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AUTH.NAME   AUTHOR AFFILIATION
VAN BRUNT,E.E.   Arizona Public Service Co.
RECIP.NAME   RECIPIENT AFFILIATION
DENTON,H.R.   Office of Nuclear Reactor Regulation, Director

SUBJECT: Forwards Bechtel Power Corp & util responses to open items of class IE dc power sys review.Responses have been submitted to review board & final resolution will be submitted to NRC when completed.

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ARIZONA PUBLIC SERVICE COMPANY

P. O. BOX 21666 · PHOENIX, ARIZONA 85036

June 30, 1980
ANPP-15765 - JMA/JPS

Mr. H. R. Denton, Director
Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Palo Verde Nuclear Generating Station
PVNGS Units 1, 2 and 3
Docket Nos. STN-50-528/529/530
File: 80-056-026

Reference: Letter dated June 4, 1980 from
E. E. Van Brunt to Mr. H. R. Denton

Dear Mr. Denton:

The responses of Bechtel Power Corporation and Arizona Public Service Company to the open items of the Class IE DC Power System Review for PVNGS are enclosed for your use, and as a continuation of the DC System Review record.

These responses have been distributed to each member of the PVNGS Power Systems Review Board for their review. The Review Board is to assure that these responses sufficiently address the concerns noted in the original presentation. Final resolution of the open items by the Review Board will be submitted to you when completed.

Respectfully submitted,

ARIZONA PUBLIC SERVICE COMPANY

By: Edwin E. Van Brunt
Edwin E. Van Brunt, Jr.
APS Vice President,
Nuclear Projects
ANPP Project Director

On its own behalf and as agent for all other joint applicants.

State of Arizona)
) ss.
County of Maricopa)

Subscribed and sworn to before me this 30 day of June, 1980.

John M. Allen

My Commission expires:

Jan 23, 1983

B001 S/1

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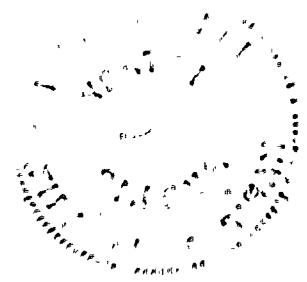

Bechtel Power Corporation
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B/ANPP-E-60457
MOC 117487
June 20, 1980

Arizona Nuclear Power Project
P. O. Box 21666 - Mail Station 3003
Phoenix, Arizona 85036

Attention: Mr. Edwin E. Van Brunt, Jr.
APS Vice President, ANPP Project Director

Subject: Arizona Nuclear Power Project
Bechtel Job 10407
Resolutions to Actions from
D.C. Power System Review
File: N.28.02

Reference: Transcript of System Review Meeting, 5/8/80

Dear Mr. Van Brunt:

Enclosed are resolutions of the open items addressed at the System Review meeting for the Class IE DC Power System held on May 8, 1980.

Very truly yours,

BECHTEL POWER CORPORATION

W. H. Wilson /JDH

W. H. Wilson
Project Manager
Los Angeles Power Division

NB:pb

Enclosures: (1) Action/Bechtel Resolutions Regarding
D.C. Power System Review (6 pages, 4 copies)
(2) FSAR Table 8.3-5 Changes (1 page, 4 copies)

cc: F. W. Hartley
D. B. Fasnacht
J. Allen
D. Karner
J. Barrow
C. Rogers
R. Paul
S. Shepard
R. Kramer
C. Ferguson
M. Barnoski
All w/enclosure

RESOLUTIONS OF OPEN ITEMS ADDRESSED AT
SYSTEM REVIEW MEETING OF 5/8/80
CLASS IE DC POWER SYSTEM

ACTION #1

Bechtel provide additional information on the drainage for the battery room.

Resolution:

Item closed out at presentation (drains are 4"; sized for water removal from fire hose flows used as backup fire protection system ---- see p. 125 of transcript).

Action #2:

Bechtel provide information on monitoring of the door between charger rooms C and D.

Resolution:

The door is normally shut (emergency fire exit) and, when opened, is alarmed in the Control Room and in the plant security system at the guard house.

Action #3:

Bechtel provide information discussing the failure of the damper in the single duct leading from the battery rooms.

Resolution:

In accordance with P&ID 13-M-HJP-002 each battery room has a separate exhaust duct. Single failure will not result in isolating air flow from all battery rooms. P&I Drawing 13-M-HJP-002, Revision 3, added a high pressure differential switch between the exhaust fans and the first fire damper for each battery room. With this modification, if a fire damper fails closed or closes upon a fire, the differential pressure switch would sense high exhaust pressure in the duct and would signal an alarm to the control room. A low pressure differential switch located between the exhaust fans and the first fire damper would sense low pressure and signal an alarm to the control room should the fans malfunction and provide no flow.

The supply ducting is initially common to all battery rooms before splitting into two ducts, one for battery rooms A and C and one for battery rooms B and D. A flow switch will be added to each of the two ducts to indicate loss of flow and signal an alarm to the control room should a fire damper close.

