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ACCESSION NBR:8112020603 DOC.DATE: 81/11/20 NOTARIZED: NO DOCKET #
FACIL:50-397 WPPSS Nuclear Project, Unit 2, Washington Public Powe 05000397
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SCHWENCER,A. Licensing Branch 2

SUBJECT: Forwards responses to Containment Sys Branch questions per 810316 request for addl info.Responses will be incorporated into FSAR Amend 21.

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November 20, 1981
G02-81-484
SS-L-02-CDT-81-100

Docket No. 50-397

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

Dear Mr. Schwencer:

Subject: SUPPLY SYSTEM NUCLEAR PROJECT NO. 2
RESPONSES TO CONTAINMENT SYSTEMS BRANCH QUESTIONS

Reference: Letter, R. L. Tedesco to R. L. Ferguson, "Request for Additional Information Regarding the WNP-2 Facility (CSB)", dated March 16, 1981

Enclosed are sixty (60) copies of the remaining responses to the Containment Systems Branch questions transmitted to the Supply System by the referenced letter. These responses will be incorporated into Amendment No. 21 to the WNP-2 FSAR.

Very truly yours,

G. D. Bouchey

G. D. BOUCHEY, Deputy Director
Safety & Security

GDB/CDT/sm
Enclosures

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COMMITMENTS IN

LETTER NO.G02-81-484 TO A. SCHWENCER

Subject: Supply System Nuclear Project No. 2
Responses to Containment Systems Branch Questions

1) "A detailed description of the (recombiner) startup sequence will be provided with the January 1982 FSAR Amendment."

2) "A discussion of the recycle ratio will be included in the FSAR revisions to containment inerting to be submitted to the NRC in January 1981."

Action on items 1 and 2 required by B. A. Holmberg.

CONCURRENCE: [signature]
B. A. HOLMBERG

Q. 022.096

You state on page 14 of your report, APCI-78-6P, that you calculated an average air velocity of about 3 feet/sec. Provide the analysis, including your assumptions, which you used to calculate that velocity. You also state that the WNP-2 scrubber will operate in a pressure range of 32 to 14 psia and a temperature range of 100 degree F to 220 degree F. Discuss the effect on the scrubber efficiency and the amount of water entrainment if the hydrogen concentration inside containment necessitates operating the hydrogen recombiner at pressures and temperatures outside the ranges cited above (refer to Item 021.44).

Response:

In the discussion on the scrubber in APCI Report No. APCI-78-6P, page 14, APCI stated, "The calculated WNP-2 velocity averages about 3.0 feet per second ...". This is the approximate vapor at the bottom of the packed section, based on assumed containment composition, temperature, and pressure. The cross-sectional flow area is based on 14.25-inch inside diameter and a bed porosity of 94% (for 1" Norton #24 Gauge Pall rings). At conditions soon after LOCA ($T=215^\circ F$, P=31.0 psia, Mol. Wt=23.18), the gas velocity is 2.92 feet per second; this is approximately test condition I, refer to Table 2-1 of APCI-78-6, "Air Products Post-LOCA Recombiner Test Summary", dated June 1978. At conditions long after LOCA ($T=100^\circ F$, P=14.7 psia, mole weight= 27.20), the velocity is 2.65 feet per second; refer to Table 2-1 of APCI-78-6.

At the top of the packed section and at the demister, the velocity is 80 to 100 percent of the velocity at the bottom of the packed section, depending on the extent of cooling of the vapor flow through the scrubber. This effect is more pronounced early in the LOCA. However, the cooling effect is offset by the higher actual containment feed gas flow which was, as tested, approximately ten (10) percent higher than the design flow rates required for each test condition. Hence, it is more accurate to state that the range of velocities is 2.7 to 3.2 feet per second.

The effects on scrubber efficiency of operating at high temperature and pressure are discussed in "Addenda Number One to Air Products Post-LOCA Recombiner Test Summary Report No. APCI-78-6P", Questions 18 and 20.

Q. 022.098

In Table A of your report, APCI-78-7P, you present an analysis of a postulated failure of the containment atmosphere control system which shows that operator action is required to isolate the affected system and to initiate the standby system. Indicate the time interval you assume it would take the operator to complete this action and provide justification for this amount of time. Specify the delay time required for the hydrogen recombiner to reach full efficiency (i.e., that time at which the catalyst bed is preheated to the specified operating temperature). Discuss the effect of this latter delay time on the hydrogen concentration inside containment.

Response:

Each recombiner system consisting of a skid and control panel is independent of the other and the feed to each system is also independent, thus allowing one or both systems to be operated.

The recombiner systems have two manual start-up steps for post-LOCA operation. First the systems will go through a warm-up of instrumentation and then automatically proceed through preheat of the recombiner to 550^{o}F recycling cover gas. After preheat is complete, a light indicates to the operator that the systems are ready to accept containment gas. It is at this time (approximately 30 minutes after initial start-up) that only one system will receive containment gas. In the event that the first system fails to operate, the second system will be immediately placed into operation. In the event that the first system operates as intended and recombination is verified, the second system will be shutdown.

