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ComEd

September 24, 1997

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Subject: Application for Amendment to Appendix A, Technical Specifications, to Facility Operating Licenses

Byron Station Units 1 and 2
Facility Operating Licenses NPF-37 and NPF-66
NRC Docket Nos. 50-454 and 50-455

Braidwood Station Units 1 and 2
Facility Operating Licenses NPF-72 and NPF-77
NRC Docket Nos. 50-456 and 50-457

Revision of Throttle Valve/Governor Testing Frequency

Pursuant to 10 CFR 50.90, ComEd proposes to amend Appendix A, Technical Specifications, of Facility Operating Licenses NPF-37, NPF-66, NPF-72 and NPF-77. The proposed amendment requests a change to revise the allowable time interval for perfoming tubine throttle valve and turbine governor valve surveillance requirements from monthly to quarterly. ComEd requests approval of this amendment prior to February, 1998, to take advantage of reduced costs and increased electrical generation.

This proposed amendment request is subdivided as follows:

1. Attachment A gives a description and safety analysis of the proposed changes in this amendment.

2. Attachment B includes the marked-up Technical Specification pages with the requested changes indicated.

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3. Attachment C describes ComEd's evaluation performed in accordance with 10 CFR 50.92(c), which confirms that no significant hazards consideration is involved.

4. Attachment D provides the Environmental Assessment.

5. Attachment E provides WCAP-14732 (Proprietary) and WCAP-14733 (Non-Proprietary) entitled "Probabilistic Analysis of Reduction in Turbine Valve Test Frequency for Nuclear Plants with Westinghouse BB-296 Turbines with Steam Chests." Also enclosed are a Westinghouse authorization letter, CAW-97-1074, accompanying affidavit, Propietary Information Notice, and Copyright Notice.

This proposed amendment has been reviewed and approved by ComEd Onsite and Offsite Review in accordance with ComEd procedures.

ComEd is notifying the State of Illinois of this application for amendment by transmitting a copy of this letter and its attachments to the designated State Official.

Please handle proprietary documents according to the requirements of 10 CFR 2.790.

Please direct any questions you may have concerning this submittal to Marcia Lesniak at (630)-663-6484.

Attachments

cc: Regional Administrator - RIII
Byron/Braidwood Station Project Manager - NRR
Braidwood Station Senior Resident Inspector
Byron Station Senior Resident Inspector
Office of Nuclear Facility Safety - IDNS

STATE OF ILLINOIS

IN THE MATTER OF

COMMONWEALTH EDISON (COMED) COMPANY

Docket Nos. 50-454
50-455
50-456
50-457

BYRON STATION - UNITS 1 & 2
BRAIDWOOD STATION - UNITS 1 & 2

AFFIDAVIT

I affirm that the content of this transmittal is true and correct to the best of my knowledge, information and belief.

H. Gene Stanley
PWR Vice President

Subscribed and sworn to before me, a Notary Public in and for the State above named, this 24th day of September, 1997.

OFFICIAL SEAL
JACQUELINE T EVANS
NOTARY PUBLIC, STATE OF ILLINOIS
MY COMMISSION EXPIRES: 12/15/97

Jacqueline T. Evans
Notary Public

ATTACHMENT A

DESCRIPTION AND SAFETY ANALYSIS OF PROPOSED CHANGES TO APPENDIX A TECHNICAL SPECIFICATIONS OF FACILITY OPERATING LICENSES NPF-37, NPF-66, NPF-72, AND NPF-77

A DESCRIPTION OF THE PROPOSED CHANGE

Commonwealth Edison (ComEd) proposes to revise Technical Specification Surveillance Requirement (TSSR) 4.3.4.2, "Turbine Overspeed Protection," and the associated Bases, 3/4.3.4, for Byron Nuclear Power Station (Byron) and Braidwood Nuclear Power Station (Braidwood). These changes will implement one of the line item Technical Specification improvements recommended by Generic Letter 93-05, "Line-Item Technical Specification Improvements to Reduce Surveillance Requirements for Testing During Power Operation." The items in the generic letter are based on the recommendations of an NRC study that included a comprehensive examination of surveillance requirements. The recommendations are reported in NUREG-1366, "Improvements to Technical Specifications Surveillance Requirements." The proposed changes revise the allowable time intervals for performing turbine throttle valve and turbine governor valve surveillance requirements from monthly to quarterly. The Bases change will update a referenced vendor document.

