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

# ENVIRONMENTAL ASSESSMENT

# BY THE OFFICE OF NUCLEAR REACTOR REGULATION

# RELATING TO THE SECOND MODIFICATION OF THE

# SPENT FUEL STORAGE POOL

PROVISIONAL OPERATING LICENSE NO. DPR-18

ROCHESTER GAS AND ELECTRIC CORPORATION

R. E. GINNA NUCLEAR POWER PLANT

DOCKET NO. 50-244



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## 1.0 INTRODUCTION

The spent fuel storage capacity of the R. E. Ginna Nuclear Power Plant (Ginna) was 210 fuel assemblies when the plant was licensed in 1969. This licensed capacity was increased in 1976 to 595 fuel assemblies by reracking the spent fuel pool (SFP). This limited increase in storage capacity was in keeping with the expectation generally held in the industry that the federal government would begin accepting spent fuel for interim storage in the 1981-1982 time frame.

Commercial reprocessing of spent fuel has not developed as had been originally anticipated. In 1975 the Nuclear Regulatory Commission (NRC) directed 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 was to 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.

### 1.1 Alternatives

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 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 SFPs. Applications for approximately 108 SFP capacity increases have been received and 100 have been approved. The remaining ones are still under review. 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 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 SFP, the FGEIS discusses in detail other spent fuel storage alternatives. 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 various alternatives reflects 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 existing 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 Assessment (EA) addresses only the specific environmental concerns related to the proposed expansion of the Ginna spent fuel storage capacity.

The amendment would authorize the licensee to increase the storage capacity of the SFP from the current capacity of 595 fuel assemblies to 1016 fuel assemblies with average planar enrichments no greater than 4.25 weight percent U-235.

The environmental impacts associated with the operation of Ginna, as designed, were considered in the NRC's Final Environmental Statement (FES) issued in December 1973. An Environmental Evaluation, done in support of the conversion to a Full-Term Operating License, was published on June 17, 1983.

## 1.2 Need for Increased Storage Capacity

The plant now has licensed fuel storage capacity for 595 fuel assemblies. At the present time, there are 332 spent fuel assemblies in the SFP. The licensee estimates that full-core reserve in the SFP would be lost following the 1987 refueling. Since this date is earlier than the date a federal depository should be available for spent fuel [1998-Nuclear Waste Policy Act of 1982, Sec. 302(a)(5)] additional spent fuel capacity is needed.

## 1.3 Fuel Reprocessing History

Currently, spent fuel in not being reprocessed on a commercial basis in the United States. The Nuclear Fuel Services (NFS) plant at West Valley, New York, was shut down 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 (GE) Morris Operation (formerly Midwest Recovery Plant) 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 the licensee* is presently not accepting any additional spent fuel for storage, even from those power generating facilities that had contractual arrangements with West Valley.** On May 4, 1982, the license held by GE for spent fuel storage activities at its Morris operation was renewed for another 20 years; however, GE is committed to accept only limited quantities of additional spent fuel for storage at this facility from Cooper and San Onofre Unit 1.

*The current licensee is New York Energy Research and Development Authority.

**In fact, spent fuel is being removed from NFS and returned to various utilities.

## 2.0 FACILITY

The principal features of spent fuel storage at Ginna, as they relate to this action, are described here as an aid in following the evaluations in subsequent sections of this EA.

### 2.1 Spent Fuel Pool

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 is designed for storage of these assemblies to allow for radioactive and thermal decay prior to shipment. Space permitting, the assemblies may be stored for longer periods, allowing continued fission product decay and thermal cooling.

The handling of spent fuel is performed within the auxiliary building. This employs a crane for underwater fuel transport, storage racks for fuel and control rods in a storage pool, and underwater fuel preparation stations. Fuel and control rods transferred from the core will be stored in the fuel pool racks. The fuel pool cooling system cools, filters, and demineralizes the fuel pool water.

The fuel pool water level is monitored and high or low level is alarmed. Makeup water is available from the refueling water storage tank. The 39 feet of water in the pool (25 feet above the fuel) provides sufficient shielding for normal building occupancy by operating personnel.

