UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

PROPOSED SPENT FUEL COOLING SYSTEM

ROCHESTER GAS AND ELECTRIC CORPORATION

R. E. GINNA NUCLEAR POWER PLANT

DOCKET NO. 50-244

1.0 INTRODUCTION

By letters dated February 13, 1980 and June 9, 1981, the Rochester Gas and Electric Corporation (RG&E) submitted a request for approval of modifications to increase the heat removal capacity of the spent fuel pool cooling system (SFPCS) at the R. E. Ginna Nuclear Power Plant. This application is in accordance with the 1976 license amendment which permitted R. E. Ginna to re-rack the spent fuel storage pool; increasing the storage capacity from 210 fuel assemblies to 595 fuel assemblies without a concurrent increase in the capacity of the spent fuel pool cooling system.

The decay heat resulting from the fuel stored in the pool at the time of the 1976 licensing action was significantly less (92 fuel assemblies) than the capability of the existing SFPCS. Therefore it was stipulated that RG&E commit to submitting the SFPCS modification in a timely manner at some future date before the pool's heat load exceeds the capacity of the existing SFPCS.

Without degrading the performance of the existing SFPCS, RG&E proposed to install an additional parallel cooling loop designed to seismic Category I criteria.

Based on the stated decay times, before the fuel is moved into the pool, the heat removal capability of the new 100% capacity spent fuel pool cooling loop ($16 \times 10^6 \frac{BTU}{HR}$ at a pool temperature of 150°F) is capable of removing the total accumulated decay heat from discharged fuel assemblies up through the year 2009 and a full core discharge in year 2010 (1360 fuel assemblies total).

In addition a 100% capacity non-seismic Category I backup SFPCS is provided. It will consist of the existing SFPCS and a skid-mounted cooling system. Each is capable of removing 7.93×10^6 BTU/HR at a pool temperature of 150°F. The spent fuel pool contains 255,102 gallons of water.

2.0 DECAY HEAT

The June 9, 1981 submittal presents the results of an RG&E analysis of the Ginna spent fuel pool's future decay heat load assuming a plant life of 40 years (year 2009) including the existing stored spent fuel (231 fuel assemblies) and all future discharged fuel. Typically a normal annual discharge ranges between 28 and 32 fuel assemblies. The analysis conservatively assumes that 36 fuel assemblies are discharged instantaneously to the pool following 100 hour cooling in the reactor vessel. The maximum total accumulated heat load incrementally increases from 7.07×10^6 BTU/HR in 1981 to 9.96×10^6 BTU/HR in the year 2010.

Assuming a full core discharge were to occur at each refueling cycle, RG&E states they will maintain the maximum total accumulated decay heat load in the pool slightly below the rated capacity of the new SFPCS (16×10^6 BTU/HR when the pool water temperature is allowed to rise to 150°F) by incrementally increasing the cooldown time in the reactor vessel from 8 days in the year 1981 to 14 days in the year 2010.

Using the stipulated cooldown times, we have checked the calculated decay heat values given in the June 9, 1981 submittal and find them to be consistent with NRC Branch Technical Position APCSB 9-2 and, therefore, they are acceptable.

3.0 NEW SPENT FUEL POOL COOLING SYSTEM

The proposed spent fuel pool cooling system (SFPCS) will consist of a seismic Category I additional cooling loop in parallel with the existing SFPCS. It will be designed and installed such that it will not degrade the performance of the existing SFPCS or service water system. The added cooling loop consists of one shell and U-tube type heat exchanger, one horizontal/centrifugal stainless steel pump, plus the stainless steel piping, valves and associated controls.

The performance of the added SFPCS, under the described conditions, is presented below:

Design Heat Load Conditions	Full Core Discharge	Normal Discharge
Initial decay heat, Btu/hr.	16×10^6	7.6×10^6
Maximum pool temperature, °F	150	120
SFP heat up rate, °F/hr. (assumes no cooling)	7.7	3.7
Service Water Requirements		
SW temperature, °F	80	80
Max. SW temp. increase, °F	20	15
SW flow, gpm (approx.)	1600	1000

The controls for both the new and existing pumps are from local control stations located near the pumps. Mechanical interlocks will be provided to prevent the simultaneous operation of the new and existing cooling systems. The two existing spent fuel pool suction lines will be piped to a common header which supplies pool water to the installed SFPCS pumps. The piping will be designed to assure adequate NPSH at the pumps and flow for the removal of the design heat loads. Check valves in the new and existing pump discharge lines will prevent back flow.

Local pressure, temperature and flow instrumentation will be provided in the new cooling loop for testing and monitoring its performance. The flow indicating device will alert the control room in the event low flow or a pump trip occurs. An additional pool water level switch will be installed. In the event the low level is reached the pool water level switch will trip the pump. The pump will be powered by essential bus #16. It will be shed in the event of a safety injection signal. After about one hour into the safety injection event the pump can be manually started and operated on diesel generator 1B.

To the extent practical electrical separation of the new and existing SFPCS motors and controls will be in accordance with IEEE 384.

Radiation detectors, alarms and recorders will detect radioactivity in the service water should a tube leak develop in one of the heat exchangers.

Based on our review we find the new SFPCS meets our criteria and therefore is acceptable.

4.0 BACKUP COOLING SYSTEM

The existing SFPCS and a skid mounted unit, capable of operating in parallel comprise the 100% capacity backup cooling system. RG&E states that the backup cooling system will be in place and available before a full core discharge takes place. Service water from loop A will provide cooling for the backup cooling system while service water from loop B will provide cooling for the new SFPCS loop. The following subsections describe the components of this backup cooling system.

