September 15, 1982

Docket No. 50-155
LS05-82-09-050

Mr. David J. VandeWalle
Nuclear Licensing Administrator
Consumers Power Company
1945 W. Parnall Road
Jackson, Michigan 49201

Dear Mr. VandeWalle:

SUBJECT: SEP TOPIC XV-18, RADIOLOGICAL CONSEQUENCES OF MAIN STEAM LINE FAILURE OUTSIDE CONTAINMENT - BIG ROCK POINT

Our draft evaluation of Topic XV-18 was issued to you on May 20, 1982. You responded to this evaluation on June 29, and July 19, 1982. The staff has reviewed your June 29, 1982 review and still concludes, as they did in the draft evaluation, that without modifications, the radiological dose consequences are above the Standard Review Plan Criterion of 10% of 10 CFR 100 guidelines. It is therefore recommended that the plant adopt the GE Standard Technical Specifications for BWRs concerning iodine activity and control in the reactor coolant.

Accordingly, we are reissuing the draft SER as final except that the second paragraph on page 6 of the draft SER has been removed to account for the comment in your July 19, 1982 letter.

This evaluation will be a basic input to the Integrated Assessment for your facility. The assessment may be revised in the future if your facility design is changed or if NRC criteria relating to this topic are modified before the Integrated Assessment is completed.

SEO4
DSU use(15)
ADD:
G. Staley

Sincerely,

Original signed by:

Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
Division of Licensing

Enclosure:
As stated

cc w/enclosure:
See next page

*See previous concurrence

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| | 8/25/82 | 8/25/82 | 8/25/82 | 8/25/82 | 9/7/82 | 9/14/82 | 9/15/82 |

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Our draft evaluation of Topic XV-18 was issued to you on May 20, 1982. You responded to this evaluation on June 29, and July 19, 1982. The staff has reviewed your June 29, 1982 review and still concludes, as they did in the draft evaluation, that without modifications, the radiological dose consequences are above the Standard Review Plan Criterion of 10% of 10 CFR 100 guidelines. Additionally, the staff concludes that coolant iodine specifications established at values beyond the design basis envelope defeat the purpose of having technical specifications. Technical specifications should assure that the plant operates within the established design basis. It is therefore recommended that the plant adopt the GE Standard Technical Specifications for BWRs concerning iodine activity and control in the reactor coolant.

Accordingly, we are reissuing the draft SER as final except that the second paragraph on page 6 of the draft SER has been removed to account for the comment on your July 19, 1982 letter.

This evaluation will be a basic input to the Integrated Assessment for your facility. The assessment may be revised in the future if your facility design is changed or if NRC criteria relating to this topic are modified before the Integrated Assessment is completed.

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Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
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Enclosure:
As stated

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See next page

| OFFICE | | | SEPB | SEPB | SEPB | SEPB | ORB#5 |
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# XV-18 RADIOLOGICAL CONSEQUENCES OF A MAIN STEAM LINE FAILURE OUTSIDE CONTAINMENT

## I. INTRODUCTION

Rupture of a steam line outside containment will allow radioactivity contained in the coolant to escape to the environment. SEP Topic XV-18 is intended to review the radiological consequences of such failures. This review has encompassed those design features and technical specifications which limit the amount of radioactivity that can be released.

## II. REVIEW CRITERIA

Section 50.34 of 10 CFR Part 50 requires that each applicant for a construction permit or operating license provide an analysis and evaluation of the design and performance of structures, systems, and components of the facility with the objective of assessing the risk to public health and safety resulting from operation of the facility. The steam line break accident is one of the postulated accidents used to evaluate the adequacy of these structures, systems, and components with respect to public health and safety.

In addition, 10 CFR Part 100.11 provides dose guidelines for a Design Basis Accident.