### 2.2 Radioactive Waste Treatment System

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 FES dated December 1973. There will be no change in the waste treatment systems described in Section 3.5 of the FES because of the proposed modification.

## 3.0 RADIOLOGICAL ENVIRONMENTAL IMPACTS OF PROPOSED ACTION

### 3.1 Introduction

The potential radiological environmental impacts associated with the expansion of the spent fuel storage capacity were evaluated and determined to be environmentally insignificant as addressed below.

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 nonvolatile. The primary impact of such nonvolatile radioactive nuclides is their contribution to 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, however, 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 SFP water appears to be radionuclides that were present in the reactor coolant system prior to refueling (which becomes mixed with water in the SFP during refueling operations) or crud dislodged from the surface of the spent fuel during transfer from the reactor core to the SFP.

During and after refueling, the SFP purification system reduces the radioactivity concentration considerably. It is theorized that most failed fuel contains small, pinhole-like perforations in the fuel cladding at the reactor operating condition of approximately 800°F. A few weeks after refueling, the spent fuel is cooled in the SFP and the fuel clad temperature becomes relatively cool, approximately 180°F. This substantial temperature reduction should reduce the rate of release of fission products from the fuel pellets and decrease the gas pressure in the gap between pellets and clad, 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 the operational reports submitted by the licensees and discussions with the operators, there has not been any significant leakage of fission products from spent fuel stored in the Morris Operation at Morris, Illinois, or at the NFS storage pool at West Valley, New York. Some spent fuel assemblies which had significant leakage while in operating reactors have been stored in these two pools. After storage in the onsite SFP, these fuel assemblies were later shipped to either Morris Operation or NFS for extended storage. Although the fuel exhibited significant leakage at reactor operating conditions, there was no significant leakage from these fuel assemblies in the offsite storage facility.

## 3.2 Radioactive Material Released to the Atmosphere

The capacity of the Ginna spent fuel storage racks in their current configuration is 595 fuel assemblies and, at the present time, 332 fuel assemblies are stored in the pool. The licensee also has 81 fuel assemblies at what was formerly the NFS at West Valley, New York, and the licensee will transfer these fuel assemblies to the Ginna SFP by September 1985.

This amendment would increase the licensed storage capacity to 1016 fuel assemblies. Twenty-eight fuel assemblies are expected to be added to the SFP following each refueling. Since space must be reserved to accommodate a complete reactor core unloading operation (normally 121 fuel assemblies), the useful remaining pool capacity is 482 fuel assemblies with the proposed modification (1016 fuel assemblies less 332 presently stored, 81 from NFS, and 121 full reactor core unloading). At an input of 28 spent fuel assemblies per refueling operation the storage capacity will be exhausted in approximately 17 years.

With respect to releases of gaseous materials to the atmosphere, the only radioactive gas of significance which could be attributable to storing additional spent fuel assemblies for a longer period of time would be the noble gas radionuclide Krypton-85 (Kr-85). 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 spent fuel containing cladding defects.

The staff review was based on the conservative assumption that all of the Kr-85 will be released from defective fuel between the refueling intervals. The assumption of prompt release is conservative and maximizes the amount of Kr-85 to be released. The enlarged capacities of the pool, therefore, has no effect on the total amount of Kr-85 released to the atmosphere each year.

Iodine-131 released from spent fuel assemblies to the SFP water will not be significantly increased because of the expansion of the fuel storage capacity since the Iodine-131 inventory in the fuel will decay to negligible levels between refuelings.

Most of the tritium in the SFP water results from activation of boron and lithium in the primary coolant and this will not be affected by the proposed changes. A relatively small amount of tritium is contributed during reactor operation by fissioning of reactor fuel and subsequent diffusion of tritium through the fuel and the Zircaloy cladding. Tritium release from the fuel essentially occurs while the fuel is hot, that is, during operations and, to a limited extent, shortly after shutdown. Thus, expanding SFP capacity will not increase the tritum activity in the SFP.

