May 23, 1990

Docket Nos.: 50-254 and 50-265

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Mr. Thomas J. Kovach
Nuclear Licensing Manager
Commonwealth Edison Company-Suite 300
OPUS West III
1400 OPUS Place
Downers Grove, IL 60515

Dear Mr. Kovach:

SUBJECT: JET PUMP FLOW INDICATION TECHNICAL SPECIFICATION AMENDMENT - QUAD CITIES NUCLEAR POWER STATION (TAC NOS. 75065 AND 75066)

The Commission has issued the enclosed Amendment Nos. 124 and 121 to Facility Operating License Nos. DPR-29 and DPR-30 for the Quad Cities Nuclear Power Station, Units 1 and 2. These Technical Specifications (TS) amendments are in response to your application dated October 11, 1989.

The amendments modify the Technical Specification requirements for jet pump flow indication.

A copy of our related Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's biweekly Federal Register notices.

Sincerely,

/s/

Leonard N. Olshan, Project Manager
Project Directorate III-2
Division of Reactor Projects - III, IV, V, and Special Projects

Enclosures:
1. Amendment No. 124 to License No. DPR-29
2. Amendment No. 121 to License No. DPR-30
3. Safety Evaluation

cc w/enclosures:
See next page

| PD3/2:LA | PD3/2:PM | PD3/2:D | OGC |
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

May 23, 1990

Docket Nos.: 50-254 and 50-265

Mr. Thomas J. Kovach
Nuclear Licensing Manager
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Leonard N. Olshan, Project Manager
Project Directorate III-2
Division of Reactor Projects - III,
IV, V, and Special Projects

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1. Amendment No. 124 to License No. DPR-29
2. Amendment No. 121 to License No. DPR-30
3. Safety Evaluation

cc w/enclosures:
See next page

cc:

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

COMMONWEALTH EDISON COMPANY

AND

IOWA-ILLINOIS GAS AND ELECTRIC COMPANY

DOCKET NO. 50-254

QUAD CITIES NUCLEAR POWER STATION, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 124
License No. DPR-29

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

   A. The application for amendment by Commonwealth Edison Company (the licensee) dated October 11, 1989, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and 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 Operating License No. DPR-29 is hereby amended to read as follows:

B. Technical Specifications

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 124 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

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

FOR THE NUCLEAR REGULATORY COMMISSION

Richard F. Dudley

Richard F. Dudley, Acting Director
Project Directorate III-2
Division of Reactor Projects - III,
IV, V and Special Projects

Attachment:
Changes to the Technical
Specifications

Date of Issuance: May 23, 1990

ATTACHMENT TO LICENSE AMENDMENT NO. 124

FACILITY OPERATING LICENSE NO. DPR-29

DOCKET NO. 50-254

Revise the Appendix A Technical Specifications by removing the pages identified below and inserting the attached pages. The revised pages are identified by the captioned amendment number and contain marginal lines indicating the area of change.

| REMOVE | INSERT |
|---|---|
| 3.6/4.6-9 | 3.6/4.6-9 |
| 3.6/4.6-10 | 3.6/4.6-10 |
| 3.6/4.6-11 | 3.6/4.6-11 |
| 3.6/4.6-12 | 3.6/4.6-12 |
| 3.6/4.6-13 | 3.6/4.6-13 |
| 3.6/4.6-23 | 3.6/4.6-23 |

G. Jet Pumps

1. Whenever the reactor is in the Startup/Hot Standby or Run modes, all jet pumps shall be intact, and all operating jet pumps shall be operable. If it is determined that a jet pump is inoperable, an orderly shutdown shall be initiated and the reactor shall be in a cold shutdown condition within 24 hours.

2. Flow indication from 19 of the 20 jet pumps shall be verified prior to initiation of reactor startup from a cold shutdown condition.

