Commonwealth Edison
1400 Opus Place
Downers Grove, Illinois 60515

April 28, 1994

Mr. William Russell, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attn: Document Control Desk

Subject: Braidwood Station Unit 2
Additional Information Regarding
Emergency Technical Specification Amendment for
Technical Specification 3/4.4.5
NRC Docket No. 50-456

Reference: 1) D. Saccomando letter to W. Russell transmitting Emergency Technical Specification Amendment dated April 25, 1994

2) Teleconference dated April 25, 1994, between the Nuclear Regulatory Commission (NRC) and the Commonwealth Edison Company (CECo)

Dear Mr. Russell,

The reference letter transmitted CECo's request for an Emergency Technical Specification amendment to Section 3/4.4.5. Per the referenced teleconference CECo is providing additional details to address several items regarding our Emergency Technical Specification amendment request. The Attachment addresses our response.

If you have any questions concerning this correspondence, please contact this office.

Sincerely,

Denise Saccomando
Nuclear Licensing Administrator

Attachment

cc: R. Assa, Braidwood Project Manager
S. Dupont, Senior Resident Inspector-Braidwood
J. Martin, Regional Administrator-Region III
Office of Nuclear Facility Safety-IDNS

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ATTACHMENT

A) Discuss the control and processing of contaminated water.

This discussion will consist of three sections. The first section will discuss actions to minimize secondary contamination when a steam generator (SG) tube leak is detected. The second section will deal with the method of leaking SG cooldown. The third section adresses methods of processing contaminated secondary water.

1. MINIMIZING SECONDARY CONTAMINATION

Steps to minimize secondary contamination are contained in Braidwood SG tube leak and SG tube rupture (SGTR) procedures; Braidwood Operating Abnormal Procedure (BwOA) SEC-8, "Steam Generator Tube Leak," Braidwood Emergency Operating Procedure (BwEP)-3, "Steam Generator Tube Rupture," respectively. All licensed operators are trained on these procedures during initial license training and requalification training.

During October, 1993, the Braidwood Unit 1, "C" (1C) SG developed a 300 gallon per day (gpd) tube leak. BwOA SEC-8 was entered and the unit was subsequently shut down. During this event, all contaminated water was processed without creating contamination problems in any auxiliary systems. Since this event, the following procedural enhancements have been incorporated into BwOA SEC-8:

> Auxiliary steam will be transferred to the non-affected unit or the auxiliary boiler. This will minimize contamination of the auxiliary steam system. Care should be taken to ensure the unit auxiliary steam systems are not cross connected and the auxiliary steam return should be aligned to the non-affected unit. Gland sealing steam for the affected unit will be left on main steam to limit the production of contaminated water.
>
> Plant walkdowns will be initiated by the Operating Department. All isolable leaks will be isolated. Any leaks that can not be isolated will be contained and directed to floor or equipment drains. Radiation Protection will be notified of any steam leaks that may require monitoring for off-site release (ie. main steam flash tank vent, leaking feedwater heater reliefs).
>
> Radiation Protection will be notified to monitor radiation levels, and initiate surveys to monitor for contaminated areas in the turbine building, main steam tunnel, and condensate polishers (CPs). Radiation Protection will also quantify the release to verify off-site releases are below regulatory limits.

The Station Duty Officer or Duty Operating Engineer will be consulted to determine the method for processing of the water. Normally, condensate water is "cleaned up" via the CP System, however, with contaminated secondary side water, the water will be processed via the blowdown system in Rad Waste. This system configuration up will minimize the amount of secondary side contamination and on-site dose to personnel.

Rad Waste will be notified of the potential for contamination in secondary systems. Blowdown, turbine building sumps and auxiliary steam could be affected. Blowdown return may be realigned to the condenser hotwell rather than the condensate storage tanks (CSTs). Consideration will be given to isolating hotwell makeup and overflow.

2. LEAKING STEAM GENERATOR COOLDOWN PROCEDURES

The following discussion addresses three procedures: BwEP Event Specific (ES) -3.1, "POST-SGTR COOLDOWN USING BACKFILL," BwEP ES-3.2, "POST-SGTR COOLDOWN USING BLOWDOWN," and BwEP ES-3.3, "POST-SGTR COOLDOWN USING STEAM DUMPS," that would be used to cooldown a leaking steam generator. Specific plant conditions, available operating equipment, and the potential for radiological releases are various factors that the Operating Department will consider when selecting a cooldown method. Training on these various procedures is given to all licensed operators during initial and requalification training.

ES-3.1, "POST-SGTR COOLDOWN USING BACKFILL," is the preferred method for cooldown and depressurization of a SG with a large leak. Normal letdown is required to be available to control Pressurizer level during the cooldown. This method minimizes any radiological releases and the spread of contamination. Primary coolant is processed through the normal liquid waste systems, thus reducing personnel radiation exposure. This method will not be effective for small leaks due to the small amount of water that can be transferred back to the Reactor Coolant System.