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.

### 3.3 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 activity is highest during refueling operation 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, if any, due to the proposed modification, should be minor because of the capability of the cleanup system to continuously remove radioactivity in the SFP water to acceptable levels.

The licensee does not expect any significant increase in the amount of solid waste generated from the SFP cleanup systems due to the proposed modification. While the staff agrees with the licensee's conclusion, as a conservative estimate the staff has assumed that the amount of solid radwaste may be increased additionally by one resin bed (60 cubic feet solidified) and one spent filter cartridge (10 cubic feet solidified) per year due to the increased operation of the SFP cleanup systems. The annual average volume of solid wastes shipped offsite for burial from a typical PWR is approximately 20,000 cubic feet. If the storage of additional spent fuel does increase the amount of solid waste from the SFP cleanup systems by about 70 cubic feet per year, the increase in total waste volume generated from Ginna would be less than 1% and would not have any significant additional environmental impact.

The present spent fuel racks to be removed from the SFP will not be disposed of but will be modified so that fuel assemblies can be stored in what were the water box locations in the fuel pool. Therefore, the staff has estimated that only less than 100 cubic feet of solid radwaste will be removed from the plant because of the proposed modifications. Averaged over the lifetime of the plant, this would increase the total waste volume shipped from the facility by less than 1%. This will not have any significant additional environmental impact.

### 3.4 Liquid Radioactive Wastes

There should not be a significant increase in the liquid release of radionuclides from the plant as a result of the proposed modifications. Since the SFP cooling and cleanup systems operate 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 neither the quantity nor activity of the floor cleanup water will change as a result of these modifications. The SFP demineralizer resin removes soluble radioactive materials from the SFP water. These resins are periodically sluiced with water to the spent resin storage tank. The amount of radioactivity on the SFP 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.

If any radioactive material is transferred from the spent resin to the sluice water, it will be removed by the liquid radwaste system. After processing in the liquid radwaste system, the amount of radioactivity released to the environment as a result of the proposed modification would be negligible.

## 3.5 Radiological Assessment

### 3.5.1 Occupational Radiation Exposure

The staff has reviewed the licensee's plans for the modification of Ginna SFP racks with respect to occupational radiation exposure. The occupational exposure for the entire operation is estimated by the licensee to be about 78 man-rems. The staff considers this to be a reasonable estimate because it is based on realistic dose rates and occupancy factors for individuals performing a specific job during the pool modification. This operation is expected to be a small fraction of the total annual man-rem burden from occupational exposure.

The staff has estimated the increment of onsite occupational dose resulting from the proposed increase in stored fuel assemblies on the basis of information supplied by the licensee for dose rates in the SFP area from radionuclide concentrations in the SFP water and from the spent fuel 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. Consequently, the occupational radiation exposure resulting from the additional spent fuel in the pool represents a negligible burden. Based on present and projected operations in the SFP area, the staff estimates that the proposed modification should add less than 1% to the total annual occupational radiation exposure burden at this facility. Thus, the staff concludes that storing additional fuel in the SFP will not result in any significant increase in doses received by occupational workers.

### 3.5.2 Radiological Impact to the Public from Normal Operations

The principal source of radiation doses to individual members of the general public from the SFP modifications is exposure to airborne releases from the SFP during subsequent storage. Kr-85 is the most important nuclide in terms of dose. As noted earlier (Section 3.2), the staff assumes conservatively that all the Kr-85 will be released from defective fuel during storage in the SFP.

The additional whole body dose that might be received by an individual at the site boundary is less than 0.1 millirem per year. The dose to the population within a 50-mile radius is estimated to be less than 0.1 man-rem per year. These doses are very small compared to the fluctuations in the annual dose this population receives from background radiation.

