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

April 30, 1979

Docket No. 50-409

Mr. Frank Linder
General Manager
Dairyland Power Cooperative
2615 East Avenue South
La Crosse, Wisconsin 54601

Dear Mr. Linder:

RE: TOPIC V-12.A - WATER PURITY OF BOILING WATER REACTOR PRIMARY COOLANT

Enclosed is a copy of our draft evaluation of Systematic Evaluation Program Topic V-12.A. You are requested to examine the facts upon which the staff has based its evaluation and respond either by confirming that the facts are correct, or by identifying any errors. If in error, please supply corrected information for the docket. We encourage you to supply for the docket any other material related to this topic that might affect the staff's evaluation.

Your response within 30 days of the date you receive this letter is requested. If no response is received within that time, we will assume that you have no comments or corrections.

Sincerely,

Dennis L. Ziemann

Dennis L. Ziemann, Chief
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Enclosures:
Topic V-12.A

cc w/enclosure:
See next page

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LA CROSSE

TOPIC V-12.A WATER PURITY OF BOILING WATER REACTOR PRIMARY COOLANT

Topic V-12.A was included in the Systematic Evaluation Program in order that BWR compliance with Regulatory Guide 1.56 be determined. Regulatory Guide 1.56, Revision 1, July 1978, had been determined by the NRC's Regulatory Requirements Review Committee to be a "backfit" (Category 3) item. This means that plants on which this and other backfit guidance is to be implemented must comply with the guidance or have satisfactory alternatives.

Although the topic definition mentions that there are proposed revisions to Regulatory Guide 1.56, and although NUREG-0531 ("Investigation and Evaluation of Stress Corrosion Cracking in Piping of Light Water Reactor Plants," February 1979) recommends oxygen control in BWRs, we have determined that Regulatory Guide 1.56, Revision 1, July 1978, in its "For Comment" form, is the latest approved staff guidance and have therefore based our review upon this guidance. The specific points of the regulatory position are quoted below and an explanation of the licensee's degree of conformance follows. Information for this review was obtained from the licensee's Technical Specifications, applicable plant drawings, and March 21 and 22, 1979 telephone conversations with his staff.

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I. Regulatory Position 1.

The licensee should establish appropriate limits for the electrical conductivity of purified condensate to the reactor vessel (the electrical conductivity of the BWR feedwater cycle and that of the reactor water cleanup cycle). Separate limits may be required for such operating conditions as startup, hot standby, low power, high power, and at temperatures $\leq 212^{o}F$ ($100^{o}C$).

Chemical analyses for dissolved and suspended impurities should be performed as called for in the plant technical specifications. A conductivity meter should be provided at each condenser hotwell or in the line between the hotwell and the condensate demineralizer with sufficient range to measure at least all levels of conductivity up to and including the limiting conditions of the technical specifications that require immediate shutdown of the reactor. The recording conductivity meters recommended in regulatory position 4.a may be used for this purpose.

La Crosse Technical Specification 4.2.2.2 requires that reactor coolant conductivity be limited to a maximum of 5 μmho/cm. Although no sampling is called for in this specification, plant procedures do call for a daily sample during reactor operation and a sample once every 3 days when the reactor is shutdown. The licensee has also established limits and sampling frequencies for the demineralyzers of the condensate system. Two out of the three beds will be on service when reactor power is greater than 50%. A weekly sample, by plant procedure, determines chloride, turbidity, conductivity, and gross beta-gamma activity, both on the discharge of the condenser hotwell and on the discharge of the demineralyzer bed(s) on service. From this sample the bed DF (decontamination factor) is determined. The resin beds are replaced (no resins are regenerated at La Crosse) based on a decreasing DF and an increase in bed effluent conductivity, with the limit established at .1 μmho/cm.

The primary purification system (La Crosse does not have a Reactor Water Cleanup System) contains two demineralyzer beds, one a cation bed and the other a mixed bed. Each of these is sampled weekly by plant procedure and the same criteria (conductivity and DF) applied for replacement determination as on the condensate demineralyzers.

The requirement for conductivity meters shall be discussed below under Regulatory Position C.4.a.

II. Regulatory Position 2.

The licensee should establish the sequential resin regeneration frequency or resin replacement frequency required to maintain adequate capacity margin in the condensate treatment system for postulated condenser cooling water inleakage. The capacity required and corresponding resin regeneration or replacement frequency will depend on several parameters, including condenser cooling water composition, chloride concentration, flow rate in each demineralizer unit, type and quantity of resin, cation/anion resin ratio, postulated condenser leakage, and time for orderly reactor shutdown.

