantage of continued generation of nuclear power versus its replacement by coal fired power generation. In the bounding case considered in the FGEIS, that of shutting down the reactor when the spent fuel storage capacity is filled, the cost of replacing nuclear stations before the end of their normal lifetime makes this alternative uneconomical.

This Environmental Impact Appraisal (EIA) addresses the environmental concerns related only to expansion of the Quad Cities Station spent fuel storage pools. Additional discussion of the alternatives to increasing the storage capacity of existing spent fuel pools is contained in the FGEIS.

1.1 Description of the Proposed Action

By application dated March 26, 1981, and supplemented by letters dated May 24, July 24, August 19, September 21, October 19, November 2, December 29, 1981, January 27 and March 12, 1982, Commonwealth Edison proposed an amendment that would allow an increase in the licensed storage capacity of the two spent fuel pools from 2,920 to 7,570 fuel assemblies. The storage capability would be increased by replacing the existing racks with new, more compact, neutron absorbing racks. This would provide storage for spent fuel generated at Quad Cities for the next 20 years.

The environmental impacts of Quad Cities Station, as designed, were considered in the NRC's Final Environmental Statement (FES) issued September, 1972, relative to the continuation of construction and operation of the Station. The licensee was later authorized to increase the storage capacity from 2280 to 2920 bundles. The environmental impact of this action was considered in an environmental impact appraisal issued with our authorization

for this action in January, 1978.

In this EIA we have evaluated any additional environmental impacts which are attributable to the currently proposed increase in the SFP storage capacity for the Station.

1.2 Need for Increased Storage Capacity

Spent fuel storage pools are provided for each of the two nuclear generating units at the Quad Cities Station. The Station now has a combined licensed fuel storage capacity of 2920 spaces. Of this number, 2280 spaces are provided by racks already installed. Of the installed racks, 1716 spaces are occupied by spent fuel and 564 spaces are empty. For the Unit 1 refuel outage now scheduled for fall, 1982, the full core of 724 assemblies needs to be removed and stored temporarily in order to safely and with minimum personnel exposure perform needed inspections and modifications. The 564 empty spaces in the racks now installed obviously will not accommodate the full Unit 1 core. Therefore, additional space is needed in the immediate future if Unit 1 is to refuel and continue to operate on schedule.

1.3 Fuel Reprocessing History

Currently, spent fuel is not being reprocessed on a commercial basis in the United States. The Nuclear Fuel Services (NFS) plant at West Valley, New York, was shutdown in 1972 for alterations and expansion; in September, 1976, NFS informed the Commission that it was withdrawing from the nuclear fuel reprocessing business. The Allied

General Nuclear Services (AGNS) proposed plant in Barnwell, South Carolina, is not licensed to operate.

The General Electric Company's (GE) Morris Operation (MO) in Morris, Illinois is in a decommissioned condition. Although no plants are licensed for reprocessing fuel, the storage pool at Morris, Illinois and the storage pool at West Valley, New York are licensed to store spent fuel. The storage pool at West Valley is not full, but NFS is presently not accepting any additional spent fuel for storage, even from those power generating facilities that had contractual arrangements with NFS. GE is also not accepting any additional spent fuel for storage at the Morris Operation.

2.0 The Facility

The principle features of the spent fuel storage and handling at Quad Cities Station as they relate to this action are described here as an aid in following the evaluations in subsequent sections of this environmental impact appraisal.

2.1 The Spent Fuel Pool (SFP)

Spent fuel assemblies are intensely radioactive due to their fresh fission product content when initially removed from the core; also, they have a high thermal output. The SFP was designed for storage of these assemblies to allow for radioactive and thermal decay prior to shipping them to a reprocessing facility. The major portion of decay occurs in the first 150 days following removal

from the reactor core. After this period, the spent fuel assemblies may be withdrawn and placed in heavily shielded casks for shipment. Space permitting, the assemblies may be stored for longer periods, allowing continued fission product decay and thermal cooling.

2.2 SFP Cooling System

The SFP cooling system for each unit at the Quad Cities Station consists of two pumps and two heat exchangers. Each pump is designed to pump 700 gpm (350,000 pounds per hour), and each heat exchanger is designed to transfer 3.5×10^6 BTU/hr from 125 F fuel pool water to 70 F cooling water which flows through the shell side of the heat exchanger.