If a damper should close, an alarm is given in the control room. A fire damper can be easily reset by replacing the fusible link holding the

Enclosure (1)

damper open. The time available to repair a damper is more than adequate to avoid hydrogen concentration buildup in the rooms. The hydrogen gas given off by the batteries in the worst case is 1.47 cubic feet per hour. Based on this generation rate, assuming all gas will remain in the battery room, a one percent concentration buildup of hydrogen gas will require approximately 45 hours.

Action #4:

Bechtel provide additional discussion on the use of an air circuit breaker between the batteries and the dc bus. (This discussion should include the mention of the circuit breaker being replaced by a disconnect, discussion of whether this would provide easier maintenance, and a discussion of how false trips of the ACB are prevented.)

Resolution:

A comparison was made between the use of an air breaker on the battery versus a fused switch. The air breaker is subject to opening on spurious trips and on faults on the 125V DC control center bus. The fused switch opens only on bus faults. A comparison of spurious trip rates and frequency of bus faults from IEEE-P500 indicates that the frequency of faults on a bus is the same order of magnitude as spurious breaker trips. The result is that the air breaker will open twice as often as the fused switch under those circumstances. The fused switch, however, must be replaced and tested after each trip which could require as much as 2 to 10 times greater outage time. Under these conditions the unavilability of the fused switch will be equal to or greater than the unavailability of the air breaker. In addition, common cause faults can occur on separate buses due to shorts in identical components, causing multiple air breakers, or fused switches, to trip simultaneously. For these reasons a change from air breakers to fused switches is not recommended.

There are three disadvantages associated with the use of fused disconnect switches:

1. During emergency conditions it decreases the likelihood of bringing the DC system back on line in a short time following a trip (the fuses have to be replaced and tested).

2. A fault during normal operation increases the probability of a unit shutdown as the result of technical specification violations. This is also due to probable extended time to replace and test the fused switch.

3. During maintenance evolutions, fuses must be pulled, inspected, tested and replaced. The time involved in this process is greater than the time required to secure and restore system operation through the use of a circuit breaker. (False trips of the circuit breaker are prevented by quality assurance and specific operating procedures, as well as operator training.)

4. A blown or malfunctioned fuse may not be detected.

Action #5:

Bechtel discuss with the Palo Verde charger manufacturer any failures of their equipment that had been experienced and discuss how like failures will be prevented on Palo Verde.

Response:

Power Conversion Products (P.C.P.) has had no experience with their present design battery chargers failing. An earlier P.C.P. charger design experienced drift on the current limit control circuit due to an electrolytic capacitor. This design has been changed and no drift has been experienced since.

Action #6:

Bechtel examine the dc power system's capability to withstand multiple failures; that is, to go beyond the existing regulatory requirements.

Response:

The results of our analysis indicate that the DC power system can tolerate at least two independent failures except for the 120 VAC and 125 VDC buses, and the cables and breakers directly connected to those buses.

Action #7:

Bechtel verify that there are no adverse interactions between acid spills in the battery room and the floor coatings. That item was also discussed further later on in the presentation (page 122). However, there was a supplementary item that was requested that Bechtel investigate that the battery rack embeds and mounting wells are protected from acid spills.

Response:

The floors and embeds in the battery rooms are coated with an epoxy paint which resists acid attack. The embeds are flush with the concrete floor; the coating covers the floor, embeds, and welded battery supports.

Additionally, there are no cinch anchors or concrete expansion joints used in the battery rooms. All embeds are set into the floor.

Action #8:

Bechtel investigate how the battery rooms are protected from flooding by fire protection water sprays in the lower cable spreading room. Also, Bechtel verify that we can't have any flooding in the corridors where the water could come into the battery rooms or charger rooms and cause any problems.

Response:

There are no floor penetrations between the lower cable spreading room and battery rooms. A fire-resistant silicon foam is used for seals between the lower spreading room and the remaining area of el. 100' (outside the battery rooms).

Water is prevented from entering the battery rooms from the outside corridors by floors being sloped to exterior drains.

Additionally, the major fire protection header outside the battery room is CO_2, and not water. (See also response to Action #1.)

Action #9:

Bechtel verify that all equipment in the battery rooms is Seismic Category I or, if it is not Seismic Category I, it cannot cause damage to the batteries during or after a seismic event.

Response:

All equipment in the battery rooms is either Seismic I or Seismic IX (Seismic IX defined to be: equipment may lose function during an SSE but may not damage essential systems).

Action #10:

Bechtel verify the allowable fluctuations in the ac power source to the battery chargers. (That item dealt with a determination of how much fluctuation was allowable in the ac power source in order to meet the plus or minus 2% allowable fluctuation in the dc.)

Response:

The battery charger specification 13-EM-051 allows a maximum ripple of 2% with an input three-phase voltage of 480V $\pm$ 10%.

Action #11:

Bechtel explain the differences which exist between the Palo Verde FSAR battery loading tables and the loading tables shown in the system description.

Response:

The battery loading tables presented under the System Description Outline were based on the latest available information in April 1980. The loading tables described in the FSAR were based upon the best available information in September, 1979.

