Omaha Public Power District

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May 14, 1982
LIC-82-194

Mr. Robert A. Clark, Chief
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Licensing
Operating Reactors Branch No. 3
Washington, D.C. 20555

Reference: Docket No. 50-285

Dear Mr. Clark:

Subject: Technical Specifications Regarding Iodine Spiking

Over the last two years, there have been a number of letters and telephone discussions between Omaha Public Power District and the Commission regarding Technical Specifications to account for the iodine spiking phenomenon. The initial communication was the Commission's letter to the District dated July 22, 1980, which asked the District to submit an application to amend the Fort Calhoun Station Technical Specifications to address iodine spiking. The District responded with an amendment application dated November 17, 1980. After several telephone conferences between District and Commission staff personnel, the Commission's letter to the District dated April 23, 1981 asked for additional changes to the Fort Calhoun Station Technical Specifications to more closely follow the Combustion Engineering Standard Technical Specifications (STS). The District's letter to the Commission dated June 26, 1981 responded to the April 23, 1981 letter; however, two issues remained unresolved. The first issue involves the District's use of a 2 μc/gm dose equivalent iodine equilibrium chemistry limit instead of the 1 μc/gm limit used in the STS. The second issue concerns the time allowed for cleanup of an iodine spike. The STS allows 48 hours and the District has requested 100 hours. Enclosures 1 and 2 provide additional justification for our positions on each of these issues, which the District believes should resolve your concerns. Therefore, the District requests approval of our license amendment application, as submitted June 26, 1981.

Sincerely,

W C Jones

W. C. Jones
Division Manager
Production Operations

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Enclosures

cc: LeBoeuf, Lamb, Leiby & MacRae

RELATIONSHIP OF EQUILIBRIUM IODINE TO SPIKE MAGNITUDES

The Commission's letter to Omaha Public Power District dated April 23, 1981 reaffirmed the position that the Fort Calhoun Station Technical Specifications must be modified to change the existing equilibrium iodine limiting conditions for operation from the present 2.0 μc/gm limit to 1.0 μc/gm dose equivalent iodine. The 1.0 μc/gm limit is that value specified in the STS. As part of the Commission's discussion in support of the STS limit, it was stated "We concluded some time ago that the STS equilibrium value is a realistic operating limit, and that, with reasonably good fuel, this limit will have no impact on plant operation. No operating plant has approached this value." In the April 23, 1981 letter, it was also concluded that a 2.0 μc/gm equilibrium value "could lead to 'spiked' coolant activity levels twice the transient limit of 60 microcuries/gram."

The Commission's first contention is that the STS limit is realistic and that "no operating plant has approached this value." It should be noted that the Fort Calhoun Station operated for a full cycle with equilibrium iodine levels in the reactor coolant system between 1.0 and 2.0 μc/gm dose equivalent iodine. Additionally, the 2.0 μc/gm limit is based upon an allowable 1% failed fuel criteria, as determined in the Fort Calhoun Station FSAR and discussed in the District's letters dated November 17, 1980 and June 26, 1981. The STS limit is an arbitrarily selected value to be sufficiently conservative for all plants. The District contends that our plant specific analysis supports the 2.0 μc/gm limit. To impose the STS value or limit strictly for the purpose of conformity is not consistent with existing practices for the Fort Calhoun Station.

The second part of the Commission's concern is that, by doubling the equilibrium value, an iodine spike could achieve activity levels as high as 120 μc/gm dose equivalent I^{131}. To reach such a conclusion, one must assume that (1) there is a direct relationship between the equilibrium iodine activity and the magnitude of the spike and (2) that this relationship is directly proportional. The Commission referenced an ONRR paper prepared by Mr. W. F. Pasedag, "Iodine Spiking in BWR and PWR Coolant Systems," to support their conclusion. We concur that it is the District's responsibility to demonstrate the 2.0 μc/gm limit cannot result in activity levels whereby 10 CFR 100 limits could be exceeded under the postulated accident conditions; i.e., MSLB and steam generator tube rupture. Accordingly, the District has evaluated the data provided by Mr. Pasedag's report, as detailed below, to provide assurance that our proposed equilibrium level does not pose a threat to the general public.

The first part of the District's evaluation consisted of a detailed review of Mr. Pasedag's report. In his study, he reviewed 69 iodine spiking events which had occurred at various PWR's and BWR's. After comparing the equilibrium activities to the peak spike activity, he concluded "the number, duration, and magnitude of spikes cannot be predicted without further study." Mr. Pasedag did, however, find a possible correlation suggesting a "direct proportionality between a maximum inventory available for spiking and the failed fuel level of the core." The District's review of the 69 events reveals that the maximum observed "spike" of 18 μc/gm occurred for two separate events, with

coincident equilibrium values of 0.69 μc/gm and 5.9 μc/gm. In evaluating the data subjectively, as was done by Mr. Pasedag, it is impossible to define any specific direct relationship between equilibrium and "spike" activity levels. It is also worth noting that an independent Combustion Engineering study of the iodine spiking phenomenon, as detailed in CENPD-180, also concluded that a direct relationship between equilibrium and spike activities could not be determined.