A similar amendment to reduce the frequency of turbine valve testing was approved on February 7, 1989, for Prairie Island Generating Plant. Amendments No. 86 and No. 79 for Prairie Island Unit 1 and Unit 2 reduced the surveillance test frequency of turbine stop valves, governor valves and intercept valves associated with turbine overspeed protection.

The proposed changes are discussed in detail in Section E of this attachment. The marked up Technical Specification pages for each station indicating the proposed changes are provided in Attachment B. Because the Improved Technical Specifications (ITS) relocate this requirement, there are no ITS marked up pages included in this amendment.

B DESCRIPTION OF THE CURRENT REQUIREMENT

TSSR 4.3.4.2.a. requires that, during turbine operation, the movement of the turbine valves be observed through one complete cycle, at least once per 31 days. This movement is from the valve position prior to testing, to full close, and returning to the original position. This test is conducted by the control room operator with an observer at the valve. The turbine valves are the four high pressure turbine throttle valves, the four high pressure turbine governor valves, the six turbine reheat stop valves, and the six turbine reheat intercept valves.

C BASES FOR THE CURRENT REQUIREMENT

This TSSR ensures that the turbine speed control valves are operable and will protect the turbine from excessive overspeed. Valve testing verifies freedom of movement of the valve stem and plug, the actuator rod and piston, and verifies proper operation of the servo valve. Testing also identifies non-closure or sluggish operation of the valves and it identifies the gross outward appearance of valve condition.

The turbine valves isolate large quantities of steam with high potential for delivering energy to the rotor system. The turbine design recognizes this potential in providing rapid action, dual shutoff capability in each path, remote testing capability, and a flow path that reduces the effect of changes in flow distribution, load reductions, and thermal transients during testing. The testing intervals are in accordance with the latest manufacturer's recommendations: "Operation and Maintenance Memo 041," Steam Turbine Division, Westinghouse.

Protection from turbine excessive overspeed is required since excessive overspeed of the turbine could generate missiles which could impact and damage safety-related components, equipment, or structures. These turbine missiles are high-speed ... bine rotor fragments which are ejected through the turbine casing. At overspeed conditions it is assumed that the rupture of one rotor disc will do sufficient damage to the turbine assembly such that further overspeeding and additional missile generation will not occur. It is further assumed that the disc will rupture into four quadrants, of which two will be projected downward into the turbine foundation, one will be projected toward the plant, and one will be projected away from the plant. The concern is this damage caused by the rotor fragments could interfere with the integrity of reactor coolant pressure boundary, with normal safe shutdown, or the damage could result in environmental releases beyond that specified by Title 10 Code of Federal Regulations Part 100 (10CFR100) during normal operating or safe shutdown conditions.

Turbine valve testing is conducted to verify that equipment is capable of performing its intended function. The turbine valves function to control and protect the main turbine. They must be capable of moving freely in response to control and protection signals. The valve testing provides asssurance that the affected equipment will perform when required. Valve testing tests these abilities or detects non-performance of these abilities. Regular testing of turbine valves and regular inspection of the low pressure turbine rotor are performed to manage the risk of turbine missile ejection. Turbine valve testing affects only the probability of missile ejection resulting from overspeed of the turbine. The probability that a missile will strike a barrier which houses a critical plant component, or the probability that a missile will penetrate a barrier is not directly affected by turbine valve testing.

D. NEED FOR REVISION OF THE CURRENT REQUIREMENT

The Bases change updates the reference to the latest Westinghouse Operation & Maintenance Memo 041, Steam Turbine Division. On November 18, 1988 this Westinghouse memo was superseded by Westinghouse Operation & Maintenance Memo 093, from the Power Generation Business Unit.

