APPENDIX 51

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APPENDIX 5I

DESIGN FEATURES FOR HIGH ENERGY PIPE FAILURE OUTSIDE THE REACTOR BUILDING

1.0 Introduction

This appendix summarizes the structural design features provided for protection from postulated high energy line breaks described in Section 14.4.

2.0 Main Steam System

Whip restraints for the Main Steam Lines (shown in Figures 1-10, 1-19, 14.4.6-1 and 14.4.6-2) are designed to withstand the loadings associated with postulated pipe failures. Shield plates and concrete slabs are provided on the auxiliary building roof to protect structures, systems and components necessary for cold shutdown. Restraints are provided on the roof and along the south wall of the auxiliary building to prevent unacceptable pipe whip. These restraints are designed to allow for pipe growth resulting from thermal transients and for equivalent static pipe rupture force with consideration given to the gap effects. The auxiliary building frame and concrete roof and walls are designed to take the maximum reaction forces from the pipe restraints. Pipe restraints are also provided at the turbine stop valves to prevent pipe whip into the south wall of the auxiliary building.

To protect equipment within the auxiliary building from pipe whip and jet impingement, the auxiliary building roof is designed as a steel plate supported by a heavy space frame north of column H and as a concrete roof slab south of column H. Doors on the south wall of the auxiliary building will be designed to prevent steam flooding of the control room or upper and lower cable spreading rooms. The analytical methods for pipe whip restraint design are described in Reference 1.

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3.0 Main Feedwater

The feedwater system is routed entirely outside the auxiliary building (See Figures 1-5 and 1-10.) The structural behavior of the auxiliary building resulting from postulated pipe whip is being investigated by methods described in Reference 2, treating the whipping pipe as a missile. Several design alternatives are being considered to protect safety equipment in the auxiliary building. These alternatives are discussed in Section 14.4.7.6. A gap is provided between the reactor building and the auxiliary building wing to ensure that there is no interaction between these two buildings in the event of a postulated feedwater pipe rupture concurrent with the loading from the maximum earthquake as required by Reference 3.

4.0 Other High Energy Systems

The protective enclosures within the auxiliary building are designed as isolated compartments, able to withstand the combined effects of jet impingement, pipe whip, differential pressure and steam-water flooding. In most cases, the equivalent static pressure, determined from the pressurization transient, governs the design since jet impingement and pipe whip effects are local. The concrete walls and slabs are treated as rectangular plates subjected to this uniform equivalent static pressure. Where necessary, vents or pressure relief panels are provided.

5.0 References

1. "Design For Pipe Break Effects", Bechtel Report BN-TOP-2, Revision 1, dated September 1973.
2. "Design of Structures for Missile Impact", Bechtel Report, BC-TOP-9, Revision 1, dated May 1973.
3. "Structural Design criteria for Evaluating the Effects of High Energy Pipe Breaks on Category I Structures Outside the Containment", Structural Engineering Branch Report, Directorate of Licensing.

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