Docket No. 50-265

March 3, 1983

Mr. Dennis L. Farrar
Director of Nuclear Licensing
Commonwealth Edison Company
P. O. Box 767
Chicago, Illinois 60690

Dear Mr. Farrar:

The Commission has issued the enclosed Amendment No. 79 to Facility Operating License DPR-30 for the Quad Cities Nuclear Power Station, Unit 2. This Amendment consists of changes to the Technical Specifications in response to your application dated January 27, 1983.

The amendment revises the Technical Specifications to allow a temporary increase in the Linear Heat Generation Rate (LHGR) from 13.4 to 14.7 kw/ft for certain Barrier Fuel Test Assemblies present in the Unit 2 core. This new limit applies only during the remainder of the current operating Cycle 6.

Copies of the Safety Evaluation and Notice of Issuance are also enclosed.

Sincerely,

Roby B. Bevan, Project Manager
Operating Reactors Branch #2
Division of Licensing

Enclosures:
1. Amendment No. 79 to DPR-30
2. Safety Evaluation
3. Notice

cc w/enclosures
See next page

Called SRI at QC Sta at 4:20 to inform him of issuance on 3/3/83 Also called NLA at CECo same Time

DISTRIBUTION:	Docket File	NRC PDR	LPDR	ORB#2 Rdg	DEisenhut	SNorris
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DATE							

NRC FORM 318 (10-80) NRCM 0240 OFFICIAL RECORD COPY USGPO: 1981—335-960

Mr. Dennis L. Farrar
Commonwealth Edison Company

cc:

Mr. D. R. Stichnoth
President
Iowa-Illinois Gas and
Electric Company
206 East Second Avenue
Davenport, Iowa 52801

Robert G. Fitzgibbons Jr.
Isham, Lincoln & Beale
Three First National Plaza
Suite 5200
Chicago, IL 60602

Mr. Nick Kalivianakas
Plant Superintendent
Quad Cities Nuclear Power Station
22710 - 206th Avenue - North
Cordova, Illinois 61242

Resident Inspector
U. S. Nuclear Regulatory Commission
22712 206th Avenue N.
Cordova, Illinois 61242

Illinois Department of Nuclear Safety
1035 Outer Park Drive
5th Floor
Springfield, Illinois 62704

Chairman,
Rock Island County Board
of Supervisors
Rock Island County Court House
Rock Island, Illinois 61201

James G. Keppler
Regional Administrator, Region III
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

U.S. Environmental Protection Agency
Region V Office
Regional Radiation Representative
230 South Dearborn Street
Chicago, Illinois 60604

Susan N. Sekuler
Assistant Attorney General
Environmental Control Division
188 W. Randolph Street
Suite 2315
Chicago, Illinois 60601

The Honorable Tom Corcoran
United States House of Representatives
Washington, D.C. 20515

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

COMMONWEALTH EDISON COMPANY
AND
IOWA ILLINOIS GAS AND ELECTRIC COMPANY

DOCKET NO. 50-265

QUAD CITIES NUCLEAR POWER STATION, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 79
License No. DPR-30

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Commonwealth Edison Company (the licensee) dated January 27, 1983 complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 3.B of Facility License No. DPR-30 is hereby amended to read as follows:

   B. Technical Specifications

   The Technical Specifications contained in Appendices A and B, as revised through Amendment No.79 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

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3. This license amendment is effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Domenic B. Vassallo, Chief
Operating Reactors Branch #2
Division of Licensing

Attachment:
Changes to the Technical
Specifications

Date of Issuance: March 3, 1983

Attachment to License Amendment No. 79

To Facility Operating License DPR-30

Docket No. 50-265

Revise Appendix A Technical Specifications by removing page 3.5/4.5-10 and inserting revised page 3.5/4.5-10.

within the prescribed limits within 2 hours, the reactor shall be brought to the cold shutdown condition within 36 hours. Surveillance and corresponding action shall continue until reactor operation is within the prescribed limits.

Maximum allowable LHGR for all 8X8 fuel types is 13.4 KW/ft.*

K. Minimum Critical Power Ratio (MCPR)

During steady-state operation at rated core flow, MCPR shall be greater than or equal to:

1.37 for $\tau_{ave} \leq 0.73$ secs

1.42 for $\tau_{ave} \geq 0.86$ secs

$0.385\ \tau_{ave} + 1.089$ for $0.73 < \tau_{ave} < 0.86$ secs

where τ_{ave} = mean 20% scram insertion time for all surveillance data from Specification 4.3.C. which has been generated in the current cycle.