The need for revision of the current requirement was identified in NUREG-1366, which provided four criteria to screen surveillance requirements in order to identify those that should be modified. The monthly turbine steam inlet valve testing meets all four criteria. The applicable criteria are:

- The surveillance could lead to a plant transient.
- The surveillance results in unnecessary wear to equipment.
- The surveillance results in radiation exposure to plant personnel which is not justified by the safety significance of the surveillance.
- The surveillance places an unnecessary burden on plant personnel because the time required is not justified by the safety significance of the surveillance.

Periodic turbine valve testing requires a temporary power reduction that results in lost electrical generation. An inadvertent reactor trip is more likely during the transient power reduction and increase. The surveillance results in adding thermal and mechanical stresses to high pressure turbine inlet piping. The reactor power level must be reduced to approximately 75%.

The power level reduction is achieved by shedding load and adjusting boron in the reactor coolant system. When valve testing is completed, boron levels must be altered again in order to return the reactor to pre-test conditions. The cycling of the reactor power as described places an unnecessary thermal and pressure cycle on the plant equipment. The testing increases the amount of liquid and solid radioactive waste that results in an increase in personnel exposure and it places the plant operator in a vulnerable position where an inadvertent reactor trip is more likely during the transient power reduction and increase. In addition, during such power swings, even with the aid of control rods, it takes three days for the power distribution between the top and bottom of the core to stabilize. During this testing, the power shape in the core has been altered and the decay of I-135 and Xe-135 need time to go back to their pre-test levels, providing unnecessary challenges to the operator.

Certain reload designs can be such that power differences between the top and bottom of the core are more sensitive to control and can develop divergent xenon oscillations when the power reduction occurs during the middle of core life. Near the end of core life,

stabilizing even larger differences in axial power distribution becomes more of a problem because of the larger temperature coefficient, lower boron concentration and larger differential xenon transient. In the Safety Evaluation Report related to the Prairie Island Amendment Numbers 86 and 79 in regard to the discussion above, the NRC wrote, "Based on the above, the staff has concluded that the margin of safety is reduced when the plant is undergoing turbine valve testing."

NUREG-1366 refers to a study that was made to determine which surveillance test resulted in the most reactor trips and other types of plant transients. This portion of the study was done by reviewing 10 CFR 50.72 reports and LERs to provide insight into the frequency and severity of test-caused events. For PWRs, reactor protection system surveillance testing provided the most trips. Turbine valve testing caused the next highest number. In the LER review, the most common cause of trips from power was turbine-related tests at power.

In NUREG-1366, the NRC concluded that the number of trips attributed to this testing was significant. The NRC staff recommended that, where the turbine manufacturer agrees, the testing interval for turbine valves as part of the turbine overspeed protection system surveillances be extended from weekly and monthly to quarterly, in which a direct visual observation will be made of the movement of each of the turbine valves currently required by Technical Specifications to be tested.

This is a Cost Beneficial Licensing Action (CBLA). Implementing the proposed changes could save up to 8 surveillance tests per year per unit, depending on the refueling outage schedule, for a total of 32 tests eliminated between Byron and Braidwood. Eliminating these tests would reduce labor cost, water processing costs, and lost electrical generation. For each test, 8 man-hours of operator time per test would be saved for a total of 256 man-hours/year due to the reduced number of routine surveillances that must be performed. To be conservative, an outage rate of 4 outages/ 3 years/ station will be assumed to normalize the data over 3 years. This would result in 16 tests/site not being performed over the 3 years. Therefore, taking into account outages, the proposed changes would save a total of 32 tests between Byron and Braidwood. Using $25/hr./person-hr., the total annual labor savings for the combined stations is $64,000. The annual savings in water processing and boron additions would come out to a total of $81,150 for Byron and Braidwood.

