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Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Attention: Document Control Desk

SUBJECT: Braidwood Nuclear Power Station Units 1 and 2
NRC Dockets 50-456 and 50-457
BRAIDWOOD STATION RESPONSE REVISION TO
GENERIC LETTER 89-13

REFERENCES: a) NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-related Equipment" Dated July 18, 1989.

b) Commonwealth Edison Response to Generic Letter 89-13 attachment F page 3, from M. Richter/Commonwealth Edison Co. to U.S. Nuclear Regulatory Commission Document Control Desk, dated January 29, 1990.

c) Commonwealth Edison Response to Generic Letter 89-13 attachment F page 3, from K. Kaup/Commonwealth Edison Co. to U.S. Nuclear Regulatory Commission Document Control Desk, dated May 20, 1994.

The purpose of this letter is to notify the NRC of a change being made to previous commitments by Braidwood Station in response to Generic Letter 89-13 (reference a) in Section I: Surveillance and Control Techniques to Reduce Flow Blockage Problems Due to Biofouling. In the reference b response, Braidwood originally committed to injecting Sodium Hypochlorite into the service water system for a maximum of 20 hours/day due to Sodium Hypochlorite system design limitations. In the reference c response, Braidwood stated it was focusing its resources on improving the Sodium Hypochlorite system by installing a modification which would inject sodium hypochlorite through independent lines at the Lake Screen House to allow for 24 hour treatment of the service water systems. However, cost considerations require Braidwood to stop pursuing the Lake Screen House Sodium Hypochlorite Modification, and continue injecting sodium hypochlorite through the existing system.

A description of how the existing systems operate is as follows: There are five trains of service water at Braidwood Station. They are: Non-Essential service water, WS, and two 'A' trains and two 'B' trains of Essential Service water, SX. An 'A' and a 'B' train SX pump are crosstied through their discharge header crosstie valves to form a single Unit's SX system. Only one SX

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pump is operated at a time to supply a Unit's SX system. Due to air operated valves, check valves, and injection pumps, the existing sodium hypochlorite injection system will only inject into one of the five trains of service water at any one time. While one Unit's SX system is being treated, neither the other Unit's SX system, nor the WS system receives any treatment. This system limitation dictates a two step sodium hypochlorite injection program be followed. Therefore, in order to ensure no shelled mollusks become permanently established in the essential service water system (SX) the following two step treatment regimen will be followed when the Braidwood cooling lake transitions through sixty five degrees Fahrenheit in the spring and in the fall.

a) Braidwood Station will inject Sodium Hypochlorite for twenty three hours per day into one Unit's SX system for a two week time period. The remaining hour per day will be used to treat WS.

b) Braidwood Station will then inject Sodium Hypochlorite for twenty three hours per day into the second Unit's SX system for a three week time period. The remaining hour will be used to treat WS.

c) Braidwood Station will continue with the SX system heat exchanger and cooler inspection program per 89-13 Guidelines on Trending Results to judge the performance of the biocide injection and to ensure that clams, corbicula, zebra mussels, or any other shelled mollusk do not become established in the SX system.

Details and justification of the changes are contained in the attachment to this letter.

Any questions on this issue can be directed to Howard James, System Engineering Secondary Systems Group Leader at (815)458-2801 Ext. 2475.

Sincerely,

Karl Kaup
Site Vice-President
Braidwood Station

cc: J. B. Martin, NRC Regional Administrator- RIII
R. R. Assa, Braidwood Project Manager
S. G. Dupont, Senior Resident Inspector (Braidwood)

