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October 30, 1985
ST-HL-AE-1437
File No.: G9.17

Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Information to Support the NRC Review
Regarding Internal Flooding

Dear Mr. Knighton:

The attachment enclosed provides information to support the NRC review regarding internal flooding. This is being provided in response to a verbal request from the NRC reviewer regarding protection against internal flooding of ESF equipment trains.

Please note that the attached response was discussed with Mr. N. P. Kadambi and Mr. R. Goel of your staff by our Mr. C. A. Ayala during the week of October 16, 1985. Additionally, the insert refers to other recent letters to the Staff containing DSER/FSAR item responses. Refer to letter ST-HL-AE-1389, dated 10/14/85 regarding "Pipe Break Analysis" (see Table 3.6.2-2), and ST-HL-AE-1418, dated 10/12/85 regarding "Section 3.4" (see insert VIII Attachment 1).

If you should have any questions concerning this matter, please contact Mr. Powell at (713) 993-1328.

Very truly yours,

M. R. Wisenburg
Manager, Nuclear Licensing

CAA/bl

Attachments: Annotated FSAR pages addressing Internal Flooding

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cc:

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Revised 9/25/85

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forces are calculated using the formula given in Subsection 3.4.2.2.1.1. The maximum depths and the resulting forces are given in Table 3.4-1.

3.4.2.2.2 Vertical Loading: The vertical hydrostatic loading acting on a horizontal plane is the weight of water above that plane. The vertical buoyant load that affects the stability of a structure is the buoyant force which is equal to the weight of water displaced by the structure. Table 3.4-1 shows the elevations of maximum water surface used for buoyancy calculations based on average depths. The maximum buoyant force is calculated by assuming that the granular backfill around the structures is completely saturated so that the buoyant force will occur as soon as water arrives at the plant area. The maximum buoyancy effects for the ECW intake structure are based on a maximum water-surface El. of 41.0 ft MSL based on the steady-state condition.

Incert new subsection → 3.4.3 & 3.4.4

Insert 3.4-3 3 4
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3.4.3 Internal Flood Protection Measures

Safety-related systems, components and structures are protected such that the plant can achieve and maintain a safe shutdown condition and prevent unacceptable radiological releases to the environment.

In general, the plant layout arrangement is based on maximizing the physical separation of redundant or diverse safety-related components and systems from each other and from nonsafety-related items. Therefore, there is minimal effect on other systems or components which are required for safe shutdown of the plant or to mitigate the consequence of internal flooding.

Where separation is not feasible, other protection features are employed. These protection features include the following:

- Structural enclosures including water-tight doors
- Structural barriers
- Curbs and elevated thresholds
- Seismically designed components
- Hardening
- Orientation
- Equipment leak detection systems
- Floor Drain System

Specifically, water-tight doors are designed to withstand the design flood level on either side of the door and to prevent leakage through the door. Structural barriers or spray shields are designed to preclude water spray damage from postulated leakage cracks and sprinkler activation. Curbs and elevated thresholds are designed to prevent leakage from compartments and unsealed cubicles to other areas. Penetration seals through firewalls or radiation barriers of rooms are designed to withstand the design flood level on either side of the wall and prevent leakage through the penetration. Class 1E leak detection level instrumentation is provided for the containment spray and safety injection system rooms. (See FSAR Section 9.3.3.2.3 for more design information for the leak detection level instrumentation.) The Floor Drain System is equipped to protect safety-related equipment from the effects of leakage of systems within the building as described in FSAR Section 9.3.3. For example, concrete floors are sloped to floor drains located at low points in the same area to facilitate floor drainage and prevent water accumulation. Also ESF equipment will be protected from unacceptable damage due to flooding caused by reverse flows through the drainage system by either the drain system design or building design features.

Methodology used in analysis of the effects of high energy line breaks is discussed in FSAR Section 3.6. Flooding effects analyses are contained in Table 3.6.2-2 for postulated high energy line breaks. For example, the containment flooding analysis has shown that the maximum volume of water discharged to the RCB occurs as a result of a Loss of Coolant Accident, and water from the RCS, accumulators and the RWST is assumed to spill onto the RCB floor.