G. Jet Pumps

1. Whenever there is recirculation flow with the reactor in the Startup/Hot Standby or Run modes, jet pump integrity and operability shall be checked daily by verifying that two of the following conditions do not occur simultaneously:

   a. The recirculation pump flow differs by more than 10% from the established speed-flow characteristics.

   b. The indicated total core flow is more than 10% greater than the core flow value derived from established core plate DP core flow relationships.

   c. Individual jet pump flow for each jet pump does not differ by more than 10% from established flow to average loop jet pump flow characteristics.

2. Additionally, when operating with one recirculation pump with the equalizer valves closed, the diffuser to lower plenum differential pressure shall be checked daily, and the differential pressure of any jet pump in the idle loop shall not vary by more than 10% from established patterns.

3. The indicated core flow is the sum of the flow indication from each jet pump with operable flow indication. In addition, for any jet pump with inoperable flow indication, the flow indication from the companion jet pump on the same jet pump riser shall be summed a second time to compensate for the flow through the jet pump with inoperable flow indication. If flow indication failure occurs for three or more jet pumps, immediate corrective action shall be taken. If flow indication for all but two jet pumps cannot be obtained within 12 hours, an orderly shutdown shall be initiated and the reactor shall be in a cold shutdown condition within 24 hours.

4. If flow indication failure occurs for both jet pumps on the same jet pump riser, immediate corrective action shall be taken. If flow indication for at least one of the jet pumps cannot be obtained within 12 hours, an orderly shutdown shall be initiated and the reactor shall be in a cold shutdown condition within 24 hours.

5. If flow indication failure occurs for both calibrated (double-tap) jet pumps on the same recirculation loop, immediate corrective action shall be taken. If flow indication for at least one of the jet pumps cannot be obtained within 12 hours, an orderly shutdown shall be initiated and the reactor shall in cold shutdown condition within 24 hours.

3. The baseline data required to evaluate the conditions in Specifications 4.6.G.1 and 4.6.G.2 will be acquired each operating cycle.

H. Recirculation Pump Flow Limitations

1. Whenever both recirculation pumps are in operation, pump speeds shall be maintained within 10% of each other when power level is greater than 80% and within 15% of each other when power level is less than 80%.

2. If Specification 3.6.H.1 cannot be met, one recirculation pump shall be tripped.

3. During Single Loop Operation for more than 12 hours, the following restrictions are required:

   a. The MCPR Safety Limit shall be increased by 0.01 (T.S. 1.1A);

   b. The MCPR Operating Limit, as specified in the CORE OPERATING LIMITS REPORT, shall be increased by 0.01 (T.S. 3.5.K);

   c. The flow biased APRM Scram and Rod Block Setpoints shall be reduced by 3.5% to read as follows:

      T.S. 2.1.A.1;
      $S \leq .58WD + 58.5$

      T.S. 2.1.A.1;*
      $S \leq (.58WD + 58.5)$ FRP/MFLPD

      T.S. 2.1.B;
      $S \leq .58WD + 46.5$

      T.S. 2.1.B;*
      $S \leq (.58WD + 46.5)$ FRP/MFLPD

      T.S. 3.2.C (Table 3.2-3);*
      APRM Upscale $\leq (.58WD + 46.5)$ FRP/MFLPD

      * In the event that MFLPD exceeds FRP.

H. Recirculation Pump Flow Limitations

Recirculation pumps speed shall be checked daily for mismatch.

d. The flow biased RBM Rod Block setpoints, as specified in the CORE OPERATING LIMITS REPORT, shall be reduced by 4.0%.

e. The suction valve in the idle loop shall be closed and electrically isolated except when the idle loop is being prepared for return to service.

I. Shock Suppressors (Snubbers)

1. During all modes of operation except Shutdown and Refuel, all snubbers on safety-related piping systems shall be operable except as noted in 3.6.I.2 following.

I. Shock Suppressors (Snubbers)

The following surveillance requirements apply to all snubbers on safety-related piping systems.