4.1 EXISTING COOLING SYSTEM.

The existing SFPCS consists of a horizontal/centrifugal stainless steel pump and a shell and U-tube type heat exchanger. The loop will be powered by essential bus #14. A safety injection signal will cause the pump to be shed from the bus. At the termination of safety injection the pump can be started and powered on diesel generator 1A. Upon coincident loss of offsite power and safeguard actuation signals the existing SFPCS will be isolated from the service water system. Handwheels are provided for manual operation. The existing cooling system is rated as follows:

	Full Core Discharge		
	Maximum Heat Removal	Rated Conditions	Normal Discharge
Heat Removal Capacity	9.3×10^6 BTU/HR	7.93×10^6 BTU/HR	5.3×10^6 BTU/HR
Service Water Temperature In	80°F	80°F	80°F
Service Water Temperature Out	-------------	100°F	100°F
Service Water Temperature Differential	*	20°F*	20°F
Pool Water Temperature	150°F	150°F	120°F

*Environmental guidelines require the lake water differential temperature not to exceed 20°F. This requirement is neither an NRC or nuclear safety requirement. Therefore for the maximum heat removal mode, this 20°F limitation on the SFPCS is relaxed, considering that the water discharge from the SFPCS will mix with the discharge from other equipment and ensure that the overall plant discharge differential temperature of 20°F is not exceeded.

4.2 SKID-MOUNTED COOLING SYSTEM

The manually operated skid-mounted cooling system, consisting of a pump and heat exchanger, will be powered by a non-safety power source. When operating in parallel with the existing SFPCS it is rated at 7.93×10^6 BTU/HR with a pool temperature of 150°F, service water inlet temperature of 80°F and service water outlet temperature of 100°F.

4.3 USE OF EXISTING COOLING SYSTEMS TO AUGMENT THE CAPACITY OF THE NEW SFPCS

The Ginna Final Safety Analysis Report (FSAR) indicates that the operational limit for the pool water temperature during normal refuelings is 120°F. The total accumulated decay heat load, assuming normal discharges, incrementally increases from 7.07×10^6 BTU/HR to 9.96×10^6 BTU/HR at the end of plant life. Once the value exceeds 7.6×10^6 BTU/HR (about year 1985) the new SFPCS will not be able to maintain the pool water temperature at 120°F. For a matter of a few days the decay heat would cause the pool water temperature to rise to some value greater than 120°F. However the heat removal capability of the system will also increase as the pool water temperature increases.

Whereas the 120°F temperature is not an NRC or safety requirement, RG&E indicates that for operator comfort during refueling they plan to maintain the pool water temperature around 120°F by placing one of the backup cooling systems in operation for a few days until the decay heat has decayed below the rating of the new spent fuel pool cooling system (7.6 x 10^6 BTU/HR). We find this acceptable.

The Ginna Technical Specifications indicate that due to structural integrity considerations the pool water temperature is not to exceed 180°F. Therefore, in order to provide time sufficient to take corrective action, the pool temperature is not to exceed 150°F for all modes of operation including a full core discharge. Our calculations show that, in the unlikely event that the new SFPCS should become inoperative when the pool water temperature is 150°F and the heat load is 16 x 10^6 BTU/HR, the pool water temperature would begin to rise at a rate of 7.5°F per hour. In approximately 45 minutes the existing SFPCS could be placed in operation at which time the pool water temperature would be 156°F. At this time the increase in pool water temperature would drop to approximately 3°F/hr. Therefore an additional 8 hours are available, to repair the new SFP cooling loop or to activate the skid mounted unit, before the pool water temperature reaches 180°F. RG&E indicates that approximately 3 hours are required to place the skid mounted unit in parallel operation with the existing SFPCS. In this time the pool water temperature would rise 9°F and the temperature would be 165°F.

We conclude that adequate time and cooling systems are available to prevent the pool water from reaching 180°F and therefore the new SFPCS and backup systems are acceptable.

5.0 MAKEUP SYSTEM

The normal makeup water source is the Refueling Water Storage Tank. It contains a minimum of 230,000 gallons of borated water. The maximum makeup rate of 60 gpm can be made available in less than 15 minutes.

The following alternate makeup sources and makeup rates are possible in the indicated times:

a) Primary Water Treatment Plant, 120 gpm in 15 minutes
b) Reactor Makeup Water Tank or the Monitor Tanks, 40gpm in 45 minutes and
c) Fire System which can be initiated in less than one hour.

Makeup water may be necessary in the event of a leak in the SFPCS, the pool or in the unlikely event that pool boiling should occur. Whereas boiling is highly unlikely the makeup rate from the above sources exceeds the boiloff rate of 33 gpm and therefore these sources are acceptable in this regard.

The pool water leakage is collected by channels which direct it to a container. The level in this container is checked twice per shift.

Past operating experience has shown the leakage to be very small. In addition, leak detection is possible should the pool level drop 20 inches below the top of the spent fuel pool. This would activate the spent fuel pool low level alarm on the main control board.

We have reviewed the above information and conclude that adequate measures have been provided to detect leakage and to provide makeup water. The design is therefore acceptable.

6.0 CONCLUSION

Based on our review, we conclude that the proposed SFPCS modification is acceptable and that this system, and the existing backup systems, will maintain pool temperature below that at which the pool was structurally analyzed and found to be acceptable.

Date: November 3, 1981