

GOTHIC Auxiliary Building Analysis Models

Background

As a full-service provider for pressurized water reactor (PWR) and boiling water reactor (BWR) nuclear power plants, Westinghouse offers engineering services for auxiliary building and secondary containment building (AB/SCB) analyses for both PWRs and BWRs. Westinghouse AB/SCB analyses use the GOTHIC code to model the auxiliary building or secondary containment building in detail in order to capture the transient effects of an event on the building or a given location.

Description

The GOTHIC code is a state-of-the-art program for modeling multiphase flow that is used to calculate a variety of system thermal hydraulic parameters such as pressure, temperature and liquid level. This code is rapidly becoming the industry standard for performing both inside- and outside-containment pressure and temperature analyses. Numerical Applications Incorporated developed and maintains the code, with funding from the Electric Power Research Institute (EPRI). The GOTHIC code has been extensively reviewed and has subsequently been validated by an impressive array of tests. In addition, the U.S. Nuclear Regulatory Commission has reviewed and approved many plant-specific analyses.

A plant-specific AB/SCB model is a flexible tool that can be used for a variety of analyses. The developed model will be biased for the particular analysis of interest. Thermal hydraulic analyses for auxiliary buildings, which can be performed using the GOTHIC code, include:

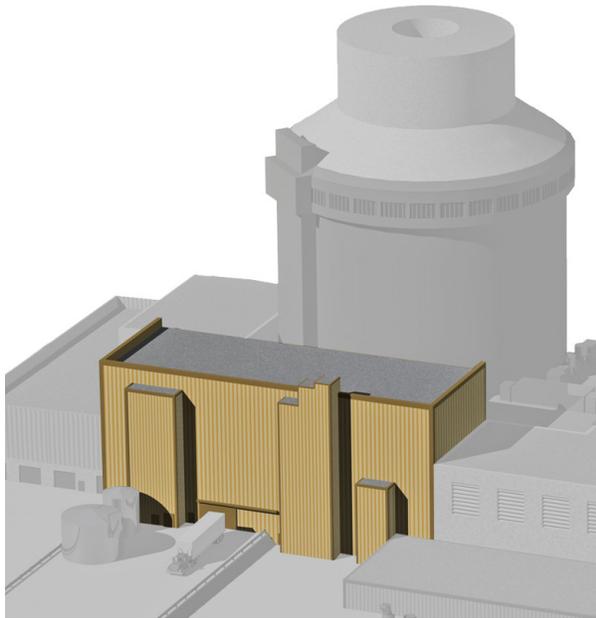
- Analytical support of procedure development for the operation of portable safety equipment
- Subcompartment pressure/temperature analysis following a high energy line break (HELB)
- Calculation of room temperature following a station blackout (SBO) or loss of the heating, ventilation and air conditioning (HVAC) system
- Calculation of room temperature during a fire event
- Auxiliary building flooding analyses

Westinghouse can provide plant walk-down services so that the unique characteristics of an AB/SCB are captured in the model as it is developed.

Benefits

Auxiliary building models allow a utility to quickly and cost effectively determine the following:

- The optimal placement of room-cooling portable emergency equipment following SBO events
- The survivability of key equipment following HELB or flooding incidents
- The habitability of auxiliary building rooms following HELB, flooding incidents, HVAC failures or fires
- The adequacy of pressure relief pathways following HELB events



Auxiliary building

Experience

- Westinghouse developed single-floor models of a plant's auxiliary building to analyze room heat-up following a loss of HVAC.
- Multi-room GOTHIC models were developed and used to analyze room cool-down for SBO events during extreme winter weather for the AP1000® nuclear power plant.
- Westinghouse developed a GOTHIC model of a plant's intake structure to support procedure development addressing beyond-design-basis flooding in order to prevent the flooding of pump motor locations and preserve cooling capabilities. Actual flooding occurred shortly after this work was completed and the procedures proved successful when used.

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