1. Visual inspections shall be performed in accordance with the following schedule utilizing the acceptance criteria given by Specification 4.6.I.2.

| Number of Snubbers Found Inoperable During Inspection or During Inspection Interval | Next Required Inspection Interval |
|---|---|
| 0 | 18 months ±25% |
| 1 | 12 months ±25% |
| 2 | 6 months ±25% |
| 3,4 | 124 days ±25% |
| 5,6,7 | 62 days ±25% |
| ≥8 | 31 days ±25% |

The required inspection interval shall not be lengthened more than one step at a time.

1. (Cont'd)

   Snubbers may be categorized in two groups, 'accessible' or 'inaccessible' based on their accessibility for inspection during reactor operation. These two groups may be inspected independently according to the above schedule.

   Snubber service life monitoring shall be followed by the snubber surveillance inspection records and maintenance history records. The above record retention method shall be used to prevent the snubbers from exceeding a service life.

2. From and after the time that a snubber is determined to be inoperable, continued reactor operation is permissible during the succeeding 72 hours only if the snubber is sooner made operable.

2. Visual inspections shall verify:

   a. There are no visible indications of damage or impaired operability, and

   b. Attachments to the foundation or supporting structure are secure.

3. If the requirements of 3.6.I.1 and 3.6.I.2 cannot be met, an orderly shutdown shall be initiated and the reactor shall be in a cold shutdown condition within 36 hours.

3. Once each refueling cycle a representative sample of 10% of the total of each type of snubber in use in the plant shall be functionally tested either in place or in a bench test. For each snubber that does not meet the functional test criteria, an additional 10% of that type of snubber shall be functionally tested.

G. Jet Pumps

Failure of a jet pump nozzle assembly holddown mechanism, nozzle assembly, and/or riser increases the cross-sectional flow area for blowdown following the postulated design-basis double-ended recirculation line break. Therefore, if a failure occurs, repairs must be made to assure the validity of the calculated consequences. Maintenance of jet pump integrity is required to demonstrate that the core can be reflooded to two-thirds core height following a large recirculation line break loss-of-coolant accident.

The following factors form the basis for the surveillance requirements:

1. A break in a jet pump decreases the flow resistance characteristic of the external piping loop causing the recirculation pump to operate at a higher flow condition when compared to previous operation.

2. Agreement of indicated core plate dp/core flow relationships provides assurance that recirculation flow is not bypassing the core through inactive or broken jet pumps.

3. The change in flow rate of the failed jet pump produces a change in the indicated flow rate of that pump relative to the other pumps in that loop. Comparison of the data with a normal relationship or pattern provides the indication necessary to detect a failed jet pump.

Comparison of individual jet pump flows to average loop jet pump flow is the most sensitive indicator of significant jet pump performance degradation. The individual jet pump flow deviation from established patterns will clearly indicate jet pump displacement since the indicated flow of the jet pumps on the affected riser changes by 45% and 67%. Failure of a jet pump with lost flow indication would be indicated by a change in the flow to average loop jet pump flow ratio of the companion jet pump on the same jet pump riser.

Plant operation with loss of flow indication for both jet pumps on the same riser is not permitted. If this should occur, there is no method for ensuring jet pump integrity is being maintained for the affected jet pumps.

Plant operation with loss of flow indication for both calibrated (double-tap) jet pumps on a recirculation loop is not permitted. If this should occur, uncertainties introduced into core flow calibration exceed the value assumed in the derivation of the Safety Limit Minimum Critical Power Ratio.

A nozzle-riser system failure could also generate the coincident failure of a jet pump body; however, the converse is not true. The lack of any substantial stress in the jet pump body makes failure impossible without an initial nozzle riser system failure.