Heat is transferred from the spent fuel pool cooling system to the reactor building closed cooling water system. The reactor building closed cooling water system, in turn, transfers heat to the service water system. The service water system is a once-through cooling system in which strained water from the Mississippi River is supplied from pumps in the intake structure and returned to the river after removing heat from a number of systems, including the reactor building closed cooling water system.

2.3 Radioactive Wastes

The plant contains waste treatment systems designed to collect and process the gaseous, liquid and solid waste that might contain radioactive material. The waste treatment systems are evaluated in

the NRC's Final Environmental Statement (FES) dated September, 1972. There will be no change in the waste treatment systems described in Section III.D.2 of the FES because of the proposed modification.

2.4 Spent Fuel Pool Cleanup System

The SFP cleanup system is part of the pool cooling system. It consists of a demineralizer with inlet and outlet filters, and the required piping, valves, and instrumentation. There is also a separate skimmer system to remove surface dust and debris from the SFP. This cleanup system is similar to such systems at other nuclear plants which maintain concentrations of radioactivity in the pool water at acceptably low levels.

3.0 Environmental Impacts of the Proposed Action

3.1 Nonradiological

The nonradiological environmental impacts of Quad Cities Station, as designed, were considered in the FES issued September, 1972. Increasing the number of assemblies stored in the existing fuel pools will not cause any new nonradiological environmental impacts not previously considered. The amounts of waste heat emitted by each of the units as a result of the proposed increased spent fuel storage capacity will increase slightly (less than one percent), but will result in no measurable increase in impacts upon the environment.

3.2 Radiological Consequences of the Proposed Action

3.2.1 Introduction

The potential offsite radiological environmental impact associated with the expansion of spent fuel storage capacity at Quad Cities Station has been evaluated.

During the storage of the spent fuel under water, both volatile and non-volatile radioactive nuclides may be released to the water from the surface of the assemblies or from defects in the fuel cladding. Most of the material released from the surface of the assemblies consists of activated corrosion products such as Co-58, Co-60, Fe-59 and Mn-54, which are not volatile. The radionuclides that might be released to the water through defects in the cladding, such as Cs-134, Cs-137, Sr-89 and Sr-90, are also predominantly non-volatile at the temperature conditions that exist in pool storage. The primary impact of such non-volatile radioactive nuclides is their contribution of radiation levels to which workers in and near the SFP would be exposed. The volatile fission product nuclides of most concern that might be released through defects in the fuel cladding are the noble gases (xenon and krypton), tritium and the iodine isotopes.

Experience indicates that there is little radionuclide leakage from spent fuel stored in pools after the fuel has cooled for several months. The predominance of radionuclides in the pool water appear to be radionuclides that were present in the reactor coolant system prior to refueling (which becomes mixed with water in the spent fuel pool during refueling operations), or crud dislodged from the surface of the spent fuel during transfer from reactor core to the SFP. During and after refueling, the spent fuel pool cleanup system reduces the radioactivity concentrations considerably.

A few weeks after refueling, the spent fuel cools in the pool so that the fuel cladding temperature is relatively cool, approximately 180°F. This substantial temperature reduction reduces the rate of release of fission products from the fuel pellets, and decreases the gas pressure in the gap between pellets and cladding, thereby tending to retain the fission products within the gap. In addition, most of the gaseous fission products have short half-lives and decay to insignificant levels within a few months. Based on operational reports submitted by licensees, and discussions with storage facility operators, there has not been any significant leakage of fission products from spent light water reactor fuel stored in the Morris Operation (MO) (formerly Midwest Recovery Plant) at Morris, Illinois, or at Nuclear Fuel Services' (NFS) storage pool at West Valley, New York. Spent fuel has been stored in these two pools which, while it was in a reactor, was determined to have significant leakage and was therefore removed from the core. After storage in the onsite spent fuel pool, this fuel was later shipped to either MO or NFS for extended storage. Although the fuel exhibited significant leakage at reactor operating conditions, there was no significant leakage from this fuel in the offsite storage facility.

3.2.2 Radioactive Material Released to the Atmosphere

With respect to releases of gaseous materials to the atmosphere, the only radioactive gas of significance which could be attributable to storing additional fuel assemblies for a longer

period of time would be the noble gas radionuclide Krypton-85 (Kr-85). As discussed previously, experience has demonstrated that, after spent fuel has decayed 4 to 6 months, there is no longer a significant release of fission products, including Kr-85, from stored fuel containing cladding defects.