The District has also statistically evaluated Mr. Pasedag's data using a standard linear regression analysis to better define the equilibrium/spike relationship. The linear regression was applied only to the 34 data points associated to the PWR's. Using all 34 data points, the best fit line is described by the following equation:

$$A_{spike} = 3.15 + 0.88\ A_{eq}$$

where:

A_{eq} = equilibrium activity in μc/gm dose equivalent I^{131}
A_{spike} = maximum "spike" activity in μc/gm dose equivalent I^{131}

However, the standard error for this solution is 5.03 μc/gm and the coefficient of correlation 0.071, both indicating that the linear solution is a poor fit; i.e., there is a very limited relationship. Much of this error can be caused by the wide range of data points (4 decades). To remove the possible error, the District performed a linear regression on only those data points where $A_{eq} \geq 0.5$ μc/gm. Those 14 points are identified by asterisk on the attached data table. For these 14 points, the best fit line is described by the equation:

$$A_{spike} = 3.29 + 1.7\ A_{eq}$$

with standard error = 5.14 μc/gm
coefficient of correlation = 0.34

Although there is a better line fit when using equilibrium activities in the area of concern (i.e., near 2 μc/gm), the linear relationship is still questionable. However, using the standard error, we can define the bounding values for A_{spike}. Using 3 standard errors, we can bound 99% of the possible values of A_{spike} for a given A_{eq}. Using A_{eq} = 2 μc/gm, the maximum A_{spike} in 99% of the cases would be 22.11 μc/gm. Accordingly, the District can conclude with a high level of confidence that an equilibrium value of 2 μc/gm will not result in an iodine spike in excess of 60 μc/gm.

Table 1

PWR EVENTS ANALYZED[1]

Data Set No.	Initial Conc. (μc/gm)	Peak Conc. (μc/gm)
I-11	5.0E-2	4.4E-1
I-12	3.1E-1	6.0E-1
P-11	1.3E-1	4.6E-1
P-12	4.6E-2	2.0E 0
P-13	6.7E-1*	1.2E 0
P-21	6.1E-3	5.3E-2
S-11	7.4E-2	8.5E-1
S-12	2.0E-1	1.05E 0
S-13	2.8E-2	8.0E-1
S-14	5.7E-1*	1.02E 0
S-21	2.3E-2	2.5E-1
S-22	1.2E-1	2.35E 0
Y-11	4.4E-1	1.55E+1
E-11	1.5E-1	5.2E-1
E-12	1.5E-1	4.3E-1
T-11	2.4E-2	1.5E-1
T-12	1.3E-1	1.8E-1
C-11	2.0E-2	2.8E 0
C-21	1.2E-2	2.5E 0
C-22	8.3E-1*	1.6E 0
C-23	1.5E 0*	1.8E 0
C-24	1.4E 0*	1.8E 0
G-11	9.0E-1*	6.9E 0
G-12	5.9E 0*	1.8E+1
G-13	8.7E-1*	5.2E 0
G-21	6.9E-1*	1.8E+1
G-22	6.8E 0*	1.1E+1
G-23	1.3E 0*	5.5E 0
G-24	1.7E 0*	7.5E 0
H-11	4.1E-2	3.0E 0
H-12	2.2E 0*	3.0E 0
H-21	3.0E-2	6.5E-1
H-22	4.4E-1	6.0E 0
H-23	3.5E 0*	1.2E+1

[1] This information is excerpted from NRC's Report "Iodine Spiking in BWR and PWR Coolant Systems".

IODINE REMOVAL CAPABILITY

The Combustion Engineering Standard Technical Specifications (STS) allow 48 hours for iodine removal following an iodine spiking event, after which a plant shutdown must be initiated. The time to cleanup an iodine spiking event is dependent upon three factors: (1) the magnitude of the iodine spike, (2) the letdown flow rate of the cleanup system vs. total reactor coolant volume, and (3) the efficiency of the demineralizers. The District, in its letter to the Commission dated June 26, 1981, submitted an application for license amendment that allowed 100 hours for iodine cleanup. The District also included operational data in support of the 100 hour time frame in the June 26, 1981 letter. As the result of several telephone conferences between the District and the Commission, the District submits the following information to further support our request that 100 hours be allowed for iodine cleanup for the Fort Calhoun Station.

The data on the attached sheet provides the calculated time periods for reducing the reactor coolant system iodine levels to acceptable values (i.e., about 1 μc/gm) following an iodine spike equivalent to 60 μc/gm I^{131} dose equivalent. These time periods were calculated assuming two charging pumps are available and using different iodine removal efficiencies for the demineralizers. Two pumps in operation was assumed because Technical Specification 2.2 requires only two pumps to be operational when the reactor is critical. When the reactor is shutdown, only one pump may be available. Accordingly, the cleanup time period for one pump in operation is also provided.

TIME REQUIRED TO CLEANUP THE REACTOR COOLANT SYSTEM BY BRINGING THE I-131 ACTIVITY FROM 60 μc/gm TO 1 μc/gm

Two Pumps in Operation
Mixed Bed Demineralizer Characteristics

	72 gpm* and 90% eff.	72 gpm* and 85% eff.	58-60 gpm** and 90% eff.	58-60 gpm** and 85% eff.
Cleanup time in hours	53	55	65	70

One Pump in Operation
Mixed Bed Demineralizer Characteristics

	36 gpm* and 90% eff.	36 gpm* and 85% eff.	29 gpm** and 90% eff.	29 gpm** and 85% eff.
Cleanup time in hours	106	112	131	139

NOTE: Reactor coolant volume, excluding pressurizer and purification system volumes, is approximately 50,000 gallons.

* Assuming charging pumps operating at their full capacity.
** Based on the operational data gathered during a one week period during the summer in 1976. One pump flow was measured at 29 gpm (58-60 gpm for two pumps).