Analysis of radiation exposure experience involving over 30 SFP modifications indicates that public doses have been very small. Estimated doses to a hypothetical individual at the boundary of a plant undergoing such modifications have ranged from 0.1 to 0.00002 millirem with an average for such doses of 0.015 millirem. Similarily, estimated doses to the population within a 50-mile radius of these plants have ranged from 0.02 to 0.0001 man-millirem, with an average for such doses of 0.008. The potential radiation exposure of the public resulting from the proposed increase in spent fuel storage at the Ginna plant is consistent with this previous experience. Estimated doses are comparable to the average doses for previous SFP expansions, and will be negligible.

3.5.3 Radiological Impact of Accidents

3.5.3.1 Cask Drop/TIP Accidents - Technical Specification 3.11.6 states that "The spent fuel shipping cask shall not be carried by the auxiliary building crane, pending the evaluation of the spent fuel cask drop accident and the crane design by RG&E, and NRC review and approval." Since the shipping cask cannot presently be carried by the auxiliary building crane by this administrative control, because the crane design evaluation has not yet been completed by the staff, a cask drop/tip accident was not considered in the proposed technical specification amendment.

3.5.3.2 Tornado Missile Accidents - The basis for the tornado missile accident was established in the staff review of Systematic Evaluation Program (SEP) Topics III-2, Wind and Tornado Loadings, and III-4.A, Tornado Missiles. The design missile was assumed to be a 1490 lb wooden pole, 35 feet in length and 13.5 inches in diameter, which could impact the racks with a vertical velocity of 70 ft/sec. The staff judged that the worst position for impact of this missile would be that centered on a fuel storage location, where, because of the 13.5-inch missile diameter compared to a diagonal dimension of the spent fuel storage box of 11.9 inches, a total of five fuel storage cells could be damaged in the reracked six sections of the SFP. However, this relative impact orientation of missile and storage cell configuaration would have a low likelihood of occurrence.

It was judged that a realistic estimate of damage to stored spent fuel assemblies in this accident is sufficient damage to 7% of the fuel in either one or five assemblies, for fuel stored in the unreracked or reracked pool areas, respectively, to result in the underwater release of volatile gaseous radioactivity that has been generated in the gap between fuel and the metal fuel container. In performing the radiological consequence analysis, it is assumed that the fuel was discharged from the reactor after operation at a steady-state power level of 1551 $MW_{th}$ for an extended period of time. An atmospheric diffusion and transport relative concentration (0-2 hr) of 5 x $10^{-5}$ sec/m$^3$ representative of average site meterology was used. The calculated 0-2 hr radiological consequences, with 100 hr cooldown time, was 0.08 Rem thyroid and 0.0003 Rem whole body at the Exclusion Area Boundary, for an accident with an equivalent assembly in the unreracked pool area. For an accident with an assembly in the reracked pool area, the corresponding estimated offsite radiological consequences, with 60 days cooldown time, were 0.0015 Rem thyroid and 0.0003 Rem whole body at the Exclusion Area Boundary. All computed doses are extremely small fractions 10 CFR Part 100 dose guideline values.

3.5.3.3 Fuel Handling Accident - It was judged that a realistic estimate of underwater damage to stored spent fuel assemblies in this accident is sufficient damage to 7% of the fuel in a single assembly to result in the release of the corresponding volatile gap activity. In performing the radiological consequence analysis, it was assumed that the fuel had been discharged from the reactor after operation at a steady-state power level of 1551 $MW_{th}$ for an extended period of time. An atmospheric diffusion and transport atmospheric relative concentration (0-2 hr) of $5 \times 20^{-5}$ sec/m³ was used as representative of average site meteorology. The calculated 0-2 hr radiological consequences, with 100 hr cooldown time, were estimated to be 0.08 Rem thyroid and 0.0003 Rem whole body at the Exclusion Area Boundary, for impact with an assembly in the unreracked pool area. For impact with an assembly in the reracked pool area the corresponding offsite radiological consequences, with 60 days cooldown time, were 0.0003 Rem thyroid and 0.000006 Rem whole body. Both calculated whole body doses were less than the 0.008 Rem whole body dose presented in the staff FES of December 1973. All computed doses are extremely small fractions of 10 CFR Part 100 dose guideline values.