III. RELATED SAFETY TOPICS

Topic II-2.C, "Atmospheric Transport and Diffusion Characteristics for Accident Analysis" which would provide the meteorological data used to evaluate the offsite doses has not been submitted to date. In lieu of this information, the staff evaluated the radiological consequences using the atmospheric dispersion factors obtained from Regulatory Guide 1.5 for a 30 meter elevated release. Topic III-B, "Pipe Break Outside Containment" covers the dynamic effects of the postulated pipe failure.

IV. REVIEW GUIDELINES

Guidelines for this review are contained in Regulatory Guide 1.5, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Steam Line Break Accident for Boiling Water Reactors" and in Standard Review Plan (SRP) Section 15.6.4, Revision 2.

V. EVALUATION

In July 1981, the licensee provided NRC with an evaluation of the radiological consequences following a postulated main steam line failure. The licensee's calculation using the primary coolant iodine concentration contained in the present technical specifications showed that the calculated radiological consequences (92 Rem) would exceed the staff acceptance criterion (i.e., small fraction of the 10 CFR Part 100 guideline values for an equilibrium iodine specification). While the licensee's submittal contained most of the assumptions

used in their analysis, it did not contain the atmospheric dispersion factors or the assumed iodine isotopic distribution in the coolant.

In accordance with SRP Section 15.6.4 Rev. 2, the staff performed an independent review of the radiological consequences following a postulated main steam line break outside containment using the appropriate assumptions of Regulatory Guide 1.5, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Steam Line Break Accident for Boiling Water Reactors." The staff analyzed two cases for the reactor coolant iodine concentration: (1) a case with a preaccident iodine spike, and (2) a case with the equilibrium iodine concentration defined in the standard technical specifications (STS).

The staff's review of the licensee's technical specification on primary coolant activity indicates that it does not contain the two-tier levels (equilibrium and maximum limits) currently found in the standard technical specification (STS) for BWR's and, therefore, it is very difficult to evaluate with respect to current NRC practice (Standard Review Plan 15.6.4) which is based on the presumption of STS activity levels.

In order to permit the evaluation of the Big Rock Point technical specification (TS) shutdown limit with current criteria, it is necessary to discuss the SRP acceptance criteria as based on the STS. First, the STS limits permit continued operation with a relatively infrequent sampling requirement as long as the coolant activity remains below the equilibrium value. When the equilibrium value is exceeded,

increased surveillance (coolant sampling) is required and a definite time period is set in which the facility is required to reduce the coolant concentrations below the equilibrium value. Failure to reduce the coolant concentration below the equilibrium value in the set time indicates that an irreversible degradation of the fuel integrity has occurred, and requires facility shutdown.

A cumulative time feature is also imposed which restricts the total time a plant can operate above the equilibrium value. This cumulative time restriction provides consideration for the effects of many spikes. The cumulative time limit restricts the total time the plant can operate above the equilibrium value to less than 10% of a year. Any plant reaching or exceeding this cumulative time limit is required to shutdown.

The acceptance criteria of the SRP are structured so that the consequences of the accident occurring during unrestricted operation (up to the equilibrium value) can not exceed a small fraction of the 10 CFR Part 100 exposure guidelines. Because unrestricted operation is permitted up to the equilibrium value, this value is used in the analysis examining conformance to the "small fraction". Operation is permitted above the equilibrium value by the STS, but the STS are structured to reduce the likelihood of the accident occurring during this time by at least 10% (the cumulative time limit) and, hence the SRP takes recognition of this and permits an appropriate factor of 10 increase in allowed consequences (doses up to 10 CFR Part 100). In no case, however, are the doses permitted to exceed 10 CFR Part 100 and, therefore, the maximum activity limit is established. The SRP uses this maximum activity limit in testing the

consequences against Part 100.