For core flows other than rated, these nominal values of MCPR shall be increased by a factor of k_f where k_f is as shown in Figure 3.5.2. If any time during operation it is determined by normal surveillance that the limiting value for MCPR is being exceeded, action shall be initiated within 15 minutes to restore operation to within the prescribed limits. If the steady-state MCPR is not returned to within the prescribed limits within 2 hours, the reactor shall be brought to the cold shutdown condition within 36 hours. Surveillance and corresponding action shall continue until reactor operation is within the prescribed limits.

K. Minimum Critical Power Ratio (MCPR)

The MCPR shall be determined daily during steady-state power operation above 25% of rated thermal power.

*For the purpose of the end-of-cycle 6 Barrier Fuel Ramp Test, the steady-state LHGR for the Barrier Ramp Cell fuel may exceed the maximum allowable LHGR identified in Technical Specification 3.5.J by no more than 10 percent (14.7 KW/ft), effective from initiation of the test until the end of operating Cycle 6 shutdown.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 79 TO FACILITY LICENSE NO. DPR-30

COMMONWEALTH EDISON COMPANY

AND

IOWA-ILLINOIS GAS AND ELECTRIC COMPANY

QUAD CITIES NUCLEAR POWER STATION, UNIT 2

DOCKET NO. 50-265

Background

The planned demonstration irradiation of pellet/cladding interaction (PCI)-resistant BWR fuel involves a large-scale (144 bundles) irradiation in Unit 2 of the Quad Cities Nuclear Power Station, starting with Cycle 6. It is proposed that about half (64) of the bundles would be power ramped, in groups of 16, i.e., one group of 16 would be ramped at the end of each of four successive reactor cycles.

The term "barrier fuel" stems from the use of a 0.003-inch thick, high purity zirconium liner, i.e., barrier, which is metallurgically bonded to the Zircaloy-2 structural part of the fuel rod cladding. The dimensions of the fuel rods and the mechanical design of the fuel bundle are the same as the current General Electric (GE) prepressurized 8x8 retrofit bundle (P8X8R). A general description of the barrier fuel program, including information on the program scope, fuel loading and operation, fuel mechanical design, and safety analyses, was presented in a General Electric topical report, NEDO-24259, (Ref. 1) which was reviewed and approved by NRC in October 1980 (Ref. 2). Approval for the Quad Cities 2 (QC-2) Cycle 6 Barrier Fuel demonstration was granted (Ref. 3) in December 1981, following (1) the receipt and review of some additional information on the proposed ramp and (2) the commitment (Refs. 4 and 5) of the licensee, Commonwealth Edison Company (CECo) to provide more detailed information at a later date and to perform certain on-line monitoring and post-irradiation examinations. A letter satisfying the requirement for further information was submitted in November 1982 (Ref. 6).

Introduction

In a recent letter (Ref. 7), requested that the QC-2 license be amended to allow a 10 percent increase in the allowable Linear Heat Generation Rate (LHGR) limit for the barrier fuel assemblies that will be power ramped (these demonstration barrier fuel assemblies are termed "special" assemblies). The current LHGR limit, specified in Technical Specification 3.5.J Local LHGR, is 13.4 kW/ft for all 8X8 fuel types. The new limit, specified in the attachment to the January 27, 1983 CECo letter (Ref. 7), would apply only to the Barrier Ramp

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Cell Fuel, and would be 14.7 kW/ft. According to CECo, the requested increase in the LHGR limit is necessary to allow for the effects of Traversing Incore Probe (TIP) measurement asymmetries and other uncertainties on the QC-2 process computer program P-1 that typically result in calculated peak LHGRs that are greater than the GE 3-D simulator results. Using GE's 3-D Core Simulator, a maximum LHGR of 13.02 kW/ft had been obtained. Thus, the LHGRs calculated by P-1 for the special barrier fuel assemblies during the power ramps could be higher than the current Technical Specification limit of 13.4 kW/ft, thereby forcing corrective action, including control rod reinsertion, in accordance with the requirements of Technical Specification 3.5.J. The license amendment proposed by CECo to accommodate the high LHGRs expected during the QC-2 Cycle 6 ramp adds a footnote to Technical Specification 3.5.J to read as follows:

> For the purpose of the end-of-cycle 6 Barrier Fuel Ramp Test, the steady-state LHGR for the Barrier Ramp Cell fuel may exceed the maximum allowable LHGR identified in Technical Specification 3.5.J by no more than 10 percent (14.7 KW/ft), effective from initiation of the test until end of Cycle 6 shutdown.

Evaluation

Our technical evaluation of the proposed license amendment focused primarily on the question of whether fuel damage limits and licensing safety limits would be compromised by a 10 percent increase in LHGR. In its January 27, 1983, submittal, CECo made the following key technical points in support of the proposed license amendment:

1. "The basis for setting the LHGR operating limit is that the peak LHGR during the normal or abnormal transient be less than or equal to the LHGR at which one percent plastic strain is calculated to occur. For P8X8R fuel (UO_2 rods) this corresponds to an LHGR value of 22.7 kW/ft for exposures up to 25,000 MWd/t (Table 2-3 of NEDE-24011).