For the simplest and most conservative case, we assumed that all of the Kr-85 that is going to leak from defective fuel will do so in the 18 month interval between refuelings. In other words, all of the Kr-85 available for release is assumed to come out of the fuel before the next batch of fuel enters the pool. Our calculations show that the expected release of Kr-85 from a 200 fuel assembly refueling is approximately 46 Ci each 12 months. As far as potential dose to offsite populations is concerned, this is actually the worst case, since each refueling would generate a new batch of Kr-85 to be released. Since all of the Kr-85 available for release has already left the defected fuel before the next batch enters, the annual releases remain approximately the same. The enlarged capacity of the pool has no effect on the total amount of Kr-85 released to the atmosphere each year. Thus, we conclude that the proposed modifications will not have any significant impact on exposures offsite.

Similarly, Iodine-131 released from stored spent fuel to the pool water will not significantly increase because of the expansion of the fuel storage capacity, since the Iodine-131 inventory in the fuel will decay to negligible levels between refuelings for each unit.

Storing additional spent fuel assemblies is not expected to increase the bulk water temperature during normal refuelings above the 150 F used in the design analysis. Therefore, it is not expected that there will be any significant change in the annual release of tritium or iodine as a result of the proposed modifications from that previously evaluated in the FES. Most airborne releases of tritium and iodine result from evaporation of reactor coolant, which contains tritium and iodine in higher concentrations than the pool water. Therefore, even if there were a higher evaporation rate from the spent fuel pool, the increase in tritium and iodine released from the plant as a result of the increased stored spent fuel would be small compared to the amount normally released from the plant and that which was previously evaluated in the FES. Charcoal filters are available for the removal of radioiodine from the atmosphere before release to the environment. In addition, the station radiological effluent Technical Specifications, which are not being changed by this action, limit the total releases of gaseous activity.

Based on the foregoing considerations, implementation of the proposed increased spent fuel storage capability will not result in significantly increased amounts of radioactivity being released to the atmosphere.

3.2.2 Solid Radioactive Wastes

The concentration of radionuclides in the pool water is controlled by the filters and the demineralizer and by decay of short-lived isotopes. The level of activity is highest during refueling operations, when reactor coolant water is introduced into the pool, and decreases as

the pool water is processed through the filters and demineralizer. The increase of radioactivity in the pool water, if any, due to the proposed modification, should be minor because of the capability of the cleanup system to continuously remove radioactivity in the water to acceptable levels.

The licensee does not expect any significant increase in the amount of solid waste generated from the spent fuel pool cleanup systems due to the proposed modification. While we agree with the licensee's conclusion, as a conservative estimate we have assumed that the amount of solid radwaste may be increased by an additional two resin beds a year, or 160 cubic feet of solid waste, due to the increased operation of the spent fuel pool cleanup system. The annual average volume, per unit, of solid wastes shipped from the Quad Cities Station during 1980 through 1981 was 30,000 cubic feet, so that the 160 cubic feet per unit per year would increase the total waste volume to be shipped offsite by less than 1%. This would have no significant additional environmental impact.

The present spent fuel racks to be removed from the SFP because of the proposed modification are contaminated and might be disposed of as low level solid waste. We have estimated that approximately 7000 cubic feet of solid radwaste will be removed from the plant because of the proposed modification. Averaged over the lifetime of the plant, this would increase the total waste volume shipped from the facility by less than 3%, which we find is not a significant additional environmental impact.

3.2.4 Radioactive Material Released to Receiving Waters

There should not be a significant increase in the liquid release of radionuclides from the plant as a result of the proposed modification. Since the SFP cooling and cleanup system operates as a closed system, only water originating from cleanup of SFP floors and resin sluice water need be considered as potential sources of radioactivity.

It is expected that the change in the quantity and activity of the floor cleanup water as a result of this modification will be insignificant. The SFP demineralizer resin removes soluble radioactive material from the pool water. These resins are periodically sluiced with water to the spent resin storage tank. The amount of radioactivity on the demineralizer resin may increase slightly due to the additional spent fuel in the pool, but the soluble radioactive material should be retained on the resins, to be shipped offsite and buried in sealed drums as solid waste at a licensed burial facility.

Leakage of water from the SFP, if any, would be detected by the pool low level alarm, the flow glass in the drain line and the level detector on the skimmer surge tank. This water would be transferred to the liquid radwaste system for processing and reuse or release to receiving waters.

Based on the foregoing considerations, there will not be a significant increase in radioactivity released to receiving waters as a result of the proposed increase in spent fuel storage capacity.