ES-3.2, "POST-SGTR COOLDOWN USING BLOWDOWN," is the preferred method for cooldown and depressurization of a SG with a small leak. This method, which requires the SG blowdown system to be in service, also minimizes any radiological releases and provides for a timely cooldown and depressurization of a SG with a small leak.

ES-3.3, "POST-SGTR COOLDOWN USING STEAM DUMP," which requires the condenser to be available, provides a more rapid method of depressurizing the leaking SG(s) by discharge steam through the steam dumps to the condenser or to the environment through the atmospheric relief valves. This method is least desirable because of the potential radiological releases to the environment and is not recommended except as a last resort. Releases from the affected SG(s) would be controlled inorder not to exceed Title 10, Code of Federal Regulations, Part 20 (10 CFR 20) limits.

These post-SGTR cooldown methods provide alternative procedures for the depressurization of a leaking steam generator. Due to the similarity of these procedures, they may be used simultaneously if more than one SG is leaking (using ES-3.1 on one SG and ES-3.2 on another SG), or to expedite the depressurization of one of the SGs (using both ES-3.1 and ES-3.2 on one SG). These procedures may be used consecutively as plant conditions change as long as the limitations of each procedure are observed (start with ES-3.1, later shift to ES-3.2)

3. PROCESSING CONTAMINATED SECONDARY WATER

Due to the design of the radwaste system, there are many options for processing contaminated secondary water. Radioactive waste operating procedures provide direction for different processing paths for secondary water. The process path is determined by considering the activity of the water, the amount of water to be processed and the storage tank space available.

Contaminated SG blowdown would be directed to the blowdown monitor tank via the steam generator blowdown mixed bed demineralizer. If further processing is required the blowdown monitor tank would be reprocessed through the steam generator blowdown mixed bed demineralizer.

Once the secondary water is in the blowdown monitor tank it can be sent to the condenser hotwell or the CST. If the contamination is low enough and sufficient storage is available this would be a desirable process method.

Water can also be sent from the blowdown monitor tank to the primary water storage tank if the water meets the requirements for reactor grade makeup water and sufficient storage is available.

Water can also be sent from the blowdown monitor tank to the radioactive waste release tanks. If the water meets the limits for release it can be released, if not, it can be sent to the regeneration waste tank and be processed through the non-blowdown liquid radioactive waste system. By using this path the water would enter the normally radioactive portion of the rad waste system and would be processed and released. This could be done if storage space was not available or activity levels were high and extensive reprocessing was required.

B) Discuss the training Braidwood has performed on Steam Generator tube leaks/Steam Generator Tube Ruptures to meet the recommendations of the Institute for Nuclear Power Operations Significant Operating Experience Report (SOER) 93-01?

The Braidwood training department routinely runs small steam generator tube leak and SGTR simulator scenarios. Various SG tube leak/rupture scenarios have been run since experiencing the tube leak in the fall of 1993. Two particular scenarios, as described below, address training issues presented in SOER 93-01:

1. A SGTR on the 'A' SG occurs with the steam jet air ejector radiation monitor out-of-service and the main steamline radiation monitors on the 'A' main steamline failed as is.

2. A 420 gpd tube leak on the 'A' SG occurs, followed by a SGTR on the 'B' SG.

Other scenarios are currently being run with small steam generator tube leaks as are scenarios with Main Steam Line Breaks coincident with SGTRs. Future scenarios will also include faulty radiation monitor indications. In addition, following the 1993 tube leak, data was collected on actual plant response, and is being used to modify the simulator modeling to reproduce this event.

C) Discuss how Braidwood ensures that criteria for diagnosing a SGTR is continuously monitored.

BwEP-0, "Reactor Trip Or Safety Injection," provides diverse diagnostic methods for determining if a SGTR actually exists. In this procedure, steam jet air ejector, SG blowdown, and main steamline radiation monitors are checked first since they give the initial response to a SGTR. If radiation monitors have not indicated the presence of a SGTR, a check is made for increasing SG level followed by a check for increased activity in any SG blowdown samples. Any of these checks will transition the operator to BwEP-3 "Steam Generator Tube Rupture" . If the initial pass through the diagnosis steps in BwEP-0 is inconclusive, the procedure loops back to re-perform these same checks. Procedure usage rules do not allow an exit from BwEP-0 until a diagnosis is made.

Other BwEPs also have continuous action steps to check for indications of SGTR. A check for secondary radiation exists in BwEP-2 "Faulted Steam Generator Isolation" that requires a transition to BwEP-3. BwEP-1 "Loss of Reactor or Secondary Coolant" has continuous checks for SG level and radiation conditions on its Operator Action Summary page that require a transition to BwEP-3.