As noted above, La Crosse does not regenerate resins. Measurements of Mississippi River water (which cools the main condensers and acts as service water) have shown the chloride levels to be approximately 9 ppm, a very low level. Gross condenser leakage, certainly detectable by the meters noted below or the samples mentioned above, would have to occur before the demineralyzers would be seriously challenged. Typical weekly samples of the primary coolant system and the condenser hotwell result in chloride readings less than .02 ppm, which is the lower level of detectability for the sampling technique being used.

We concur with the licensee that his sampling criteria and frequency, coupled with the instrumentation of the systems, serve as a reasonable alternative to the establishment of any particular resin replacement frequency.

III. Regulatory Position 3.

The initial total capacity of the new anion and cation demineralizer resins should be measured. Anion exchange capacity may be determined by a procedure recommended by the resin manufacturer. The total exchange capacity of the cation resin may be measured by a procedure recommended by the resin manufacturer or by paragraphs 41 through 49 of ASTM D2187-71, "Standard Methods of Test of Physical and Chemical Properties of Ion-Exchange Resins." For resins that are to be regenerated, these determinations should be repeated at least semiannually. The resins should be discarded and replaced when their capacity following regeneration falls below 60 percent of the initial value. More frequent determinations should be made at plants using seawater or other water containing large amounts of dissolved or suspended matter as coolant in their heat exchangers. For resins that are not regenerated but are instead replaced periodically with material of the same type, measurements of initial capacity should be made on a sample of new material at least once a year (when the time between replacements is less than 1 year) or at each replacement (when the time between replacements exceeds 1 year). When the type of anion or cation resin is changed, a measurement of total capacity of the replacement resin should be made prior to use in the demineralizer.

No determination of initial resin capacity is performed at La Crosse. We agree that such determination is unnecessary, given the purity of the cooling water, the sampling of the systems and the instrumentation of the systems. The instrumentation and the sampling serve to assure replacement of the resins in a timely manner.

IV. Regulatory Position 4.

4. The licensee should verify the minimum residual demineralizer capacity in the most depleted demineralizer unit established in accordance with the recommendations of regulatory position 2 is maintained. The following is an example of an acceptable method for determining the condition of the demineralizer units so that the ion exchange resin can be replaced or regenerated before an unacceptable level of depletion is reached.

a. Recording conductivity meters should be installed at the inlet and outlet of both the condensate treatment system and reactor water cleanup system. The range of these instruments should be sufficient to measure all levels of potential water conductivity specified in the plant technical specifications. For the condensate treatment system, the conductivity meter readings should be calibrated so that estimates of condenser leakage can be made based on cooling water conductivity, condensate conductivity, and flow rate. The chemical composition of the cooling water and its relation to specific conductance should be established and periodically confirmed so that estimates of residual demineralizer capacity can be made.

b. A recording flowmeter should be used to measure the rate of flow through each demineralizer.

c. The quantity of the principal ion(s) likely to cause demineralizer breakthrough should be calculated by:

(1) Converting the conductivity readings of the water entering the demineralizer to weight fraction (e.g., ppm or ppb) of the principal ion(s) and

(2) Integrating over time the product of concentration of this ion(s) and demineralizer flow.

The input quantity of ion(s) to the demineralizers should be determined at a frequency adequate to ensure sufficient residual ion exchange capacity in the event of a major condenser leakage to prevent exceeding reactor coolant limits.

d. Each demineralizer unit should be replaced or regenerated when the remaining capacity (calculated by subtracting the total utilization determined from conductivity and flow measurements in accordance with regulatory position 4.c from the initial capacity determined in accordance with regulatory position 3) approaches the minimum residual demineralizer capacity determined in accordance with regulatory position 2. The accuracy of the above calculation should be checked by measurements made on resin samples taken when demineralizer units are removed from service for regeneration or resin cleaning. Measurements on samples from each unit should be made at each of the first two such removals from service and at every fifth such removal from service thereafter. If appropriate, the actual measurements may be used to adjust the calculated value of residual demineralizer capacity. Such adjustment and its justification should be reported to the NRC in the annual operating report.

Once again, the licensee does not believe that such determination is necessary, given the unique characteristics of the La Crosse plant and its river coolant. We agree with this assessment and note that the following instruments, as determined from the La Crosse drawings and discussions with licensee personnel, are provided to assure early operator notification of potential problems:

A. Conductivity instruments:

(1) Feedwater system -

One conductivity element, indicator, recorder,* and alarm on the inlet to the condensate demineralyzer system.