Work is currently in progress to examine post-LOCA oxygen generation and to evaluate the recombiner performance in an inerted atmosphere. Since the containment will be inerted, oxygen concentration is considered to be of more significance than hydrogen concentration. A detailed discussion of recombiner performance, including a description of the start-up sequence, will be provided with the January 1982 FSAR amendment.

Q. 022.099

You state on page 6 of your report, APCI-78-7P, that the recycle flow ratio which you selected is based on the containment pressure to achieve the most efficient system operation. Explain how this approach maximizes the system efficiency. Revise Figure 2.1 of the cited report to include higher containment pressures up to the containment design pressure (refer to Item 022.44). In addition, indicate: (a) the information available to the control room operator to initiate the recycling system; (b) the design criteria for the recycling system; and (c) the type of interlock chosen to preclude inadvertent opening of the recycling system.

Response:

Note: The referenced report should read "APCI-78-6P" rather than "APCI-78-7P".

In a non-inerted containment, the recycle system ratio is set to achieve the most efficient recombiner system operation based upon containment withdrawal rate. Since recombiner flow through the blower on the skid is the summation of containment and recycle flow, reduction of recycle flow will increase containment withdrawal flow. To assist the operator in selecting the proper recycle flow, APCI has generated a curve in the Technical Manual (Figure 2-1) which presents recycle ratio versus containment pressure.

However, since the WNP-2 containment will be inerted, a fixed recycle ratio will be established after completion of the post-LOCA hydrogen/oxygen generation study currently in progress. Figure 2-1 of APCI-78-6P will be revised as necessary at that time. A discussion of the recycle ratio will be included in the FSAR revisions for containment inerting to be submitted to the NRC in January 1982.

The recycling system does not require operator action for initiation. However, control room instrumentation is available which will provide temperature, pressure and flow rate information for the system.

The recycle system was designed to provide a means of preheating the recombiner bed prior to introduction of containment gas and to effectively reduce the hydrogen or oxygen concentration, as required, being introduced into the recombiner. This reduction in hydrogen or oxygen is required for levels of 4% for hydrogen or 2% for oxygen to ensure that the recombiner vessel design temperature is not exceeded.

The recycle valve is interlocked with the system feed gas and return gas valves and the scrubber water valve. During warm-up and preheat, the recycle valve is wide open allowing full recycle, and the feed, return and scrubber water valves are closed. Upon completion of preheat, the operator will manually switch the system to the containment feed phase, and this will open the feed, return and scrubber water valves and allow the recycle valve to go to its preset opening. In case of system shutdown, either operator initiated or emergency, the recycle valve will go to its full open position.

Q. 022.100

You state on page 12 of your report, APCI-78-7P, that the combustible gas control system will perform its intended function at containment pressures up to 26.5 psig even though the system is designed to operate at 16 psig (i.e., the conditions following a postulated LOCA). Provide either your analysis or experimental data which substantiates this statement. Also, discuss the effect on the system performance, of initiating the combustible gas control system immediately following a postulated LOCA. In your response, consider both an inadvertent start and initiation due to a high hydrogen concentration in containment. Indicate the type of interlock chosen to preclude inadvertent operation of the combustible gas control system. Specify the design conditions of the different components of the combustible gas control system and indicate the effect of high pressure (i.e., the containment design pressure) on the components of the system.

Response:

Note: The referenced report should read "Addenda No. 1 to APCI-78-6P" rather than "APCI-78-7P".

The result presented by Air Products and Chemicals, Inc. (APCI) in "Addenda Number One to APCI Report APCI-78-6P", Question 18 concerning maximum containment pressure of 26.5 psig, was accomplished using a proprietary process fluid program. The parameters assumed and the basic equations utilized by the computer are presented in the addenda, along with the results for containment pressure, temperature, horsepower, flow rate, and preheater electrical load. Based upon no noticeable reduction for recombiner catalyst efficiency during the full scale performance tests at 0 psig to 18 psig, APCI forecasts no catalyst efficiency reduction at 26.5 psig.

The recombiner system does not have a direct high pressure shutdown in case a high pressure feed is introducted, but would safeguard itself with its integral safety relief, high temperature shutdown devices, and the power supply motor overload protection. High feed pressure will result in high blower discharge pressure until the relief device set at 45 psig is actuated. High feed pressure also increases fluid density through the blower and will eventually cause a shutdown of the blower motor. In the event that there is high hydrogen concentration in the high pressure feed, excessive temperatures may result in the recombiner or cooler exchanger. The temperature increases would eventually cause system shutdown by the high temperature switches.

Inadvertent operation of the recombiner system under high pressure conditions is prevented by the two-step manual start-up procedure. After initial system start there is a 30-minute instrument warm-up and preheat-recycle period which must be followed by a second manual start in order to introduce containment feed gas and commence recombination. Therefore, if the combustible gas control system was initiated immediately following a postulated LOCA, it would be at least 30 minutes before the system would be open to containment. During this time period, the postulated high pressure peaks inside containment, which exceed the maximum expected containment pressure of 18 psig during recombiner system operation, will have passed (see FSAR Figures 6.2-2, 6.2-6 and 6.2-11).

The design conditions of the different components of the combustible gas control system are provided in APCI-78-6P. In all cases, component design pressures are equal to or greater than the containment design pressure of 45 psig.