Implementing the proposed changes would save an estimated 2200 Megawatt-hours (MW-hr.)/test/unit, as testing requires a 275 MW load drop over 8 hours on the average. Depending on core life, and the load dispatcher's requirement, ramp rate could vary. The total annual MW-hr. savings for the ComEd electrical distribution system by the combined stations would be 70,400 MW-hrs., and using a $10/MW-hr. value, this would translate into $704,000 in annual MW savings. This savings in electrical generation would increase the annual capacity factor of each unit by approximately 0.09%. The proposed change will save approximately $849,150 annually, which is averaged over three years, for the

ComEd system in reduced labor cost, reduced water processing costs, and in electrical generation recovered.

E. DESCRIPTION OF THE REVISED REQUIREMENT

Turbine throttle valve and governor valve testing will be deleted from TSSR 4.3.4.2.a. The remaining items in TSSR 4.3.4.2.a. will be re-numbered. TSSR 4.3.4.2.b. will be added to include the throttle and governor valves at the new frequency and will read as follows:

> "b. During turbine operation at least once per 92 days by direct observation of the movement of the valves below through one complete cycle from the running position:
>
> 1) Four high pressure turbine throttle valves, and
> 2) Four high pressure turbine governor valves."

The remaining surveillance items in TSSR 4.3.4.2 will be re-designated c,d,e, and f. Corresponding administrative changes have been made to SR 4.3.4.2.e (revised to SR 4.3.4.2f)

In Bases 3/4.3.4 for Specification 4.3.4.2, the Memo number "041" will be replaced with "093". The Westinghouse internal organization that provided the memo, "Steam Turbine Division" will be replaced with the current "Power Generation Business Unit." Bases 3/4.3.4 for Specification 4.3.4.2a and Specification 4.3.4.2b and c will be re-designated 4.3.4.2a and b and 4.3.4.2c and d, respectively. Corresponding administrative changes have been made to Bases 3/4.3.4 for Specfication 4.3.4.2b and c (revised to Specfication 4.3.4.2c and d).

F. BASES FOR THE REVISED REQUIREMENT

The NRC has completed a comprehensive examination of surveillance requirements in the Technical Specifications that require testing at power. The evaluation is documented in NUREG-1366, "Improvements to Technical Specification Surveillance Requirements," dated December 1992. The NRC staff found that, while the majority of testing at power is important, safety can be improved, equipment degradation decreased, and an unnecessary burden on personnel resources eliminated by reducing the amount of testing at power that is required by the Technical Specifications. Based on the results of the evaluations documented in NUREG-1366, the NRC issued Generic Letter 93-05, "Line-Item Technical Specifications Improvements to Reduce Surveillance Requirements for Testing During Power Operation," dated September 27, 1993.

The present requirements for the throttle valve and governor valve test frequency are based on recommendations from the turbine vendor. This test interval was originally developed for fossil units and was carried over to nuclear units due to the similarity in

design. Fossil units produced steam with much greater particulate content than is permitted in nuclear units. These impurities required more frequent valve surveillance to ensure reliable operation. In addition, fossil units utilized phosphate chemistry in the condensate. This phosphate-based chemistry contributed to valve inoperability, as phosphate deposits between the shafts and bushings can occur. Byron and Braidwood Stations utilize an all volatile chemistry treatment instead of phosphate-based chemistry.

Overspeed protection is accomplished by three independent systems: normal speed governor, mechanical overspeed, and electric backup overspeed control systems. The normal speed governor modulates the turbine control valves to maintain desired speed and load characteristics. It will close the intercept valves and control valves at a maximum of 103 percent of rated speed. The mechanical overspeed sensor trips the turbine stop, control, and reheat stop and intercept valves by deenergizing the hydraulic fluid systems when 108 percent of rated speed is reached. The main steam stop, control, reheat stop, and intercept valves close in 0.3 seconds or less, and the air-operated extraction steam valves close in less than 3 seconds. These valves are designed to fail closed on loss of hydraulic system pressures. The electrical backup overspeed sensor will trip these same valves when 108 percent of rated speed is reached by independently deenergizing the hydraulic fluid system. Both of these actions independently trip systems and can be tested while the unit is on line. Therefore, the requirement in GDC 4 has been met.