(The changes noted in the response to Action #11 will be reflected in an FSAR change and a System Description revision.)

Action #12:

Bechtel verify that the presentation reflected the current battery capacities.

Resolution:

The battery manufacturer sized the Class IE batteries as follows to envelope the load profiles of Specification 13-EM-050 Rev. 2 with 25% spare capacity to compensate for aging:

Channel	Battery Type	Nom. Amp Hours
A	GN-19	1,600
B	GN-19	1,600
C	EN-21	890
D	EN-19	800

The specification load profiles contained 25% spare capacity for load growth. The load profiles presented under System Description Outline are still enveloped by the manufacturers battery size with at least 5% spare capacity for future growth in all cases and the 25% spare capacity for battery aging.

All of the Class IE batteries will be increased in size as follows because of the need to maintain margin for future loads on channels A and B and the need of the vendor to standardize his qualification for channels C and D.

Channel	Battery Types	Nom. Amp Hours
A	GN-23	1,800
B	GN-23	1,800
C	GN-13	1,144
D	GN-13	1,144

These larger batteries should provide satisfactory margin for future growth.

(The changes noted in the response to Action #12 will be reflected in an FSAR change and a System Description revision.)

Action #13:

Bechtel investigate the use of a battery high discharge rate alarm and charger overcurrent alarm.

Resolution:

It is noted from page 134 of the transcript that the charger overcurrent alarm refers to a charger current limit level alarm.

Bechtel has determined that the requested alarms are not required for the following reason:

The undervoltage relay at the dc bus will be set to alarm when the bus voltage drops approximately 5 volts below the float voltage level. This close setting detects overcurrent conditions while the voltage is still within operating range, and alerts the operator to monitor the battery and charger ammeters in the control room.

Action #14:

Bechtel verify the battery ammeter is center-reading zero.

Resolution:

This item was closed out at presentation (refer to page 175 of transcript). Ammeter is center-reading zero.

Action #15:

Bechtel examine the control board layout for the dc power system to determine if the operator interface could be improved.

Resolution:

This action will be incorporated into the human factors control room study.

Action #16:

PVNGS Operations verify that their procedures will require monitoring of battery air flow or battery room air flow.

Resolution:

No Bechtel action required. (See also response to Action #3.)

Action #17:

Bechtel determine if the failure mode and effects analysis presented should include failures that would introduce ac power components into the dc system.

Resolution:

Bechtel will add another item to the failure mode and effects analysis (FSAR Table 8.3-5). A copy of the revision to the table is found in enclosure (2) and will be reflected in an FSAR change.

Action #18: (page 176 of transcript)

Bechtel consider the schematic information presented in the FSAR to speed up evaluation processes.

Resolution:

A simplified schematic will be provided in a future amendment to the FSAR.

Table 8.3-5

FAILURE MODE AND EFFECTS ANALYSIS[a] (Sheet 5 of 8)

Identification No.[b]	Component Name	Component Function	Failure Mode	Effect on Subsystem	Effect on System
21	Feeder breaker to voltage regulator (NC)	Provides protection to the bus under fault conditions and provides power to the voltage regulator under normal conditions	Fails open	Loss of power to the voltage regulator	No effect - The voltage regulator is on standby basis in case of inverter failure.
22	Feeder breaker to battery charger (NC)	Provides protection to the bus under fault conditions and provides power to the battery charger under normal conditions	Fails open	Loss of power to one battery charger.	No effect - The battery provides power to the dc bus. In addition the standby battery charger can be connected to the dc bus.
23	Battery	Provides dc power to the bus	Fails to provide dc power	Loss of standby power to the bus	No effect - The batteries serve as the source of standby dc power to the bus. The charger provides the dc power under normal conditions
24	Battery charger	Provides dc power to the bus.	Fails to provide dc power	Loss of primary dc power.	No effect - The battery provides power to the bus and the standby charger can be connected to provide power for extended period of time.
			Impresses ac component on dc Bus	Loss of dc power to one channel	No effect -- Power is available to other three redundant channels. No actuation of ESFAS system due to 2/4 logic

ARIZONA PUBLIC SERVICE COMPANY

COMPANY CORRESPONDENCE

June 23, 1980

PVNGS-80-368-FWH/[illegible]

TO: E. E. Van Brunt, Jr.

STA: 3003

FROM: F. W. Hartley

STA: 4015

EXT: 6380

SUBJECT: PVNGS DC Power System Review Open Item

File: 80-056-026

Reference: ANPM-9036-JMA/JPS; dated June 17, 1980

The referenced memorandum requested PVNGS Operations respond to Open Item number 16:

"Verify that their procedures will require monitoring of battery air flow or battery room air flow."

There are differential pressure switches located in the exhaust ductwork of each battery room that alarm in the control room on a low flow condition. An Alarm Response Procedure will prescribe appropriate operator action.

F. W. Hartley, Manager
PVNGS

[illegible]/pr

cc: L. K. Mundth (1740)
J. E. Kirby
R. R. Clifford
R. W. Kramer
T. L. Cotton
R. L. Hoefert

Commitment 038