



SACRAMENTO MUNICIPAL UTILITY DISTRICT ☐ 6201 S Street, P.O. Box 15830, Sacramento CA 95852-1830, (916) 452-3211  
AN ELECTRIC SYSTEM SERVING THE HEART OF CALIFORNIA

JEW 86-142

June 18, 1986

DIRECTOR OF NUCLEAR REACTOR REGULATION  
ATTENTION FRANK J MIRAGLIA JR  
DIRECTOR PWR-B DIVISION  
U S NUCLEAR REGULATORY COMMISSION  
WASHINGTON DC 20555

DOCKET NO. 50-312  
LICENSE NO. DPR-54  
PROPOSED AMENDMENT NO. 121

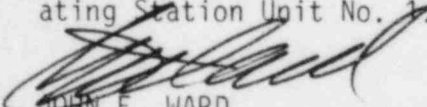
In accordance with 10 CFR 50.90, the Sacramento Municipal Utility District proposes to amend its Operating License DPR-54 for Rancho Seco Nuclear Generating Station Unit No. 1.

Proposed Amendment No. 121 deletes the surveillance requirements for the Reactor Building Upper Dome Air Circulators (RB-UDAC) from Specification 4.5.1.B of the Rancho Seco Technical Specifications. Attachment I provides the safety analysis justifying this deletion. Attachments II and III provide the "No Significant Hazards" Evaluation and the Description of Proposed Changes, respectively.

Pursuant to 10 CFR 50.91(b)(1), the Radiological Health Branch of the California State Department of Health Services has been informed of this Proposed Amendment by mailed copy of this submittal.

Enclosed is a check in the amount of \$150.00 as required by 10 CFR 170.21, "Schedule of Fees".

Should you require any further information with respect to this Proposed Amendment, please contact Mr. Ron W. Colombo at Rancho Seco Nuclear Generating Station Unit No. 1.

  
JOHN E. WARD  
ASSISTANT GENERAL MANAGER  
NUCLEAR

Attachments

cc: Region V (2)  
INPO  
MICP (2)

Subscribed and sworn to before me  
this 18th day of June, 1986

  
Notary Public



8606230225 860618  
PDR ADOCK 05000312  
P PDR

*Acc'd w/check for \$150.00  
# 111635  
11*

ATTACHMENT I  
SAFETY ANALYSIS

Background

When Rancho Seco Unit No. 1 was licensed, credit was given to the Reactor Building Upper Dome Air Circulators (RB-UDAC) to prevent hydrogen stratification in the post-accident containment atmosphere. The RB-UDAC, which consists of two independent trains of ducts and fans, is designed to recirculate the air from the top of the containment dome to the lower elevations in the containment. The RB-UDAC, which is safety related, is a separate system from the safety related emergency cooler system.

Surveillance of the RB-UDAC is required in the plant's Technical Specifications Section 4.5.2.B.1 and the associated bases for the RB-UDAC. The specifications for the RB-UDAC were required as part of the original plant design to prevent the formation of hydrogen pockets in the Reactor Building (RB) dome area that might result in a localized hydrogen burn in that area following a LOCA. The concern that prompted the design for the RB-UDAC was originated from the thought that hydrogen, being a light density gas, may rise up and concentrate in the RB dome area creating a stratified hydrogen distribution.

In addition to the post-accident function, the RB-UDAC is typically operated during normal plant operation. When required, air circulation in the RB can be improved by operating the RB-UDAC which forces warm air from the RB dome down toward the six normal cooling units for a new cycle.

Discussion

In order to control post-accident concentrations of hydrogen in the RB, Rancho Seco employs a post-LOCA hydrogen purge system and the ability to connect an offsite mobile hydrogen control system to the RB atmosphere. In addition, the original design included the RB-UDAC to assure mixing of the RB atmosphere to prevent the formation of hydrogen pockets.

The RB-UDAC was designed to mix the atmosphere in the RB to provide an adequate interchange between areas of high and low hydrogen concentrations in order to maintain hydrogen peaking factors acceptably low.

Standard Review Plan 6.2.5, "Combustible Gas Control in Containment", Section II.3., "Acceptance Criteria", states:

"In meeting the requirements of 10 CFR Part 50, 10 CFR Part 50.44 and 50.46 to provide the capability for ensuring a mixed atmosphere in the containment, and of GDC 41 to provide systems as necessary to assure that containment integrity is maintained, a system should be provided to mix the combustible gases within the containment. The functional design of this system will depend on the type of containment. This system may consist of a fan, a fan cooler, or containment spray. An analysis should be presented which shows that excessive stratification of combustible gases will not occur within the containment or within a containment subcompartment. For containments which rely on convective mixing in conjunction with systems operation to mix the combustible gases, the containment internal structures must have design features which promote the free circulation of the atmosphere.