Reviews of internal flooding ~~reviews~~ from other sources (tank ruptures, moderate energy cracks, etc.) within the following buildings are performed to assure the essential functions of affected safety-related systems, components and structures necessary to achieve and maintain a safe shutdown condition or that the appropriate combinations of the above protective measures are used:

- o Mechanical and Electrical Auxiliary Building including the Isolation Valve Cubicle
- o Diesel Generator Building
- o Fuel Handling Building
- o ECW Intake Structure

The following is an example of the analysis methods of Section 3.4.4 used to determine the appropriate protection method within the Isolation Valve Cubicle.

FSAR Table 3.6.2-2, Section II.B indicates that watertight doors were used to maintain the complete separation between trains to preclude adverse flooding effects from postulated high energy line breaks.

Due to the lift-off or vent panel design on the IVC roof (designed to relieve the pressure buildup following postulated pipe breaks described in FSAR Appendix 3.6.A) internal flooding due to rainfall associated with torandos is being evaluated.

Analyses, in accordance with the methods of FSAR Section 3.4.4, are being performed to determine the flood level in the pump cubicles. Since the lift-off panels on all four cubicle compartments are affected by the assumed tornado depressurization loading, all trains of the auxiliary feedwater pump cubicles are impacted~~, and therefore, it is expected that~~. Additional curbs and elevated thresholds will be provided as necessary to preclude unacceptable consequences. The flood level analyses will provide input into the sizing of the added curbs or thresholds. Depending on the results of the flood level analysis, administrative control of certain floor drains may be considered~~necessary~~. Since the initiating event is rainfall coincident with a tornado, sufficient operator time and access capability exists to perform the required drain control.

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3.4.4 Internal Flood Analysis Methods

The internal flooding analysis assures that safety-related systems, structures and components are not prevented from performing their essential functions following the postulated failure. The sources of flooding are:

- o Moderate energy lines with through wall cracks
- o Tank ruptures
- o High energy line breaks
- o Activation of the fire protection system

The flooding analysis assesses the maximum flow of fluid from the postulated break, crack, or sprinkler flow that possesses the maximum fluid discharge in a specific area. The maximum time for flood will vary according to the particular case being analyzed. Operator actions in the main control room to mitigate the consequences are assumed to be initiated a minimum of 10 minutes after control room indication is available to show that action is required. Operator response time for actions outside the control room is assumed to be 30 minutes after control room indication. An operator response time shorter than identified above is used if shown feasible by analysis.

If a postulated break of a pipe causes other piping to fail as a consequence of the initial break, then the flow from the secondary piping is considered in the flooding analysis.

Flooding caused by activation of the fire protection system is not considered concurrently with other design basis accidents or events.

A single, ~~random,~~ limiting independent active component failure is considered in conjunction with the effects of flooding. Single failures are not assumed in a system or component which normally operates at the time of failure initiation and which also functions to mitigate the break event, provided the system or component is designed to Seismic Category I and is qualified for the environment associated with the break.

If the postulated failure results in automatic separation of the turbine generator from the power grid, then offsite power is assumed unavailable unless the assumption of loss of offsite power is not conservative (e.g., termination of flooding due to loss of power to a pump). Power restoration is assumed after 24 hours.

For calculating outflow in postulated line failures, the normal operating pressure and temperature is utilized as the initial thermodynamic conditions. The volume occupied by equipment in a room is considered when performing the flooding analysis for the water height. The occupied volume of this equipment is subtracted from the total volume of the room. Appropriate credit for gravity drains and the volume occupied by sumps ~~shall be~~ is considered in flood height determinations.

Postulated post-accident or post-SSE failures of Non-Seismic Category I fluid systems are considered singly in the flooding analyses.