ATTACHMENT A

REVISION TO BRAIDWOOD STATION COMMITMENT
FROM GENERIC LETTER 89-13

1. Background: Concentrated, fifteen percent (15%) Sodium Hypochlorite, NaOCl, is the biocide of choice at Braidwood Station for use in treating the main condenser cooling water and service water systems. It is routinely injected year round to prevent biological fouling of the plant heat exchangers, coolers, and condensers. Automatic timers are set up for a normal daily eight hour long chemical treatment of plant cooling water systems. The plant cooling water systems are broken up into the following four segments: the Unit 1 main condenser waterboxes, the Unit 2 main condenser waterboxes, the Non-Essential service water system (WS), and the Essential Service Water system (SX). Each of the above system segments are separately treated for two hours each day. The two hour Unit 1(2), condenser waterbox treatment is further broken up so that each of the four waterboxes on the condenser are only treated for twenty five minutes each day. When determining an effective methodology for chemical treatment of the above systems, there are several items which must be addressed and be bounded to find the limiting case. These items are: Annual Chlorination Time Periods, Chlorination Concentration, Chlorination Duration, and Chlorination System Limitations.

2.0 Annual Chlorination Time Periods: Braidwood Station has a healthy ecological system in its cooling lake. Clams are present. To date no adult Zebra mussels have been found. While Asiatic clams and Zebra mussels have different breeding cycles and have different tolerances to chlorine, it is desirable for Braidwood Station to develop a uniform treatment program to fit all shelled mollusks and mussels.

2.1 The annual time period for chlorination treatment for Asiatic is Spring and Fall when the Braidwood cooling lake is making the transition through sixty five degrees Fahrenheit. The basis for this treatment is the Spring and Fall breeding season for Asiatic Clams. By killing the spawn of the clams, they will not become established in the SX cooling system.

2.2 Zebra mussels only have one breeding period per year but it cannot be timed or predicted as with clams. (See 'Zebra Mussel Monitoring and Control Guide', Electric Power Research Institute, by Stone & Webster Environmental Services, Dec 1992, page 2-23, table 2-6) Settlement and growth of Zebra mussel spat is shown on figure 5-5 of the above EPRI Guide. Per the discussion in section 6.1.1, Oxidizing Chemicals, of the above EPRI Guide, continuous chlorination will either kill any Zebra Mussel spat/veligers, or the veligers will cease swimming and pass through the system. Further, Figures 6-1 and 6-2, pages 6-4 and 6-5 of the above EPRI Guide show that after several weeks of chlorination a very high mortality of zebra mussels can be

obtained. By chlorinating in the Fall, the Zebra mussel spat which may have settled in the system during the late summer will be killed before the shells have grown large enough to pose the threat of heat exchanger, cooler, or condenser tube blockage.

2.3 Therefore, Braidwood Station has concluded that the limiting yearly chlorination treatment time periods for clam control are in the spring and fall when the cooling lake temperature transitions through sixty five degrees. The Braidwood Station NaOCl injection timers are changed so that NaOCl is injected almost continuously. Continuous injection is desired to prevent Asiatic clams, corbicula, zebra mussels, or any other shelled mollusk from becoming established in plant cooling water systems and blocking any heat exchanger, cooler, or condenser flows.

3.0 Chlorination Concentration: The Braidwood Station NaOCl chemical feed system (CF) is designed to inject up to one part per million of chlorine into the CW system, up to six parts per million of chlorine into the SX system, and up to two parts per million into the WS system. The CF system obtains these chlorine concentrations by the use of metering pumps sized to inject the proper amount of NaOCl into the applicable system.

3.1 The main condenser water boxes, CW system, are each nominally chlorinated for one half hour (twenty five minutes of chemical injection) at a chlorine concentration of approximately one part per million. Per the EPRI Guide above, page 6-6, this is not enough chlorination to prevent the attachment and growth of zebra mussels. However, NPDES Permit No. IL0048321, Appendix B to the Braidwood Station Technical Specification, does not allow any greater chlorination than is already performed. Braidwood Station has never found live clams, or live or dead Zebra mussels in the Station CW system.