3.2.5 Occupational Radiation Exposures

We have reviewed the licensee's plans for the removal and disposal of the low density racks, and the installation of the high density racks, with respect to occupational radiation exposure. The occupational exposure for the operation is estimated by the licensee to be about 18 to 39 man-rem, based on the licensee's detailed breakdown of exposure to each individual performing specific jobs for each phase of the operation. This exposure is a small fraction of the total annual man-rem from occupational exposure for all plant operations.

We have estimated the increase in onsite occupational dose resulting from the proposed increase in stored fuel assemblies on the basis of measured dose rates in the SFP area, and from radionuclide concentrations in the SFP water and from the SFP assemblies. The spent fuel assemblies themselves will contribute a negligible amount to dose rates in the pool area because of the depth of water shielding the fuel. Based on present and projected operations in the spent fuel pool area, we estimate that the proposed modification should add only a small fraction to the total annual occupational radiation exposure burden at this facility. Thus, we conclude that storing additional spent fuel in the SFP will not result in any significant increase in doses received by workers.

3.2.6 Radiological Impacts to the Population

The proposed increase of the storage capacity of the SFP will not create any significant additional radiological effects

to the population. The additional total body dose that might be received by an individual at the site boundary, and by the estimated population within a 50-mile radius, is less than 0.10 mrem/yr and 0.001 man-rem/yr, respectively. These doses are small compared to the fluctuations in the annual dose this population receives from background radiation. The population dose represents an increase of less than 0.01 percent of the dose previously evaluated in the FES for Quad Cities Station. We find this to be an insignificant increase in dose to the population resulting from the proposed action.

3.3 Environmental Impact of Spent Fuel Handling Accidents

Although the new high density racks will accommodate a larger inventory of spent fuel, we have determined that the installation and use of the racks will not change the radiological consequences of a postulated spent fuel handling accident, and a fuel shipping cask drop accident, in the SFP area, from those values previously reported in the Quad Cities FES, based on the following considerations.

The heaviest identified load with this modification is a 16 x 16 rack weighing 16 1/2 tons, whereas the main hoist on the reactor building crane is rated at 125 tons. From a previous review we had concluded that the overhead crane load handling system and the spent fuel cask handling Technical Specifications meet our requirements and are acceptable for handling spent fuel casks weighing up to 100 tons. Spent fuel casks are of course not permitted over spent fuel stored in the pool. The only items transported over spent fuel are other fuel assemblies, pool canal gates,

and a fuel channel measuring device, none of which approach this weight capacity of 125 tons. We have concluded then that the likelihood of a heavy load handling accident is sufficiently small that the proposed modifications are acceptable, and no additional restrictions on load handling operations in the vicinity of the SFP are required.

4.0 Summary

The findings contained in the Final Generic Environmental Statement on Handling and Storage of Spent Light Water Power Reactor Fuel, (the FGEIS) issued by the NRC in August, 1979, were that the environmental impact of interim storage of spent fuel was negligible, and the cost of the various alternatives reflect the advantage of continued generation of nuclear power with the accompanying spent fuel storage. Because of the differences in spent fuel pool designs, the FGEIS recommended licensing spent fuel pool expansions on a case-by-case basis. Expansion of the spent fuel storage capacity at Quad Cities Station does not significantly change the radiological impact evaluated by the NRC in the FES issued in September, 1972. As discussed in Section 3.2.6 of this EIA, the additional total body dose that might be received by an individual at the site boundary or the estimated population within a 50-mile radius is less than 0.10 mrem/yr and 0.001 man-rem/yr. respectively, and is less than the natural fluctuations in the dose this population would receive from background radiation. The occupational exposure for the modifications of the SFPs is estimated by the licensee to be 18 to 39 manrem. This is conservative. Operation of the plant with additional spent fuel in the SFP is not expected to increase the

occupational radiation exposure by more than one percent of the total annual occupational exposure at the two units.

5.0 Basis and Conclusion for Not Preparing an Environmental Impact Statement

We have reviewed the proposed modifications relative to the requirements set forth in 10 CFR Part 51 and the Council of Environmental Quality's Guidelines, 40 CFR 1500.6. We have determined, based on this assessment, that the proposed license amendments will not significantly affect the quality of the human environment. Therefore, the Commission has determined that an environmental impact statement need not be prepared and that, pursuant to 10 CFR 51.5(c), the issuance of a negative declaration to this effect is appropriate.