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. 121
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 October 11, 1989, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's rules and 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 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 Operating 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. 121 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

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

FOR THE NUCLEAR REGULATORY COMMISSION

Richard F. Dudley

Richard F. Dudley, Acting Director
Project Directorate III-2
Division of Reactor Projects - III,
IV, V and Special Projects

Attachment:
Changes to the Technical
Specifications

Date of Issuance: May 23, 1990

ATTACHMENT TO LICENSE AMENDMENT NO. 121

FACILITY OPERATING LICENSE NO. DPR-30

DOCKET NO. 50-265

Revise the Appendix A Technical Specifications by removing the pages identified below and inserting the attached pages. The revised pages are identified by the captioned amendment number and contain marginal lines indicating the area of change.

| REMOVE | INSERT |
|---|---|
| ii | ii |
| 3.6/4.6-5 | 3.6/4.6-5 |
| 3.6/4.6-5a | 3.6/4.6-5a |
| 3.6/4.6-5b | 3.6/4.6-5b |
| | 3.6/4.6-5c |
| 3.6/4.6-13 | 3.6/4.6-13 |
| 3.6/4.6-13a | 3.6/4.6-13a |

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G. Jet Pumps

1. Whenever the reactor is in the Startup/Hot Standby or Run modes, all jet pumps shall be intact, and all operating jet pumps shall be operable. If it is determined that a jet pump is inoperable, an orderly shutdown shall be initiated and the reactor shall be in a cold shutdown condition within 24 hours.

2. Flow indication from 19 of the 20 jet pumps shall be verified prior to initiation of reactor startup from a cold shutdown condition.

3. The indicated core flow is the sum of the flow indication from each jet pump with operable flow indication. In addition, for any jet pump with inoperable flow indication, the flow indication from the companion jet pump on the same jet pump riser shall be summed a second time to compensate for the flow through the jet pump with inoperable flow indication. If flow indication failure occurs for three or

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1. Whenever there is recirculation flow with the reactor in the Startup/Hot Standby or Run modes, jet pump integrity and operability shall be checked daily by verifying that two of the following conditions do not occur simultaneously:

   a. The recirculation pump flow differs by more than 10% from the established speed-flow characteristics.

   b. The indicated total core flow is more than 10% greater than the core flow value derived from established core plate DP/core flow relationships.

   c. Individual jet pump flow for each jet pump does not differ by more than 10% from established flow to average loop jet pump flow characteristics.

2. Additionally, when operating with one recirculation pump with the equalizer valves closed, the diffuser to lower plenum differential pressure shall be checked daily, and the differential pressure of any jet pump in the idle loop shall not vary by more than 10% from established patterns.

3. The baseline data required to evaluate the conditions in Specifications 4.6.G.1 and 4.6.G.2 will be acquired each operating cycle.

more jet pumps, immediate corrective action shall be taken. If flow indication for all but two jet pumps cannot be obtained within 12 hours, an orderly shutdown shall be initiated and the reactor shall be in a cold shutdown condition within 24 hours.

4. If flow indication failure occurs for both jet pumps on the same jet pump riser, immediate corrective action shall be taken. If flow indication for at least one of the jet pumps cannot be obtained within 12 hours, an orderly shutdown shall be initiated and the reactor shall be in a cold shutdown condition within 24 hours.

5. If flow indication failure occurs for both calibrated (double-tap) jet pumps on the same recirculation loop, immediate corrective action shall be taken. If flow indication for at least one of the jet pumps cannot be obtained within 12 hours, an orderly shutdown shall be initiated and the reactor shall be in a cold shutdown condition within 24 hours.

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1. Whenever both recirculation pumps are in operation, pump speeds shall be maintained within 10% of each other when power level is greater than 80% and within 15% of each other when power level is less than 80%.

2. If Specification 3.6.H.1 cannot be met, one recirculation pump shall be tripped.

H. Recirculation Pump Flow Limitations

Recirculation pumps speed shall be checked daily for mismatch.