3.2 The WS system is chlorinated with a concentration of up to two parts per million for a period of two hours each day. During the Spring and Fall 'Clam Killing Injection' time period the injection period has been cut back to twenty five minutes per day. While the general condition of the WS system heat exchangers, coolers, and condensers has been excellent after following the above injection scheme, if NaOCl injection stops or falls below two hours per day, the condition of the heat exchangers, coolers, and condensers can deteriorate quite quickly. Recent heat exchanger/system inspections have found no live clams in the WS system except for one time in the Boron Thermal Regeneration System Chiller heat exchanger where small live clams were found. Therefore, Braidwood Station feels that the chlorine concentration is correct for the WS system but that the time the chlorine is injected during the 'Clam Killing Injection' time period should be increased to guarantee that no clams grow anywhere in the system.

3.3 The SX system is normally chlorinated for two hours per day with a chlorine concentration of up to six parts per million. During the Spring and Fall 'Clam Killing Injection' time period the injection period has been increased to the maximum amount possible which is typically nineteen and one half hours per day. The SX system heat exchangers have been very clean and no live clams have ever been found in the system. Per the above EPRI Guide, these concentrations for these time periods are more that enough to kill all Zebra Mussels. Braidwood Station feels that the chlorine concentration is correct for Zebra mussels and is either more than adequate, or even excessive, for Native clams and mollusks. A change in the stroke of the service water system NaOCl metering pump to reduce the NaOCl in the SX system would also reduce the concentration in the WS system which is currently not acceptable.

3.4 Therefore, the limiting cases on chlorine concentration are bounded by permit limitations and the existing system design, and the current chlorine concentrations are acceptable.

4.0 Chlorination Duration: Asiatic clams, corbicula, and other native mollusks can be killed with moderate amounts of chlorine over a period of approximately one hundred hours. Zebra mussels are much more difficult to kill and are the limiting case. Based on 'Zebra Mussel Monitoring and Control Guide', Electric Power Research Institute, by Stone & Webster Environmental Services, Dec 1992, pages 6-4 and 6-5, figures 6-1 and 6-2, chlorine levels on the order of one part per million for a period of two weeks in fifty four to sixty five degree Fahrenheit water will achieve almost a one hundred percent kill rate. On page 6-3 of the above EPRI Guide, the last paragraph states that "If the temperature is lower, the chlorination period needs to be prolonged..." The most conservative time period for chlorination will be the fall time period where the cooling lake makes the transition from warm to cold. If Braidwood Station begins continuous chlorination as the station cooling lake transitions through sixty five degrees Fahrenheit, the temperature could be in the range of low to middle fifties when chlorination is completed. Further, shelled mollusks are more resistant to NaOCl than spawn or spat. If spawn or spat are allowed to settle they will develop juvenile shells and chlorination duration must be increased to kill them. A duration of two weeks is sufficient to kill the spawn of clams during the breeding season, and any new spat of Zebra mussels. However, due to system design limitations discussed below, separate individual chemical treatment injections are required for the Unit 1 and Unit 2 SX systems. To compensate for the time delay associated with the chlorination of the second Unit treated, for the reduced effectiveness of the NaOCl at lower temperatures, and for the possibility of juvenile shells, the duration of chlorination for the second Unit to be treated shall be increased to three weeks.

5.0 Chlorination System Limitations: The existing Braidwood Station chlorination system for service water has several key limitations. These items were to be addressed in a modification which was to install an NaOCl injection system at the Braidwood Station Lake Screen House. However, in August, 1994 the modification was cancelled due to economic considerations. The existing chlorination system will be upgraded and temporarily altered to bypass some of the limitations. They are:

5.1 The existing control stepper switch requires that chlorination occur in the following sequential order: all four Unit 1 condenser waterboxes, all four Unit 2 condenser waterboxes, the Non-Essential service water system, and finally both operating trains of the Essential service water system. No item may be skipped. Each item must be stepped through. The Unit 1 and Unit 2 SX systems can not be independently treated. A Temporary Alteration per the Station approved procedure will be processed to allow parallel chlorination of the CW system with the WS and SX systems in the Fall of 1994. This will increase the total time available for WS and SX system chlorination from twenty hours per day to twenty four hours per day. The time will be split with WS receiving one hour of chlorination per day and SX receiving twenty three hours per day. Each Unit's CW system will continue to receive treatment for up to two hours per day per Unit condenser as allowed by the NPDES Permit. If the above temporary alteration works as well as expected a permanent change will be initiated.