## 4.0 NONRADIOLOGICAL ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

The nonradiological impacts of Ginna, as designed, were considered in the FES issued in December 1973 and the Environmental Evaluation issued on June 17, 1983. No unusual terrestrial effects are anticipated or considered likely by the staff due to the proposed action. The only nonradiological discharge altered by the fuel pool modification is the waste heat. The contribution of the 18-year old and older spent fuel assemblies to the total station heat discharge will be unmeasurable in the station discharge and will be negligible. The major heat source in the SFP are the assemblies taken from the reactor immediately following shutdown. The licensee reported an analysis of cooling requirements for spent fuel through the year 2010. The normal rate of heat discharge from the spent fuel will increase from 7.07 x $10^6$ Btu/hr in 1981 to 9.96 x $10^6$ Btu/hr by the year 2010. The normal maximum heat discharge rate, resulting from discharge of a full core to the SFP, will be kept below 16 x $10^6$ Btu/hr by allowing a 14-day cooling time in the reactor prior to fuel transfer. Since Ginna uses a once-through system for condenser cooling, the total contribution of waste heat from the fuel pool is a small fraction of total station heat discharge. The normal rate of heat discharge from the fuel pool is about three tenths of a percent of the rate of heat rejection from the station condensers (3.5 x $10^9$ Btu) which occurs with the station generating normally. The increment due to expanded fuel pool capacity is less than one tenth of a percent of the total station discharge.

Increasing the capacity of the SFP will cause no effect on the chemical quality of station discharge.

## 5.0 SUMMARY

The FGEIS on Handling and Storage of Spent Light Water Power Reactor Fuel concluded that the environmental impact of interim storage of spent fuel was negligible and the cost of the various alternatives reflects the advantage of continued generation of nuclear power with the accompanying spent fuel storage. Because of the differences in SFP designs, the FGEIS recommended licensing SFP expansion on a case-by-case basis.

For Ginna the expansion of the storage capacity of the SFP will not create any significant additional radiological effects or measurable nonradiological environmental impacts. The additional whole body dose that might be received by an individual at the site boundary is less than 0.1 millirem per year; the estimated dose to the population within a 50-mile radius is estimated to be less than 0.1 man-rem per year. These doses are small compared to the fluctuations in the annual dose this population receives from exposure to background radiation. The occupational radiation dose to workers during the modification of the storage racks is estimated by the licensee to be 78 man-rems. This is a small fraction of the total man-rems from occupational dose at the plant. The small increase in radiation dose should not affect the licensee's ability to maintain individual occupational dose within the limits of 10 CFR Part 20, and as low as reasonably achievable.

The staff concluded that in the case of a tornado missile or fuel handling accident, the consequences of the atmospheric radionuclide releases would be extremely small fractions of the guidelines of 10 CFR Part 100 and fractions of 10 CFR Part 20 guidelines for workers.

5.1 Alternatives to the Proposed Action

Since the staff has concluded that the environmental effects of the proposed action are negligible, any alternatives with equal or greater environmental impacts need not be evaluated. Alternatives are discussed in Section 1.1 of this document.

5.2 Alternative Use of Resources

This action does not involve use of resources not previously considered in the Final Environmental Statement dated December 1973 or the Environmental Evaluation of June 17, 1983 for the R. E. Ginna Nuclear Power Plant, nor does it involve conflicting use of limited available resources requiring consideration of other alternatives.

5.3 Agencies and Persons Consulted

The NRC staff reviewed the licensee's request and did not consult other agencies or persons.

6.0 BASIS AND CONCLUSION FOR NOT PREPARING AN ENVIRONMENTAL IMPACT STATEMENT

The staff has reviewed this proposed facility modification relative to the requirements set forth in 10 CFR Part 51. Based on this assessment, the staff concludes that there are no significant radiological or non-radiological impacts associated with the proposed action and that the issuance of the proposed license amendment will have no significant impact on the quality of the human environment. Therefore, pursuant to 10 CFR 51.31, an environmental impact statement need not be prepared for this action.

7.0 ACKNOWLEDGMENT

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