Turbine valve testing affects only the probability of missile ejection resulting from overspeed of the turbine. In the Westinghouse study, WCAP-11525, "Probabilistic Evaluation of Reduction in Turbine Valve Test Frequency," the effect of varying the turbine valve test interval was evaluated by calculating the total probability of turbine missile ejection, P_1, for the overspeed events. The methodology developed to calculate the probability of missile ejection due to overspeed events applied in WCAP-11525 is used in the Westinghouse Proprietary Class 2C report, WCAP-14732, "Probabilistic Analysis of Reduction in Turbine Valve Test Frequency for Nuclear Plants with Westinghouse BB-296 Turbines with Steam Chests." Byron and Braidwood have Westinghouse BB-296 turbines with steam chests. The BB-296 unit has two steam chests, one on each side of the high pressure turbine. In each steam chest there are two throttle valves with two governor valves downstream. WCAP-14732 uses the destructive overspeed model. Destructive overspeed is runaway speed in excess of approximately 180%. Destructive overspeed is assumed to occur when a system separation occurs and at least one governor valve and one throttle valve in the same steam chest fail to close. System separation is defined as the sudden and total loss of load on the generator.

Westinghouse has provided an allowance to account for missile ejection probabilities at design and intermediate overspeed, and to provide margin for uncertainties in the model, and to account for the effect of the extraction nonreturn valves. WCAP-14732 added the Westinghouse allowance of 1.0×10^{-6} from WCAP-11525 to the destructive overspeed probabilities to obtain the conditional probability of missile ejection from overspeed. Then, the conditional probability of missile ejection was multiplied by 0.4, which is the frequency of system separation. The end result is the frequency of missile ejections per

year. The general NRC acceptance criteria for turbine missile ejection states that the annual probability of turbine missile ejection, P_1 , should not exceed 1.0×10^{-5} per year for turbines that are oriented unfavorably in regard to the locations of systems important to safety. Past results for Byron Unit 1 indicate the P_1 value as 6.58×10^{-6} per year and for Unit 2 as 4.62×10^{-6} per year. Representative P_1 values for Braidwood Units 1 and 2 are 4×10^{-6} per year and 5.5×10^{-9} per year, respectively. These probabilities are time dependent and will vary based on cycle length, inspections, and refurbishment activities. Relaxing the valve testing to quarterly will not cause the overall probability of missile ejection to approach the limit.

The turbine valves installed at Byron and Braidwood are tested on a monthly basis. In the life of the Byron plant, the turbine valves have undergone surveillance testing 120 times for Unit 1 and 112 times for Unit 2. The number of times the turbine valves were verified closed on a trip signal since Byron Unit 1 start-up in 1985 is 273 times. The number of times the Unit 2 valves were verified closed on a trip signal since Byron Unit 2 start-up in 1986 is 204 times. This gives a combined total of 709 turbine valve operations for Byron. During this time, there was an occasion on December 15, 1987 where the Number 3 governor valve on Unit 2 stuck as a groove was worn into the valve plug seal ring seating surface. Anti-rotation pins were installed to prevent this in the future, and this feature is now a standard Westinghouse design.

The Braidwood monthly throttle valve/governor valve surveillance has been performed 123 times for Unit 1 and 125 times for Unit 2. The number of times the turbine valves were verified closed on a trip signal since Braidwood Unit 1 start-up in 1987 is 106 times. The number of times the Unit 2 valves were verified closed on a trip signal since Braidwood Unit 2 start-up in 1988 is 102 times. This gives a combined total of 456 turbine valve operations for Braidwood. During this time problems were encountered on two separate occasions. One problem was with the DEH controller and the other was with the Moog servovalve. In both of these instances the valves themselves did close. In March of 1988 the Number 4 governor valve stuck at approximately 11% open during a shutdown. In April of 1989 the Number 4 governor valve was observed to move in a sluggish manner. The test was completed and the valve did stroke full closed, but it was taken out of service as a conservative decision as all valves were being replaced during the next outage in October 1989 with upgraded valves.