2. "Since only the sixteen bundles in the four ramp cells are expected to reach LHGR values near 13.4 kW/ft (actually only the 16 wide-wide corner pins in these bundles) the relaxation need only apply to these bundles.

3. "... the duration of operation above 13.4 kW/ft is expected to be less than 2 months due to local and core-wide fuel depletion as the coast-down progresses.

4. "The Minimum Critical Power Ratio (MCPR) and Maximum Average Planar Heat Generation Rate (MAPLHGR) values are calculated to remain well below the operating limits during the demonstration and, therefore, no waiver of these limits is necessary."

We conclude that Items 2, 3, and 4 above are straightforward and provide unequivocal support for the proposed increase in LHGR limit. Thus, the fact that (a) only relatively small fraction of the total number of rods in the core will be affected, (b) the duration of operation above the current 13.4 kW/ft limit will be limited, and (c) MCPR and MAPLHGR limits are not threatened provides substantial assurance that the fuel will perform satisfactorily. From our review of Reference 7 for example, we have found that the calculated MCPR for the affected bundles during the Barrier Fuel Ramp test is not less than the previously approved Technical Specification operating limits, and the decay ratio for the affected fuel bundles, which have a lower power peaking factor, 1.35 as compared to 1.4 used for the Cycle 6 thermal hydraulic stability analysis, is less than the previously approved value specified in Cycle 6 operation. We, therefore, conclude that the thermal hydraulic acceptance criteria, viz., that MCPR is greater than 1.07 and that the design of the core must not be susceptible to thermal hydraulic instability, will not be violated during the test and the Technical Specification MCPR limit for the Cycle 6 operation is acceptable for the test.

The key issue concerns the basis for the LHGR limit. With respect to the basis for the LHGR limit, Section 3.4.3.4.2 of the QC-2 FSAR contains the statement that the "operating limit LHGR is established to provide margin between operating and fuel damage heat generating rates." The fuel damage heat generating rate that CECo refers to is the LHGR for one percent cladding strain. There are three minor problems, however, with the CECo analysis.

The first problem is that the 22.7 kW/ft LHGR value that CECo cites as corresponding to the one percent cladding strain value for UO_2 rods at 25,000 MWd/t burnup is not the value listed in the latest amendment to GE's generic fuel design report, GESTAR-II (Ref. 8). Table 2-3a, LHGR of Calculated 1 Percent Plastic Diametral Strain for P8X8R and BP8X8R Fuel, lists $\geq$23.1 kW/ft for UO_2 rods and 20.4 kW/ft for Gd-poison rods at 25,000 MWd/mt burnup, while the 22.7 kW/ft cited for UO_2 is, in fact, the value listed in Table 2-3a for Gd rods at zero burnup. Because these apparent discrepancies are quite small relative to the overall margin to the one percent strain LHGR, we do not consider them significant with respect to the activities related to the proposed license amendment. We will, however, clarify this matter as part of our on-going generic review of the barrier fuel amendment to GESTAR-II.

The second problem with the LHGR values for one percent strain is that the cited table in NEDE-24011-P-A-5 indicates the same LHGR limit for fuel rods with standard Zircaloy cladding as for barrier cladding. Inasmuch as 10 percent of the barrier fuel thickness is comprised of high purity zirconium, which is considerably more ductile than Zircaloy-2 (this is, in fact, believed to be the reason that the barrier cladding is more

resistant to pellet/cladding interaction (PCI) cracking than standard Zircaloy cladding), it follows that the LHGR for one percent strain for barrier fuel cladding should be slightly less than for standard Zircaloy-2 cladding. We would not expect the difference to be great, however, because the fraction of cladding wall thickness is small and the zirconium, itself, has some strength. We do not believe this issue is significant enough with respect to the activities related to the proposed license amendment. We will clarify this matter, however, as part of our on-going generic review of the barrier fuel amendment to GESTAR-II.

The third problem with the CECo analysis is that it focuses only on the margin to the one percent strain LHGR. Thus, analytical results are provided to show that there is substantial margin between the peak LHGR for overpower events (such as rod withdrawal error, fuel loading error, generator load rejection without bypass, and loss of feedwater heating) and the one percent strain LHGR. From telephone discussions with the licensee and with GE to clarify the bases for the LHGR limit, it is clear that the plastic strain criterion would be satisfied with a much higher limit than the 13.4 kW/ft now in place for Quad Cities - 2 (and all other BWR's of similar type). It is clear also that the restraint on rod power resulting from the LHGR limit also serves to assure satisfactory fuel performance from the standpoint of a number of known potential fuel damage mechanisms, including hydriding, pellet-cladding interaction (PCI), and water-side corrosion. The conservation of plastic strain margin is, thus, a relatively insignificant factor in this case. The more important considerations that provide assurance that overall fuel performance will not be compromised are that the limit increase applies only to the special barrier fuel assemblies (i.e. a very limited number of rods) and for a limited duration (the last few months of the current operating cycle).

