U-0738
0982-L
L30-84(09-27)-L
1A.120

ILLINOIS POWER COMPANY

CLINTON POWER STATION, P.O. BOX 678, CLINTON, ILLINOIS 61727

September 27, 1984

Docket No. 50-461

Director of Nuclear Reactor Regulation
Attention: Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Clinton Power Station Unit 1
Mark III Containments Structural Capacity
SER Confirmatory Issue #6

Dear Mr. Schwencer:

Your letter of June 18, 1984 requested additional information relative to the ultimate capability of the Mark III containment design as applicable to the Clinton Power Station (CPS). Enclosed are CPS responses for the NRC Staff review. Included are responses to Structural Engineering Branch questions 220.61, 220.62, and 220.63. The information provided is believed to be responsive to your concerns.

Please contact us if you have any questions concerning this information.

Sincerely yours,

F. A. Spangenberg

F. A. Spangenberg
Director - Nuclear Licensing
and Configuration
Nuclear Station Engineering

Attachment

PRS/lm

cc: B. L. Siegel, NRC Clinton Licensing Project Manager
NRC Resident Office
Illinois Department of Nuclear Safety
Regional Administrator, Region III, USNRC

B001
1/1

NRC QUESTION NO. 220.61

Determine and provide the ultimate capacity, in terms of psig, of the containment shell for negative (reverse) pressure. The structural region or item which limits the pressure retaining capability should be identified as well as the particular failure mechanism. The pressure should be assumed to be static, not transient.

RESPONSE

The ultimate capacity of the containment shell for negative (reverse) pressure has been conservatively determined to be -11 psig. The item which limits the negative pressure retaining capability is the steel liner. The failure mechanism is the initiation of yield stress due to flexure in the containment liner.

NRC QUESTION NO. 220.62

The applicant may choose to justify the containment shell design against negative pressure by providing a bounded transient. Using this transient, the licensee could show the containment capability to withstand the maximum calculated pressure differential. Therefore, the following alternative question may be addressed in response to Question 220.61:

> Provide the maximum calculated negative containment pressure which would result from complete combustion of an amount of hydrogen corresponding to a 75% metal-water reaction (oxygen depletion) and the subsequent cooling of the containment atmosphere. Include a description of the analytical model and justify the assumptions used to determine the internal containment pressure response, e.g., by addressing the conservatism with respect to plant-specific applications. It is anticipated that in most cases, the calculated containment negative pressure differential would exceed the design value. Therefore, the applicant may elect to demonstrate that:
>
> A. The calculated external containment pressure capability value, which should be calculated and provided by the applicant, bounds the above transient, which is determined to be the most limiting pressure differential. Thus, the containment has the capability to withstand the most severe external pressure that might result following a hydrogen combustion event.
>
> B. Alternatively, the applicant may provide a description of the design provision regarding automatic and manual means for relieving reverse pressure differentials, e.g., by use of vacuum breakers. The discussion should include the operating procedure concerning monitoring of containment pressure, and operator actions to relieve pressure differentials following onset of an accident. In addition:
>
> 1. The system that is relied on to relieve reverse pressure differentials must be shown to survive the consequences of burning the hydrogen generated from a 75% metal-water reaction.
>
> 2. An analysis should be included to show the effectiveness of this system when considering the above stated assumptions.

RESPONSE

In response to this question, an analysis has been performed to determine the resultant pressure reduction from the complete combustion of hydrogen generated by a 75% metal-water reaction. This combustion of 2100 lbm of hydrogen, which corresponds to 75% oxidation of the zircaloy in the active fuel region, depletes only 70% of the available oxygen in the containment atmosphere. This depletion causes a -2.2 psig reduction in the internal containment pressure. This pressure reduction does not exceed the containment design external pressure of 3.0 psig as specified in Table 6.2-1 of the CPS FSAR. The largest negative pressure which could occur from the 100% depletion of all oxygen from the containment atmosphere is -3.1 psig. That is assuming air is 21% oxygen by volume and that all of the oxygen is eliminated. This pressure reduction does not exceed the containment ultimate negative pressure capacity of -11 psig as calculated in response to NRC RAI 220.61.

NRC QUESTION NO. 220.63

Determine and provide the ultimate capacity, in terms of psid, of the drywell pressure retaining boundary for positive and negative pressure. If the refueling pool is filled with water during operation, then the effect of the water on the drywell, including the steel head, should be considered. The structural region or item which limits the pressure retainment capability should be identified as well as the particular failure mechanism. The pressure should be assumed to be static, not transient.

RESPONSE

The ultimate capacity of the drywell pressure retaining boundary for positive pressure is +63 psid. The item which limits the positive pressure retaining capability is the drywell equipment hatch. The failure mechanism of the equipment hatch is the buckling of the spherical head.

The ultimate capacity of the drywell pressure retaining boundary for negative pressure is -61 psid. The item which limits the negative pressure retaining capability is the drywell personnel airlock door main hinge pin. The failure mechanism of the personnel airlock door main hinge pin is the initiation of yield stress due to flexure.

The drywell head ultimate pressure capacity for positive pressure is +217 psid and for negative pressure -86 psid. The effect of water in the refueling pool has been considered in calculating these ultimate capacities.