One conductivity element, indicator, recorder,* and alarm on the discharge of each of the three demineralyzers.

(2) Purification system -

One conductivity element on the inlet to the two resin beds, one on the discharge of each of the beds. Each element feeds a common recorder* and alarm, although only the element on the discharge of the last bed is presently alarmed.

* Although the drawings do not specifically explain this, these instruments in La Crosse are actually multipoint recorders in the control room. All alarms are in the control room.

B. Flow measuring instruments:

(1) Feedwater system -

There is a flow element, with associated indicator and alarm (control room) on the inlet to each condensate demineralyzer.

(2) Purification system -

There is a flow element, with associated indicator and alarm (control room) on the discharge of the resin beds (they are in series).

V. Regulatory Position 5.

The conductivity meter(s) located at the inlet and outlet of the demineralizer(s) of the condensate treatment system and the reactor water cleanup system should be set to trigger alarms in the control room when, as a minimum, either of the following conductivity levels is reached (values of which should be determined by the licensee):

a. The level that indicates marginal performance of the demineralizer systems.

b. The level that indicates noticeable breakthrough of one or more demineralizers.

The alarm setpoints at La Crosse are as follows:

(1) Feedwater system

2 μmho/cm on the hotwell outlet (inlet to the demineralyzers)

.1 μmho/cm on the outlet of each demineralyzer bed

(2) Purification system

5 μmho/cm on the discharge of the last of the two beds in series

These limits do not conform to the limits contained in the guidance. Suggested action is noted in the discussion of Regulatory Position 6 which follows.

VI. Regulatory Position 6.

The chloride content in the reactor vessel water should be maintained as low as practical. The ionic equilibria of the reactor vessel water should be controlled to ensure a neutral pH. The licensee should establish limits for conductivity, pH, and chlorides in the reactor vessel water and should specify procedures to be used for their determination. Acceptable reactor water chemistry limits are given in Table 1 of the appendix to this guide. If the limiting values of the conductivity, pH, or chloride content are exceeded, appropriate corrective actions as defined in the plant technical specifications should be taken.

Given that the river water contains only approximately 9 ppm chloride, chances for a gross and undetected chloride intrusion are small. However, there are areas of disagreement between the guidance limits and the licensee's limits. A comparison follows:

	Parameter	R.G. 1.56 limit	La Crosse limit
(a)	Conductivity	1 μmho/cm at steaming rates greater than 1% of rated steam flow (maximum limit established at 10 μmho/cm, which would require orderly shutdown, but 72 hours above 1 μmho/cm and .2 ppm chloride allowed per incident not to exceed 2 weeks per year)	5 μmho/cm (no dependence on power or flow, and can be exceeded for periods no longer than 24 hours provided maximum chloride does not exceed 1.0 ppm)
(b)	Chloride	.2 ppm at steaming rates greater than 1 % of rated steam flow (maximum established at 0.5 ppm, which would require orderly shutdown, but 72 hours above .2 ppm and 1 μmho/cm allowed per	.1 ppm (no dependence on power or flow, and can be exceeded for periods no longer than 24 hours provided maximum chloride does not exceed 1.0 ppm)

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	Parameter	R.G. 1.56 limit	La Crosse limit
		incident, not to exceed 2 weeks per year)	
(c)	pH	limits between 5.3 and 8.6	None
(d)	Conductivity of the Feed-water System	.5 μmho/cm at the inlet to the demin-eralyzers (maximum of 10, requiring orderly shutdown)	2 μmho/cm
		.2 μmho/cm at the individual demin-eralyzer outlet	.1 μmho/cm

It is our belief that BWR pipe cracking has been proven to be such an extensive problem that the limits of Regulatory Guide 1.56 should be conformed to where the licensee does not already have equivalent or lower limits, and further that limits and sampling frequencies for pH should be established. With this modification, the licensee will conform to the intent of the regulatory guide. However, since the need for modification to the plant (including technical specification and procedural modifications) will be judged only during the integrated assessment, the licensee need taken no action at this time.

As a final point, the sampling procedures referred to above and any new or modified ones resulting from this review should be considered by the licensee and the NRC's Office of Inspection and Enforcement to be in a "privileged" status, requiring OIE review prior to revision in order that the basis for our determination in this matter remain extant.

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