Shortly after the problem with the Number 3 governor valve at Byron and the Number 4 governor valve at Braidwood, Westinghouse was contracted to provide a throttle and governor valve modernization program consisting of various upgrades for Byron and Braidwood. The Braidwood upgrades were done in the October 1989 and Spring 1990 refueling outages. The Byron upgrades were performed in the Fall 1988 and Spring 1989 outages. These upgrades included installation of anti-swirl baffles in the steam chest, a stiff stem bushing modification, installation of anti-rotation pins between valve plug and stem, relief machined in the seal ring groove, installation of a new material valve plug, installation of new designed pressure seal rings, changes to the muffler lip/groove

clearance and blending of the muffler transition area. There have been no stuck valve problems since the upgrade.

During the life of Byron and Braidwood, there have been no incidents of unplanned turbine overspeed and no single turbine valve failures that could have lead to a turbine overspeed condition.

The statement required to confirm the turbine manufacturer's concurrence with this proposed change is WCAP-14732. WCAP-14732 used BB-296 failure rates for governor and throttle valve based on plant operating experience over a data collection period from 1990 through and including 1995. The governor valve failure rates are calculated as 2.34×10^{-7} failures per hour, utilizing the one governor valve failure at South Texas Unit 2 in April 1990 for a failure rate of one and the 4,266,679 operating hours in the database. The throttle valve failure rate is 1.17×10^{-7} failures per hour. Since there were no throttle valve failures from the plants during the date collection period, a failure rate of 0.5 was assumed over the hours of operation in the database. The missile ejection frequencies for Byron and Braidwood with a monthly turbine valve test interval is 5.34×10^{-7}. For quarterly testing the frequency is 8.8×10^{-7}. The missile ejection frequencies meet the acceptance criterion of 1.0×10^{-5} per year. These results include conservative values for the system separation frequency and the allowance for design and intermediate overspeed probabilities. Sufficient failure information at longer test intervals does not currently exist. According to WCAP-14732, "It is therefore prudent to conservatively interpret the missile ejection frequency results as supporting quarterly testing until reasonable failure rate data can be accumulated based on quarterly testing."

For the Bases change, the Westinghouse Operation & Maintenance Memo 041, "Recommended Testing Frequency for Steam Admission Valves on BB 296 Nuclear Turbine with Steam Chests," dated November 14, 1983 was superseded by a new document. The new document is Westinghouse Operation & Maintenance Memo 093, "BB296 & BB0296 Destructive Overspeed Protection," dated November 18, 1988. In accordance with Section 2.6 of Memo 093, "This Memo supersedes all prior Westinghouse communications pertaining to testing frequency for steam admission valves for BB296 & BB0296 nuclear turbines with steam chests."

G. IMPACT OF THE PROPOSED CHANGE

This proposed change deals with a change in test frequency for a TSSR. The proposed change would reduce the amount of testing at power, which would reduce the likelihood of plant trips from power. This change would also reduce the number of planned load drops, which in turn would reduce the number of potential challenges to safety systems and reduce distractions to operators. The proposed Bases change is administrative in nature.

In addition, because power must be lowered to perform this test, the test becomes very difficult to do at the end of cycle when there may not be enough dilution capability to override xenon.

No new equipment is being installed, no existing equipment is being modified. No new system configurations are being created. Applicable surveillance procedures will be changed to incorporate the new test frequency.

Therefore, this proposed change will have no significant negative impact on any operating mode, equipment or procedure.

The proposed change can save up to approximately $849,150 annually for all four units combined using the average over three years. The change also has the potential to increase the annual capacity factor by 0.09 % for each unit.

H. SCHEDULE REQUIREMENTS

ComEd requests that these proposed changes be approved by February 1, 1998.