3. Prior to Single Loop Operation for more than 12 hours, the following restrictions are required:

   a. The MCPR Safety Limit shall be increased by 0.01. (T.S. 1.1A);

   b. The MCPR Operating Limit, as specified in the CORE OPERATING LIMITS REPORT, shall be increased by 0.01 (T.S. 3.5.K);

   c. The flow biased APRM Scram and Rod Block Setpoints shall be reduced by 3.5% to read as follows:

      T.S. 2.1.A.1;
      $S \leq .58W_D + 58.5$

      T.S. 2.1.A.1;*
      $S \leq (.58W_D + 58.5)$ FRP/MFLPD

      T.S. 2.1.B;
      $S \leq .58W_D + 46.5$

      T.S. 2.1.B;*
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      T.S. 3.2.C (Table 2.1-3);*
      APRM upscale $\leq (.58W_D + 46.5)$ FRP/MFLPD

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   d. The flow biased RBM Rod Block setpoints, as specified in the CORE OPERATING LIMITS REPORT, shall be reduced by 4.0%.

   e. The suction valve in the idle loop shall be closed and electrically isolated except when the idle loop is being prepared for return to service.

I. Shock Suppressors (Snubbers)

1. During all modes of operation except Shutdown and Refuel, all snubbers on safety related piping systems shall be operable except as noted in 3.6.I.2 following.

2. From and after the time that a snubber is determined to be inoperable, continued reactor operation is permissible during the succeeding 72 hours only if the snubber is sooner made operable.

3. If the requirements of 3.6.I.1 and 3.6.I.2 cannot be met, an orderly shutdown shall be initiated and the reactor shall be in a cold shutdown condition within 36 hours.

4. If a snubber is determined to be inoperable while the reactor is in the Shutdown or Refuel mode, the snubber shall be made operable prior to reactor startup.

I. Shock Suppressors (Snubbers)

The following surveillance requirements apply to all snubbers on safety related piping systems.

1. Visual inspections shall be performed in accordance with the following schedule utilizing the acceptance criteria given by Specification 4.6.I.2.

| Number of Snubbers Found Inoperable During Inspection or During Inspection Interval | Next Required Inspection Interval |
|---|---|
| 0 | 18 months ±25% |
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| 2 | 6 months ±25% |
| 3,4 | 124 days ±25% |
| 5,6,7 | 62 days ±25% |
| ≥8 | 31 days ±25% |

The required inspection interval shall not be lengthened more than one step at a time.

Snubbers may be categorized in two groups, 'accessible' or 'inaccessible' based on their accessibility for inspection during reactor operation. These two groups may be inspected independently according to the above schedule.

G. Jet Pumps

Failure of a jet pump nozzle assembly holddown mechanism, nozzle assembly, and/or riser increases the cross-sectional flow area for blowdown following the postulated design-basis double-ended recirculation line break. Therefore, if a failure occurs, repairs must be made to assure the validity of the calculated consequences. Maintenance of jet pump integrity is required to demonstrate that the core can be reflooded to two-thirds core height following a large recirculation line break loss-of-coolant accident.

The following factors form the basis for the surveillance requirements:

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2. Agreement of indicated core plate dp/core flow relationships provides assurance that recirculation flow is not bypassing the core through inactive or broken jet pumps.

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Plant operation with loss of flow indication for both jet pumps on the same riser is not permitted. If this should occur, there is no method for ensuring jet pump integrity is being maintained for the affected jet pumps.

Plant operation with loss of flow indication for both calibrated (double-tap) jet pumps on a recirculation loop is not permitted. If this should occur, uncertainties introduced into core flow calibration exceed the value assumed in the derivation of the Safety Limit Minimum Critical Power Ratio.

A nozzle-riser system failure could also generate the coincident failure of a jet pump body; however, the converse is not true. The lack of any substantial stress in the jet pump body makes failure impossible without an initial nozzle riser system failure.

H. Recirculation Pump Flow Limitation

The LPCI loop selection logic is described in the SAR, Section 6.2.4.2.5. For some limited low probability accidents with the recirculation loop operating with large speed differences, it is possible for the logic to select the wrong loop for injection. For these limited conditions, the core spray itself is adequate to prevent fuel temperatures from exceeding allowable limits. However, to limit the probability even further, a procedural limitation has been placed on the allowable variation in speed between the recirculation pumps.