Two other features of the STS are noteworthy. First, STS set limits based on I-131 dose equivalent activity and this permits direct comparison with the licensing basis of the plant (the 10 CFR Part 100 exposure guidelines). A second feature is that the STS invoke coolant sampling when plant operation (e.g., decreasing power, etc.) is most likely to result in iodine spiking. In order to evaluate the Big Rock Point technical specification (TS) against current criteria, the staff considered the Big Rock Point shutdown limit as though it were the STS maximum limit and then considered the shutdown limit as though it were the STS equilibrium limit. The Big Rock Point TS of 35 µCi/ml of gross iodine activity in the coolant provides no limitation with regard to the iodine isotopic distribution. The Big Rock Point shutdown limit is expressed in gross iodine activity as compared to the STS limits expressed in dose equivalent I-131. Because the fuel conditions and operation of all BWR's is not identical, the iodine isotopic distribution will vary significantly from plant to plant as well as during the core cycle. This variability makes it difficult if not impossible to select an expected iodine spectrum to use in evaluating accident consequences when the iodine is specified as a gross activity level. The staff in its analysis conservatively assumed that the shutdown limit of 35 µCi/ml was equivalent to 35 µCi/gram dose-equivalent iodine 131 (DEI-131)

The staff's analyses used the licensee's estimate that 80700 lbs of reactor coolant would be released during this accident and also used elevated X/Q values of $4.0 \times 10^{-4}$ sec/m$^3$ and $9.0 \times 10^{-5}$ sec/m$^3$ for the 0-2 hour

exclusion area boundary (EAB) and 0-8 hour low population zone boundary (LPZ), respectively. Using these conservative assumptions, the calculated radiological consequences exceed the acceptance criteria for the equilibrium coolant limit (i.e. 10% of the Part 100 values), but do not exceed the guideline values of 10 CFR Part 100.

Iodine spikes, once initiated, cause rises in coolant level that cannot be prevented. In addition, the "peak" experienced in this coolant activity rise is related to the coolant activity at the initiation of a spike. Thus, it can be stated that the higher the "equilibrium" coolant activity is at the onset of a spike, the higher the level attained during a spike. Since the current Big Rock Point TS permits unrestricted operation up to the shutdown limit, this TS provides no assurance that the iodine concentration can be maintained within the limit once an iodine spike is initiated from equilibrium coolant levels near the TS limit. A lower equilibrium limit in the technical specifications, set at a level which could accommodate typical iodine spiking behavior without exceeding the upper shutdown limit, would provide the assurance that iodine concentrations would not exceed the upper limit.

The staff also analyzed Big Rock Point on the basis of the limits contained in the BWR STS and the assumptions outlined earlier.

Current NRC acceptance criteria are satisfied as indicated in the table below.

Based upon previous licensing calculations, the whole body dose values are very small and do not approach the acceptance criteria specified in the SRP, therefore, only the thyroid dose values are presented.

| Case | Thyroid Doses (rem) | |
|---|---|---|
| | EAB | LPZ |
| Staff estimates with 35 μCi/ml I-131 | 263 | 60 |
| GE STS equilibrium limit (0.2 μCi/gm DEI-131) | 1.5 | 0.3 |
| GE STS spike limit (4.0 μCi/gm DEI-131) | 30 | 6.8 |

## VI. CONCLUSION

The staff's conservative analyses show that the exposure guidelines of 10 CFR Part 100 are met assuming the coolant concentration is a shutdown limit composed entirely of I-131 and that no iodine spiking above the shutdown limit will occur. However, the analyses also show that the Big Rock Point shutdown limit does not assure the small fraction criterion is met.

On the basis of the steam line break accident analyses, the staff concludes that the Big Rock Point TS is inadequate with respect to assuring the dose acceptance criteria is met for the dose equivalent equilibrium iodine concentration value, and that iodine spikes will not increase the dose equivalent iodine concentration above the maximum technical specification limit. On the basis of calculations with STS values, the staff also concludes that adoption of the STS for primary coolant activity at Big Rock Point would result in dose consequences meeting current SRP guidelines.