Hydrogen mixing can be adequately done without the RB-UDAC. The mixing of hydrogen would be accomplished through other existing systems namely mechanisms such as convective mixing and molecular diffusion. For example, most of the hydrogen (radiolytic hydrogen and chemically formed hydrogen) evolves from the water in the RB emergency sump and water spilling from the broken reactor coolant system. These sources are located in the unrestricted main volume of the RB. The hydrogen will rapidly diffuse by rising into the RB atmosphere to give an even distribution throughout the RB. In addition, convective mixing due to the heating of air above the hot water in the sump and the forced circulation created by the RB Emergency Coolers will enhance the dispersion of hydrogen. Accordingly, operation of the emergency upper dome circulators is not considered essential to the elimination of regions of high hydrogen concentration.

The RB spray system (safety related) is automatically initiated by the high RB pressure resulting from a LOCA. This creates a turbulent condition in the RB which ensures proper mixing of hydrogen generated from the required assumed initial metal-water reaction in the core.

Two of the four RB Emergency Coolers (safety related) will be in operation after a LOCA to provide the heat sink for the containment atmosphere and recirculate the air in the areas below the operating deck. The radiolytic hydrogen generated from the water on the floor and in the RB sump will be mixed by the RB Emergency Coolers.

Rancho Seco Unit 1, has a large dry containment with 1.98 million cubic feet of free volume. Total height from the floor to the ceiling is more than 185 feet. The heat loss through the RB wall will promote the natural convective air circulation downward along the wall. This process is further enhanced by the concrete structure for the steam generator cavities which have a natural chimney effect providing an upward draft in the inner portion of the containment. The combined effects provide the natural internal recirculation of atmosphere in the RB to prevent concentrations or stratification of combustible levels of hydrogen.

A research project was conducted by the Los Alamos National Laboratory in 1978. Their report, NUREG/OR-0304, "Mixing of Radiolytic Hydrogen Generated Within a Containment Compartment Following a LOCA", provides detailed mathematical and experimental evidence that the molecular diffusion process and the turbulent mixing caused by small temperature differences between the floor and the ceiling of the containment will be sufficient to ensure proper mixing of hydrogen in containment. The same process also ensures that the mixture will not separate by gravitational force or other processes.

### Evaluation

During the late 1960s, when Rancho Seco was designed, there had been only limited research performed on the diffusion and/or mixing of hydrogen. As noted above, since that time analysis has been performed which provides additional understanding of hydrogen mixing and diffusion processes.

The NRC has recently approved a number of plant applications that did not include a separate containment recirculation system (i.e., RB-UDAC). These plants rely on natural convective forces in addition to the RB spray system and the emergency cooler system to provide adequate post-accident hydrogen mixing.

Table 1 shows a comparison of the similarities between the Davis-Besse, Midland and Rancho Seco Reactor Buildings. All of these B&W plants used Bechtel as their architect engineer and contractor. In approving the Midland combustible gas control system (which does not have a separate RB-UDAC), the NRC staff made the following conclusion in the Safety Evaluation Report:

"Natural convective currents with the containment following an accident will mix the containment atmosphere sufficiently to preclude high concentrations of combustible gases from occurring locally. However, mixing of the containment atmosphere will also be enhanced by the containment spray system and the recirculating air cooling system, both of which are designed to ESF criteria. This will ensure that samples drawn by the hydrogen monitoring subsystem are representative of the containment atmosphere."

The NRC staff has recognized that post-accident hydrogen mixing can be accomplished through a number of means. The previously discussed Los Alamos report provides a basis to conclude that natural convective currents and molecular diffusion will provide sufficient mixing. The Los Alamos report is based on generally accepted engineering and scientific principles. The Standard Review Plan (SRP), which provides the criteria for NRC staff review, does not require a separate air circulation system to promote hydrogen mixing in the RBs. The SRP recognizes that adequate mixing can be accomplished by either a fan recirculation system, a fan cooler system or a containment spray system. This view is underscored in the above excerpt from the Midland Safety Evaluation Report.

The District concludes that the Rancho Seco facility possesses diverse means of promoting post-accident hydrogen mixing. The natural convective currents along with the turbulence created by the combined action of the containment spray and the emergency coolers will provide sufficient RB atmosphere mixing. Therefore, the District concludes that, as in the Midland and Davis-Besse designs, adequate post-accident containment mixing will occur at Rancho Seco without the RB-UDAC. The RS-1 design includes sufficient equipment and features to comply with SRP 6.2.5 and therefore the District's proposed TSs change should be acceptable.