The licensee's analyses indicate that above 80% power the loop select logic could not be expected to function at a speed differential of 15%. Below 80% power, the loop select logic would not be expected to function at a speed differential of 20%. This specification provides a margin of 5% in pump speed differential before a problem could arise. If the reactor is operating on one pump, the loop select logic trips that pump before making the loop selection.

Analyses have been performed which support indefinite single loop operation provided the appropriate restrictions are implemented within 12 hours. The MCPR Safety Limit has been increased by 0.01 to account for core flow and TIP reading uncertainties which are used in the statistical analysis of the safety limit. The MCPR Operating Limit, as specified in the CORE OPERATING LIMITS REPORT, has also been increased by 0.01 to maintain the same margin to the safety limit as during Dual Loop operation.

The flow biased scram and rod block setpoints are reduced to account for uncertainties associated with backflow through the idle jet pumps when the operating recirculation pump is above 20-40% of rated speed. This assures that the flow biased trips and blocks occur at conservative neutron flux levels for a given core flow.

The closure of the suction valve in the idle loop prevents the loss of LPCI flow through the idle recirculation pump into the downcomer.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 124 TO FACILITY OPERATING LICENSE NO. DPR-29

AND AMENDMENT NO. 121 TO FACILITY OPERATING LICENSE NO. DPR-30

COMMONWEALTH EDISON COMPANY

AND

IOWA-ILLINOIS GAS AND ELECTRIC COMPANY

QUAD CITIES NUCLEAR POWER STATION, UNITS 1 AND 2

DOCKET NOS. 50-254/265

## 1.0 BACKGROUND

On October 31, 1972, Quad Cities Unit 1 Jet Pump Number 7 instrument line failed. The failure of the instrument line prevented the use of flow indication directly from Jet Pump 7. A visual examination of the No. 7 jet pump within the reactor vessel was performed to assure that the lack of flow indication was not due to damage of the jet pump. No indications were noted as a result of this examination. The licensee, Commonwealth Edison Company (CECo), evaluated the feasibility of repair of the damaged instrument line. In early 1975, CECo and GE expended considerable effort to develop a method of repairing the failed instrument line. A full scale mock-up was constructed by GE to test numerous tooling designs that could repair the instrument line. Based on this work, it was demonstrated that repair was not feasible due to the limited access to the area, and the close proximity to instrument lines for Jet Pumps 8, 9, and 10 could cause them to be damaged. The personnel radiation exposure related to the repair or replacement of the jet pump upper section would be significant. The costs associated with the repair appeared to be greater than the benefits to be gained.

Based on the factors discussed above, CECo decided not to repair or replace the jet pump flow indication sensing line. CECo performed a technical evaluation to determine the effects of the failed instrument line on plant operation and safety. This evaluation examined the effect of the failed instrument line on the accuracy of the flow measurement. The effect and ability to detect a jet pump failure using surveillance as described in current Technical Specifications (TS) and the effect on the Emergency Core Cooling System Performance Analysis were evaluated. The analysis showed that continued operation with a failed jet pump instrument was acceptable.

By letter dated October 11, 1989, CECo requested an amendment to the Facility Operating Licenses DPR-29 and DPR-30 for Quad Cities Station, Units 1 and 2.

The current TS for Quad Cities 1 and 2 requires plant shutdown if two jet pump flow indicators fail. The proposed TS will allow plant operation with a failure of two jet pump flow indicators. TS changes for Quad Cities 2 are also requested for uniformity. In a letter dated March 12, 1990, CECo confirmed that on Unit 2 all efforts will be made to fix the flow indication on all 20 jet pumps before starting from cold shutdown. The proposed TS will allow startup of Unit 2 with one jet pump flow indication inoperable.

## 2.0 EVALUATION

On Quad Cities Station, Units 1 and 2, there are 20 jet pumps. All of the jet pumps are provided with a single-tap (ST) diffuser-to-plenum delta-P transmitter. The total core flow passing through 20 jet pump diffusers is determined by the single tap delta-P transmitter of each jet pump. The square root of delta-P signal from each individual jet pump is used to obtain a signal proportional to flow which is indicated in the control room. The individual signals are then summed with other jet pump flows to obtain the jet pump loop flows and the total core flow. In addition, four of the jet pumps (two in each loop) are provided with a double-tap (DT) diffuser to diffuser delta-P transmitters. These four jet pumps are calibrated in the laboratory prior to installation, and are referred to as calibrated, or double-tap, jet pumps.