Postulated flooding caused by failures of Non-Seismic Category I non-tornado protected tanks in the yard and inside seismic Category I buildings ~~does~~ shall not result in failure of a safety-related system to perform its essential function.

Each tank rupture ~~are~~ is evaluated as follows:

a) Instantaneous release of tank fluid capacity for Non-Seismic Category I tanks.

b) Fluid flow through an area of a through wall crack equal to one-half the thickness by one half the outside diameter of the largest fluid discharge connection to Seismic Category I tanks.

The use of non-seismic Category I piping in mitigating the consequence of postulated piping failure outside the containment is clarified in the following paragraphs:

1) For non-seismic Category I piping failures, it is assumed that a safe shutdown earthquake could be the cause of the failure. Therefore, only seismic Category I equipment can be used to mitigate the consequences of the failure and bring the plant to a safe shutdown.

2) A postulated failure in seismically qualified portions of piping systems is not assumed to be seismically induced. Propagation of the failure to failures of non-seismically qualified equipment is not assumed. Only safety grade equipment is considered in satisfying protection criteria. However, credit is taken for the use of non-safety grade equipment as backup for random single failures.

QUESTION 410.13 (9.3.3)

Regarding internal flooding of safety related areas verify that adequate protection has been provided for safety-related equipment assuming the worst case flooding resulting from failures in high or moderate energy piping or postulated failure in nonseismic components (such as tanks). This protection cannot assume credit for nonseismic Category I Sump Pumps. Your response should include the time required for operator action if necessary to provide protection of essential equipment once indication from Class 1E level switches is given.

RESPONSE:

~~Results of the internal flooding analysis affecting safety-related equipment will be provided during the Fourth Quarter of 1985.~~

Section 3.4-3 and 3.4-4 have been added to provide the internal flood protection measures, flood analysis methods and sample results ~~of selected plant areas~~ of the internal flood analyses for selected plant areas.

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Question 010.10

To adequately evaluate Section 9.3.3, "Equipment and Floor Drainage Systems," provide additional information and detail explaining what is provided in each safety related compartment or area to assure the plant can be safely shut down after a postulated pipe break or crack in any system passing through or terminating in the compartment or area. Describe the protection provided, i.e., equipment or isolable compartment structure or area. In the case where equipment is provided for protection of the safety related components or system, describe what protective equipment is provided, where it is installed, and what function(s) does it perform to assure protection from flooding, of the safety related equipment in the compartment or area. Indicate what operation action, if any, and within what time interval it is required to prevent flooding of safety related equipment. Also, provide the results of an analysis that demonstrates compartment and/or area drains serving safety related components or systems have been sized for maximum flow conditions.

Response

~~Section 3.4 will be revised~~ to provide a discussion of ~~the effects of internal flooding.~~ See Section 9.3.3 for ~~drain flow sizing.~~ 40

Section 3.4.3 and 3.4.4 ~~has~~ have been added to provide a discussion of the internal flood protection measures, flood analyses methods and sample results of the internal flood analyses for selected plant areas. See section 9.3.3 for drain flow sizing.

INSERT VIII

3.4.1.2 Internal Flood Protection Measures.

Safety related systems, structures, and components are protected against internal flooding caused by postulated piping through-wall cracks and breaks, tank or vessel rupture, and by inadvertent actuation of the fire protection (water) system. Protection is provided for safety related systems and components that are required to attain and maintain a safe shutdown condition and prevent unacceptable radiological dose consequences. Watertight doors, curbs, wall penetration seals and drainage systems (see Section 9.3.3) are provided to mitigate the effects of internal flooding on essential systems and components. An appendix to Chapter 3 will be provided to include basic assumptions, results, and specific protection measures as part of the Integrated Hazards Analyses (pipe break, flooding, etc.).

Note to Reviewers :

The above insert was submitted in a previous letter to the Staff in ST-HL-AE-1418 dated 10/12/85 on page 22 of 40 of Attachment 1.
More complete information is provided in the revisions of this letter. Thus, the above insert has been deleted.