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

August 9, 1979

Docket No. 50-155

Mr. David Bixel
Nuclear Licensing Administrator
Consumers Power Company
212 West Michigan Avenue
Jackson, Michigan 49201

Dear Mr. Bixel:

RE: TOPIC V-12.A - WATER PURITY OF BWR PRIMARY COOLANT
BIG ROCK POINT PLANT

Enclosed is copy of our draft evaluation of Systematic Evaluation Program Topic V-12.A, Water Purity of BWR Primary Coolant. 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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Division of Operating Reactors

Enclosure:
Topic V-12.A

cc w/enclosures:
See next page

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Enclosure

BIG ROCK POINT

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. As part of this review, the guidance of Regulatory Guide 1.56, Revision 1, was compared against the facility design. This Regulatory Guide had been specifically identified by the NRC's Regulatory Requirements Review Committee as needing consideration for backfit on operating reactors. The review documents whether the facility design complies with the guidance of the Regulatory Guide or has some equivalent alternative acceptable to the staff. The acceptability or non-acceptability of the deviations listed below and the need for further action shall be judged during the integrated assessment for this facility.

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 in 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, the licensee's response to a March 16, 1979 telephone conversation with his staff, and telephone conversations with his staff on May 8, 1979.

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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 ≤212°F (100°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.

Big Rock Point Technical Specification 4.1.2(b) establishes the following limits on primary coolant purity:

Maximum conductivity	5.0 umho/cm
Maximum transient conductivity*	10.0 umho/cm
pH	4.0 - 10.0
Chloride	1.0 ppm
Equilibrium Halogen Radioactivity	35.0 u Ci/ml
Boron	100.0 ppm

In addition, the specification requires a daily sample of the primary coolant to determine that no limit is being exceeded. Plant procedures also require a daily turbidity test of the coolant as a means of detecting impurities.

*This applies only to the period subsequent to a cold shutdown, between criticality and 24 hours after reaching 20% rated power.

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It is important to note specific statements in Technical Specification 4.1.2(b): "The following [limits stated above] are absolute limits which if exceeded shall necessitate reactor shutdown. Corrective action shall necessarily be taken at more stringent limits to minimize the possibility of these absolute limits ever being reached."

With this philosophy in mind, the licensee has established conductivity alarm setpoints for the condensate demineralizer effluent and reactor water cleanup demineralizer effluent at 1.0 umho/cm, substantially below the allowable limit of the specification. Further discussion of alarms, monitoring instruments, and the specific requirements of the Technical Specifications will be brought out in Sections 4, 5 and 6 which follow.

Big Rock Point will modify all Technical Specifications in the future to conform to the Standard Technical Specifications format and content. This should result in no decrease in the protection afforded by the present specifications and plant procedure requirements. We conclude that these requirements meet the intent of regulatory position 1.

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.

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Big Rock Point does not regenerate resins, choosing instead to replace the resin when certain criteria for replacement are met. The reason for replacement, vice regeneration, is that Big Rock Point is cooled by Lake Michigan, a fresh water source containing only 10 ppm chloride with conductivity levels of 200-240 umho/cm. Such a relatively pure water is not expected to cause resin exhaustion for a long period of time, thus making regeneration, with its attendent large amounts of acid, base, and fresh water, an unnecessary expense in equipment, time, and expendables.

Instead, Big Rock Point has established resin replacement criteria as follows:

(1) Number of days inservice on a resin bed and number and extent of condenser leaks (if any) during that period of service.

(2) Expected future operation of the plant - this may result in replacement in advance of that required by the other criteria and allows scheduling of the resin bed replacement when it is least likely to interfere with other planned activities.

(3) Differential pressure across each bed - retention of crud (corrosion products) on the resin beds will cause an increase in differential pressure and necessitate resin replacement in advance of that dictated by resin exhaustion alone.

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(4) Resin bed effluent conductivity

Although the plant has sufficient instrumentation to alert the operators to a tube leak, and although plant experience has shown resin replacements normally occur because of (1), (2) or (3) above (or a combination thereof) instead of (4), we are concerned that a condenser leak with failure or miscalibration of the extraction conductivity instrumentation could result in exhaustion of all resin beds at once and therefore no spare capacity with which to conduct an orderly reactor shutdown. The reason for this is that the three condensate demineralizer resin beds, although rated at 1/2-capacity each, are typically all inservice at power levels greater than 50 MWe, thus challenging all three units at once. Because of the relative purity of the cooling water, we can accept alternatives to the regulatory position such as the inclusion of weekly condenser effluent sampling with bed DF determination and use as a criterion, or the maintenance of one demineralizer unit in "charged" standby to allow orderly shutdown. No action is necessary, on the licensee's part, at this time, since any recommendations for physical or procedural changes will be reviewed at the completion of the staff's integrated assessment.