D) Discuss how Braidwood trends radiation monitors during normal operation for the existence of small steam generator tube leaks?

The Braidwood Chemistry Department currently samples the SGs four times per week for activity per Braidwood Chemistry Procedure (BwCP) PD-4. The Operating Department is instituting a change to its main control room surveillances to require that an hourly trend of the steam jet air ejector radiation monitor activity level be printed on a daily basis. This printout will be reviewed for any changes in the last 24 hours and then compared to previous printouts to determine long term trends.

E) Provide justification for a 150 gpd Technical Specification leakage limit considering higher than expected growth rates seen at Braidwood.

Braidwood will implement a maximum leakage rate of 150 gpd per SG to help preclude the potential for excessive leakage during all plant conditions. The proposed Braidwood technical specification limits on primary-to-secondary leakage at operating conditions will require actions if leakage exceeds 600 gpd for all SGs, or a maximum of 150 gpd for any one SG. In conjunction with the 150 gpd Technical Specification limit requiring plant shutdown, Braidwood administratively requires plant shutdown at leakage rates less than 150 gpd based on change in leakrate criteria. A change in leakrate of greater than 25 gpd in one hour requires plant shutdown even with leakage less than 150 gpd. This response to operating leakage trends, is consistent with Draft NUREG-1477 "Voltage Based Interim Plugging for Steam Generator Tubes-Task Group Report" guidance that plant actions responding to trends in leakage as part of an effective leakrate monitoring program coupled with the 150 gpd limit provides reasonable assurance of a plant shutdown prior to tube rupture.

Regulatory Guide (RG) 1.121 "Basis for Plugging Degraded PWR Steam Generator Tubes," Revision 0, August 1976 also addresses the criteria for establishing operational leak rate limits that require plant shutdown. These limits are based upon leak-before-break considerations to detect a free span crack that could potentially rupture during faulted plant conditions. The 150 gpd limit would provide for leakage detection and plant shutdown, in the event of the occurrence of an unexpected single crack resulting from leakage that is associated with the longest permissible freespan crack length. The longest permissible crack is the length that provides a factor of safety of 1.43 against burst at faulted conditions maximum pressure differential. A voltage amplitude of 4.54 volts for typical Outside Diameter Stress Corrosion Cracking (ODSCC) corresponds to meeting this burst criteria at a lower 95% prediction limit on the burst correlation coupled with 95/95 Lower Tolerance Limit (LTL) material properties. Alternate crack morphologies can correspond to 4.54 volts so that a unique crack length is not defined by the burst pressure versus voltage correlation. Consequently, typical burst pressure versus through-wall crack length correlations are used below to define the "longest permissible crack" for evaluating operating leakage limits.

The single through-wall crack lengths that result in tube burst at 1.43 times the main steam line break (MSLB) pressure differential, and 1.0 times the MSLB break pressure differential are 0.51 inch and 0.75 inch respectively. A leak rate of 150 gpd will provide for detection of 0.4 inch long cracks at nominal leak rates and 0.6 inch long cracks at the 95% confidence level leak rates. Since tube burst is precluded during normal operation due to the proximity of the tube support plate (TSP) to the tube and the potential exists for the crevice to become uncovered during MSLB conditions, the leakage from the maximum permissible crack should preclude tube burst at MSLB conditions. Thus, the 150 gpd limit provides sufficent time for plant shutdown prior to reaching critical crack length for MSLB conditions. If measurable primary-to-secondary leakage is detected, it is reasonable to assume that multiple cracks would be contributing to the overall steam generator tube leakage, adding conservatism to the leak-before-break evaluation.

Braidwood Unit 1 Cycle 4 growth rates were calculated for all four SGs to be 0.23 volts per effective full power year (EFPY). This is slightly higher than most other plants that average between 0.1 and 0.2 volts per EFPY. Braidwood also had the advantage of performing a 100% inspection of the 1C SG tubing during October 1993 as a result of a primary-to-secondary leak unrelated to ODSCC. This allowed growth evaluations for the 1C SG for the periods of October 1992 to October 1993, and November 1993 to March 1994. The average growth rate in 1C SG for the first portion of Cycle 4 was 0.19 volts per EFPY, and only 0.11 volts per EFPY in the second portion. A few indications showed abnormally large growth rates during Cycle 4, with the largest being 9.76 volts.

Although Braidwood had sightly higher than average growth rates, and some indications showing abnormal growth, it should be noted that the 150 gpd limit is independent of growth rate. The 150 gpd limit is designed to provide for detection of leakage through cracks before thy reach the MSLB tube burst lengths, and provides defense in depth against a postulated crack that grows more than expected.