In support of its application, the licensee, with the assistance of General Electric (the NSSS vendor), evaluated the potential implications on plant safety without flow indication from three of the 20 jet pumps. The staff review of the licensee submittal follows.

### 2.1 Total Core Flow Measurement

Indicated total core flow is determined by summing individual jet pump flows from 20 jet pumps. To compensate for the error due to loss of Jet Pump 7 flow indication, the measured flow from Jet Pump 8, which shares a common recirculation flow inlet riser with Jet Pump 7, is adjusted based on historical flow bias data between this jet pump pair and input to the flow summer to simulate the Jet Pump 7 flow indication. Base data obtained prior to the sensing line failure demonstrates the ratio of Jet Pump 7 flow to Jet Pump 8 flow to be 1.0057. General Electric has calculated the uncertainty in total core flow measurement using this technique for the failure of three flow indicators.

Loss of flow indication for Jet Pump Number 7 and two additional DT pumps (one from each loop) were assumed as the worst condition. For 2-loop operation, the effect on core flow measurement uncertainty is calculated as 2.34% and 5.64% for single loop operation. Core measurement uncertainty bounding values

of 2.5% for two loop operation and 6% for single loop operation are applied in the General Electric Thermal Analysis Basis (GETAB) used for Quad Cities reload analyses. The loss of flow indication from three jet pumps still meets this requirement.

Loss of two DT pumps in one loop was not specifically evaluated, but would result in a much higher flow measurement uncertainty than calculated for loss of Jet Pump No. 7 plus one DT pump per loop. Hence, the proposed TS would not allow plant operation if flow indication failure occurs for both DT pumps on the same loop. We find this acceptable.

Since the partner jet pump sharing the same riser is critical to the measurement of the problem jet pump, the proposed TS will not permit plant operation if flow indication failure occurs for both jet pumps on the same jet pump riser. We find this acceptable.

2.2 Recirculation Flow Monitoring

The LPCI (Low Pressure Coolant Injection) loop selection logic monitors the delta-P changes in the jet pump loops to determine which, if any, recirculation loop is broken in the event of a LOCA signal. The proposed operation will not impact this logic since it is not dependent on individual jet pump flow instrumentation.

Recirculation pump flow signals are input to the Rod Block Monitor and to the flow biased APRM Rod Block and scram circuits. However, the recirculation pump flow measurement does not depend on individual jet pump flow instrumentation; therefore, this protection logic is not impacted by the proposed operation.

2.3 Loss of Jet Pump Operability

A loss of jet pump integrity can result in exceeding the allowable Peak Clad Temperature (PCT) for the design basis LOCA. Maintenance of jet pump integrity is required to demonstrate that the core can be reflooded to two-thirds core height following a LOCA. Hence, the TS incorporate surveillance requirements for daily monitoring of established flow relationships which can provide indication of jet pump failures.

The current TS require simultaneous occurrence of the following two conditions to indicate loss of jet pump integrity:

(a) the recirculation pump flow differs more than 10% from established speed flow characteristics,

(b) the indicated total core flow is more than 10% greater than the core flow value derived from established core plate DP-core flow relationships.

The following alternate methods are also used to verify jet pump integrity.

(a) Recirculation pump speed to recirculation loop flow.

(b) Core flow to core power and flow control line.

(c) Core flow to recirculation drive flow.

(d) Recirculation pump speed to jet pump loop flow.