TABLE 1

Comparison of Design Features - Reactor Buildings

<u>Design Feature</u>	<u>Midland*</u>	<u>Davis Besse</u>	<u>Rancho Seco</u>
-Containment Volume	1.6 x 10 <sup>6</sup> ft <sup>3</sup>	2.8 x 10 <sup>6</sup> ft <sup>3</sup>	1.98 x 10 <sup>6</sup> ft <sup>3</sup>
- Time Required to Reach 4% by Volume Hydrogen Concentration	12 days	50 days	20 days**
- Containment Design Pressure	56 psig	47 psig	59 psig
- Availability of Hydrogen Purge	Yes	Yes	Yes
- Ability for Hydrogen Dilution	No	Yes	No
- Containment Air Cooler Capacity	4 units @ 80,000 CFM Each	3 units @ 117,000 CFM Each	4 units @ 40,000 CFM Each
- Proposed Reactor Vessel Head Vent Design	1/2" Line to Top of Hot Leg	2.5" Line to Top of Steam Generator	Exempted from installation by NRC ltr. 9/27/83
- Ability to Sample Containment Dome Hydrogen Concentration	Uncertain	Yes	No
- Capability of Hydrogen Recombiner Hook-up	Yes (Recombiner On-Site)	Yes	Yes
- Containment Spray Configuration	1 Spray Ring	2 Spray Rings One/Pump	2 Spray Rings/ 2 pumps

\* Information verbally supplied to Toledo Edison Through a third party, may be subject to further verification.

\*\* Calculated using AEC Safety Guide 7 assumptions.

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Environmental Consideration

The District has determined that the proposed amendment does not authorize a change in effluent types or total amount nor an increase in power level and will not result in any significant environmental impact. Having made this determination, the District has further concluded that the amendment involves an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR 51.4(d)(4), that an environmental impact statement, or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

## ATTACHMENT II

### "NO SIGNIFICANT HAZARDS" EVALUATION

Proposed Amendment No. 121 involves the deletion from the Rancho Seco Technical Specifications the required surveillance of the Reactor Building Upper Dome Air Circulators (RB-UDAC). This requirement has been in effect since issuance of the initial operating license for Rancho Seco Unit 1. Since then, reviews and data have shown that the safety function of these circulators (namely to prevent the formation of explosive or flammable pockets of hydrogen within the Reactor Building dome during accident conditions) is also performed by other existing systems, namely Reactor Building Spray, Reactor Building Emergency coolers, and by naturally occurring mechanisms such as convective mixing and molecular diffusion.

In performing this evaluation, the issue of safety related RB-UDAC was reviewed against the Standard Review Plan and the omission of RB-UDACs, or equivalent, at other similar Babcock & Wilcox reactor plants, all designed by the same architect engineer, Bechtel Corporation. Comparison of Rancho Seco's design with these other plants which do not have a separate containment recirculation system (i.e., RB-UDAC) (Table 1 of Attachment I) reveals very close similarities in Reactor Building design features. This further confirms that plants similar to Rancho Seco but of later design satisfy Standard Review Plan 6.2.5, Section II.3, "Combustible Gas Control in Containment, Acceptance Criteria".

The District has reviewed the proposed change against each of the criterion of 10 CFR 50.92 and concluded that plant operation with the surveillance requirement of the RB-UDAC deleted from the Technical Specifications would not:

1. involve a significant increase in the probability or consequences of an accident previously evaluated. The initial design intent of the RB-UDAC was to insure that an accumulation of hydrogen would not occur in the Reactor Building dome under accident conditions. With respect to this safety related function of the RB-UDAC, the Rancho Seco Updated Safety Analysis Report (USAR paragraph 6.4.2) states:

"The hydrogen will rapidly diffuse by rising into the Reactor Building atmosphere to give an even distribution throughout the Reactor Building. In addition, convective mixing due to the heating of air above the hot water in the sump and the forced circulation created by the Reactor Building emergency coolers will enhance the dispersion of hydrogen. Accordingly, operation of the emergency upper dome circulators is not considered essential to the elimination of regions of high hydrogen concentration."

This conclusion is supported by a research project conducted by the Los Alamos National Laboratory in 1978. Their report, NUREG/OR-0304, "Mixing of Radiolytic Hydrogen Generated Within a Containment Compartment following a LOCA", provides detailed mathematical and experimental evidence that the molecular diffusion process and the turbulent mixing caused by small temperature differences between the floor and the ceiling of the containment will be sufficient to ensure proper mixing of hydrogen in containment.

2. create the possibility of a new or different kind of accident from any accident previously evaluated. Accepting the remote possibility that the RB-UDAC is unavailable in a future post-accident situation, this is the worst accident that can be foreseen, but as indicated above in Item 1. has already been evaluated. Therefore, the proposed change is assumed to not create the possibility of a new or different kind of accident from any accident previously evaluated.
3. involve a significant reduction in a margin of safety. As discussed above, there are various means of achieving the mixing of post-accident generated hydrogen in the Reactor Building to prevent an explosive or flammable concentration. Therefore, the possible reduction of a margin of safety resulting from the proposed change is considered not significant.

### Conclusion

The District has concluded, based on the consideration discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

ATTACHMENT III

DESCRIPTION OF PROPOSED CHANGES

1. Specification 4.5.2.1B.1a, Page 4-29: Deleted the phrase "including the upper dome air circulators" from the first sentence.