The replacement of resin in the RWCU system demineralizer is governed by the same four criteria stated above. However, in this case the maintenance of capacity is more important, in that any contaminants from condensate demineralizer breakthrough will tend to concentrate

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in the reactor, with RWCU the only means of removal other than an arduous "bleed and feed" reduction technique. Because there is only one RWCU demineralizer, special care must be taken to assure no breakthrough in the condensate system, especially with no spare capacity in the condensate and RWCU demineralizers. Therefore the recommendations above (or other acceptable alternatives) carry additional impact.

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.

The determination of initial capacity is not performed at Big Rock Point, but is instead specified in the purchase specifications for new resins to be used in the condensate and RWCU demineralizers. Capacity is to be determined in accordance with MIL R-22258 or an equivalent method. We find this to be acceptable, in that we agree with the licensee that the specific measurements

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of the Regulatory Guide are not necessary because of the cooling water purity. However, this conclusion depends upon the changes to be made in accordance with Position 2 above.

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.

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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 Big Rock Point plant and its river coolant. We agree with this assessment (with the exception noted in Position 2) and note that the following instruments, as determined from the Big Rock Point drawings and discussions with licensee personnel, are provided to assure early operator notification of potential problems:

A. Conductivity instruments:

(1) Feedwater system -

two conductivity elements (range 0-1 umho/cm),recorder and alarm (control room at 1.0 umho/cm)on the discharge of the main condenser prior to the condensate demineralizers.

one conductivity element (range 0-10 umho/cm),recorder and alarm (local at 1.0 umho/cm) on the discharge of each of the three condensate demineralizers.

(2) Reactor Water Cleanup System -

one conductivity element (range 0-1 umho/cm) and alarm (control room at 1.0 umho/cm) on the discharge of the RWCU demineralizer.

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(3) Steam drum (instead of RWCU inlet) -

one conductivity element (range 0-10 umho/cm), recorder, and alarm (control room at 2.0 umho/cm)

B. Flow measuring instruments:

(1) Feedwater system -

one flow element, transmitter, local recorder, and alarm on each of the three condensate demineralizers.

(2) Reactor Water Cleanup system -

one flow element, transmitter, and local recorder on the inlet to the RWCU demineralizer

Although the instrumentation satisfies the general requirements, we are concerned that the local alarms of the condensate demineralizers could signal a warning for as long as two hours before being noticed. This also gives added weight to the recommendations of Position 2 above.

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 alarms are listed above in Section 5 and satisfy the recommendations of the Regulatory Guide.

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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 lake water contains only approximately 10 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	Big Rock Point limit
(a)	Conductivity	1 umho/cm at steaming rates greater than 1% of rated steam flow (maximum limit established at 10 umho/cm, which would require orderly shutdown, but 72 hours above 1 umho/cm and .2 ppm chloride allowed per incident not to exceed 2 weeks per year)	5 umho/cm during power operation, with a 10 umho/cm maximum transient value allowed only during the period subsequent to a cold shutdown, between criticality and 24 hours after reaching 20% rated power. Alarms and required action are set much lower.
(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 umho/cm allowed per incident, not to exceed 2 weeks per year)	1.0 ppm during power operation

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(c)	pH	limits between 5.3 and 8.6	limits between 4.0 and 10.0
(d)	Conductivity of the Feed-water System	.5 umho/cm at the inlet to the demineralizers (maximum of 10, requiring orderly shutdown)	1 umho/cm (alarm)
		.2 umho/cm at the individual demineralizer outlet	1 umho/cm (alarm)

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.

Conclusion

With the modification of technical specifications as discussed in Position 6 and the recommendations of Position 2, the licensee will conform to the intent of the regulatory guide. However, since the need for modification to the plant (including technical specifications and procedural modificat ons) will be judged only during the integrated assessment, the licensee need take no action at this time.

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