In addition to the above, the licensee is proposing an additional surveillance requirement. Individual jet pump flow will be monitored to verify that the individual jet pump flow does not differ by more than 10% from established flow to average loop jet pump flow characteristics. The individual jet pump flow deviation pattern will indicate jet pump displacement. The current and the proposed TS require two surveillance conditions to occur simultaneously before the jet pumps can be declared as inoperable. But the surveillance procedures require engineering evaluation and root cause analysis if any one of the conditions is not satisfied. The requirement to satisfy two conditions simultaneously will not allow a jet pump to be "inoperable" due to a failed jet pump instrument. We find the proposed TS changes acceptable to monitor jet pump operability.

2.4 Effect on ECCS Analysis

The jet pump diffuser upper pressure taps are located at approximately the same elevation as the bottom of the active fuel. To minimize the signal noise and to account for any differences in the velocity distribution at the diffuser entrance, there are three 0.125 inch diameter holes at the diffuser entrance to measure the static pressure in the diffuser. A manifold connects these taps and the instrument line is connected to this manifold inside the vessel. If the jet pump instrument line should break inside the vessel, it would establish an additional leakage path through these taps to the downcomer annulus which would allow water intended for core cooling to leak into the downcomer and delay core reflooding.

During reflooding, the leak through the severed instrument line would start to occur when the water level rises to the jet pump suction elevation which is at approximately two-thirds of the core height. This additional leakage was calculated to be less than 3 gpm through the three 0.125 inch pressure taps in any one diffuser. Even if three diffusers were leaking at this rate, the total flow loss would amount to much less than 1% of the total ECCS flow available. Previous sensitivity studies have shown that a leakage increase of this magnitude has no significant effect on ECCS performance limits.

3.0 TECHNICAL SPECIFICATIONS

a. Limiting Condition for Operation (LCO) 3.6.G.2

Replace "each" with "19." This will allow plant startup with a loss of flow indication on one jet pump . This is acceptable.

b. LCO 3.6.G.3

Replace existing text with "The indicated core flow is the sum of the flow indication from each jet pump with operable flow indication. In addition, for any jet pump with inoperable flow indication, the flow indication from the companion jet pump on the same jet pump riser shall be summed a second time to compensate for the flow through the jet pump with the inoperable flow indication. If flow indication failure occurs for three or more jet pumps, immediate corrective action shall be taken. If flow indication for all but two jet pumps cannot be obtained within 12 hours, an orderly shutdown shall be initiated and the reactor shall be in cold shutdown condition within 24 hours." This is acceptable as previously discussed.

c. LCO 3.6.G.4 (new)

"If flow indication failure occurs for both jet pumps on the same jet pump riser, immediate corrective action shall be taken. If flow indication for at least one of the jet pumps cannot be obtained within 12 hours, an orderly shutdown shall be initiated and the reactor shall be in cold shutdown condition within 24 hours." This is acceptable as previously discussed.

d. LCO 3.6.G.5 (new)

"If flow indication failure occurs for both calibrated (double-tap) jet pumps on the same recirculation loop, immediate corrective action shall be taken. If flow indication for at least one of the jet pumps cannot be obtained within 12 hours, an orderly shutdown shall be initiated and the reactor shall be in a cold shutdown condition within 24 hours." This is acceptable as previously discussed.

e. Surveillance Requirement 4.6.G.1

Add "two of" and delete "two."

Add "c. Individual jet pump flow for each jet pump does not differ by more than 10% from established flow to average loop jet pump flow characteristics." This is acceptable as previously discussed.

There are changes to bases shown on pages 3.6/4.6-23, 3.6/4.6-13 addressing the above TS changes. They suitably reflect the TS changes and are acceptable.

## 4.0 ENVIRONMENTAL CONSIDERATION

These amendments involve changes to requirements with respect to the installation and use of a facility component located within the restricted area as defined in 10 CFR Part 20. The staff has determined that these amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite and that there is no significnat increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that these amendments involve no significant hazards consideration and there has been no public comment on such finding. Accordingly, these amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement nor environmental assessment need be prepared in connection with the issuance of these amendments.

## 5.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of these amendments will not be inimical to the common defense and security nor to the health and safety of the public.

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Dated: May 23, 1990