5.2 The existing CF system requires a Sodium Hypochlorite Service Water Booster Pump to inject the NaOCl metered into the service water systems. The WS and SX systems use the same pump for injection of chlorine into the systems and share a common booster pump discharge header. Since the WS and SX systems operate at different pressures, only one system can be injected into at a time. If dual system injection was attempted, all of the chlorine would be injected into the system which was operating at the lowest pressure. A modification to split out the WS NaOCl injection system from the SX NaOCl injection system is in the conceptual stage and may or may not be feasible due to economic constraints. For the short term, either SX or WS must be chosen for chlorination. SX is required for the safe shutdown of the plant. Some daily WS chlorination is required to maintain the balance of plant heat exchangers and coolers in an operating condition so that the plant can operate and generate electricity. Braidwood Station has decided that by processing the temporary alteration in paragraph 5.1 above, chlorination times can be increased to both the SX and WS systems over what is currently obtainable. Braidwood Station will rely on future heat exchanger, cooler, and condenser inspections to determine if this chlorination scheme is adequate.

5.3 Sodium Hypochlorite, NaOCl, is injected into the SX system through a single line which penetrates the Auxiliary Building wall. Four air operated valves, AOVs, direct the NaOCl into the

two operating trains SX pump discharge. The idle SX train AOVs are shut. One of each of the 'A' and 'B' train SX pumps are crosstied to feed either the Unit 1 or Unit 2 SX system. However, the Unit 1 and Unit 2 SX trains operate at different pressures and the train with the higher discharge pressure will hold its NaOCl supply check valve shut and the NaOCl will be injected into the Unit with the lower operating pressure. There is no easy way to either modify, temporarily alter, or manually manipulate the system to inject equal amounts of NaOCl into the Unit 1 and Unit 2 SX systems. In order to guarantee that NaOCl is injected into both Unit's SX systems, they must be injected one at a time and compensatory actions must be taken. Therefore, during the spring and fall clam breeding season, one Unit's SX system will have to be isolated from the chemical injection system and NaOCl will be injected into the other Unit's SX system for a period of two weeks. This will kill all spawn or spat in the NaOCl injected Unit's SX system and no clams will become established in that Unit. Then, the NaOCl injection will be switched to the second Unit which was isolated and that Unit's SX system shall be injected with NaOCl for a period of three weeks. This will kill all spawn or spat which may have become established while the first Unit's SX was being injected for two weeks. The second Unit's SX system will have to be injected for a longer period of time because the spawn or spat may have formed small protective shells and in the fall, because the water temperature may have fallen into the temperature region where NaOCl treatment was not as effective as when the water was warmer.

6.0 Recommendation: With the above discussion and limiting cases, the following sodium hypochlorite injection/inspection plan is recommended for control of shelled mollusks in the Essential Service water system at Braidwood Station when the cooling water lake makes it annual transition through sixty five degrees in the spring and the fall.

a) Braidwood Station will inject Sodium Hypochlorite for twenty three hours per day into one Unit's SX system for a two week time period. The remaining hour per day will be used to treat WS.

b) Braidwood Station will then inject Sodium Hypochlorite for twenty three hours per day into the second Unit's SX system for a three week time period. The remaining hour will be used to treat WS.

c) Braidwood Station will continue with the SX system heat exchanger and cooler inspection program per 89-13 Guidelines on Trending Results to judge the performance of the biocide injection and to ensure that clams, corbicula, zebra mussels, or any other shelled mollusk do not become established in the SX system.

If any live clams or mollusks are found during heat exchanger, cooler, or condenser inspections, the sodium hypochlorite injection periods or concentrations will be re-evaluated.