Evaluation Conclusions

We conclude that there is reasonable assurance that a 10 percent increase in the allowable peak LHGR value for barrier fuel demonstration assemblies during the remainder of the current operating cycle (Cycle 6) will not compromise licensing safety limits on MCPR, MAPLHGR, or one percent cladding strain and that overall fuel performance will not be compromised by the LHGR limit increase. Therefore, we conclude that the proposed license amendment is acceptable.

Environmental Consideration

We have determined that the amendment does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendment involves an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR §51.5(d)(4), that an environmental impact statement, or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

Conclusion

We have concluded, based on the considerations discussed above, that: (1) because the amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated, does not create the possibility of an accident of a type different from any evaluated previously, and does not involve a significant reduction in a margin of safety, the amendment does not involve a significant hazards consideration, (2) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (3) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: March 3, 1983

Principal Contributor: Michael Tokar

References

1. "Generic Information for Barrier Fuel Demonstration Bundle Licensing," NEDO-24259, May 1980.

2. L. S. Rubenstein (NRC) memorandum to R. L. Tedesco, "GE Barrier Fuel Topical Report Evaluation," October 17, 1980.

3. L. S. Rubenstein (NRC) memorandum to R. L. Tedesco, "Quad Cities 2 Cycle 6 Barrier Fuel Demonstration," December 17, 1981.

4. Thomas J. Rausch (CECo) letter to D. G. Eisenhut (NRC), "Quad Cities Unit 2 Cycle 6 Barrier Fuel Demonstration Program," November 4, 1981.

5. L. DelGeorge (CECo) letter to D. G. Eisenhut (NRC), December 3, 1981.

6. T. J. Rausch (CECo) letter to D. G. Eisenhut, November 1, 1982.

7. T. J. Rausch (CECo) letter to H. R. Denton (NRC), "Quad Cities Station Unit 2 Proposed Amendment to Operating License DPR-30 Concerning the LHGR Limit During the Cycle 6 Barrier Fuel Ramp Test," January 27, 1983.

8. "GE Standard Application for Reactor Fuel," NEDE-24011-A-5, submitted by letter, J. S. Charnley (GE) to Frank J. Miraglia (NRC), November 19, 1982.

UNITED STATES NUCLEAR REGULATORY COMMISSION

DOCKET NO. 50-265

COMMONWEALTH EDISON COMPANY

NOTICE OF ISSUANCE OF AMENDMENT TO FACILITY OPERATING LICENSE

The U.S. Nuclear Regulatory Commission (the Commission) has issued Amendment No. 79 to Facility Operating License No. DPR-30 issued to Commonwealth Edison Company and Iowa-Illinois Gas and Electric Company, which revised the Technical Specifications for operation of the Quad Cities Nuclear Power Station, Unit 2 located in Rock Island County, Illinois. The amendment is effective as of the date of issuance.

The amendment revises the Technical Specifications to allow a temporary increase in the Linear Heat Generation Rate (LHGR) from 13.4 to 14.7 kW/ft for certain Barrier Fuel Test Assemblies present in the Unit 2 core. This new limit applies only during the remainder of the current operating Cycle 6.

The application for the amendment complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations. The Commission has made appropriate findings as required by the Act and the Commission's rules and regulations in 10 CFR Chapter I, which are set forth in the license amendment. Prior public notice of the amendment was not required since the amendment does not involve a significant hazards consideration.

The Commission has determined that the issuance of the amendment will not result in any significant environmental impact and that pursuant to 10 CFR 51.5(d)(4) an environmental impact statement or negative declaration

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and environmental impact appraisal need not be prepared in connection with issuance of the amendment.

For further details with respect to this action, see (1) the application for amendment dated January 27, 1983 (2) Amendment No. 79 to License No. DPR-30 and (3) the Commission's related Safety Evaluation. All of these items are available for public inspection at the Commission's Public Document Room, 1717 H Street, NW., Washington, D.C., and at the Moline Public Library, 504 - 17th Street, Moline, Illinois. A copy of items (2) and (3) may be obtained upon request addressed to the U. S. Nuclear Regulatory Commission, Washington, D.C. 20555, Attention: Director, Division of Licensing.

Dated at Bethesda, Maryland, this 3rd day of March 1983.

FOR THE NUCLEAR REGULATORY COMMISSION

Domenic B. Vassallo, Chief
Operating Reactors Branch #2
Division of Licensing