

FATE™ Software for Reactor Auxiliary Building Accident Response

Background

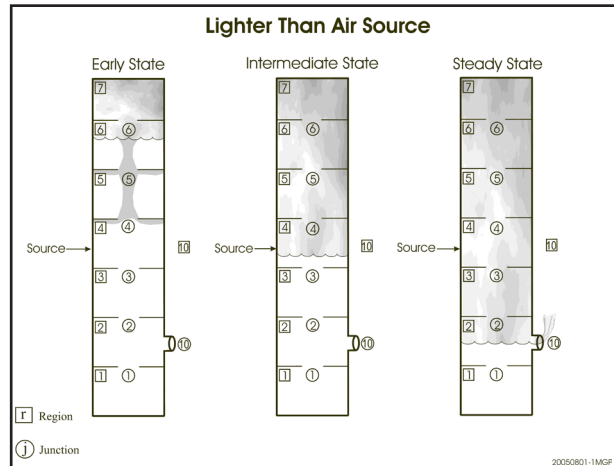
FATE™ software is a general nuclear facility model developed by Fauske & Associates, LLC, an affiliate of Westinghouse Electric Company LLC. FATE software is used for analyzing the reactor auxiliary building accident response prediction, including hydrogen behavior, contamination transport, fire and smoke migration, and room heat-up. FATE software is a versatile tool that addresses multiple issues that arise during extended station blackout events.

Description

FATE software is used to model all the reactor auxiliary building rooms outside containment in order to:

- Predict facility response to accidents that involve the release of hydrogen or contamination outside containment
- Analyze fires and smoke migration

Key results of the analysis include the time history of room and corridor habitability and the potential for flammability and its consequences. FATE software is uniquely suited to nuclear facilities because, in order to track smoke and contamination, it combines models for temperatures, pressures, flow rates and structural response with models for aerosol release, transport and deposition. FATE software has been applied to fire- and smoke-migration analyses for both nuclear power and fuel-fabrication plants, and it has been applied to many nuclear fuel-cycle facilities to examine flammability, combustibility and contamination hazards.



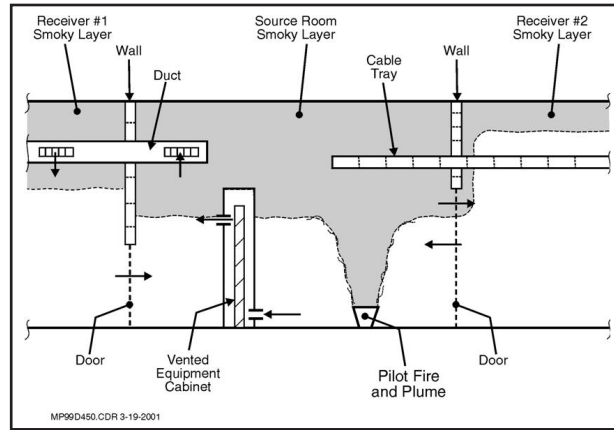
Hydrogen plume migration and stratification

Benefits

FATE software has been developed and maintained under the Westinghouse/Fauske & Associates Nuclear Quality Assurance system, and its predecessor software won a U.S. Department of Energy Technology Innovation award for Hanford applications in 2000.

FATE software has a unique combination of models for reactor auxiliary building accident response evaluation:

- Hydrogen behavior is realistically modeled via source plumes and stratification consideration to predict flammability potential
- Fire and explosion models predict consequences for damage
- Temperatures in rooms account for density stratification, and temperatures of walls and equipment are evaluated in multiple dimensions
- Time-dependent habitability of corridors and rooms due to smoke, steam and contamination hazards includes the effects of doorway configuration and ventilation systems

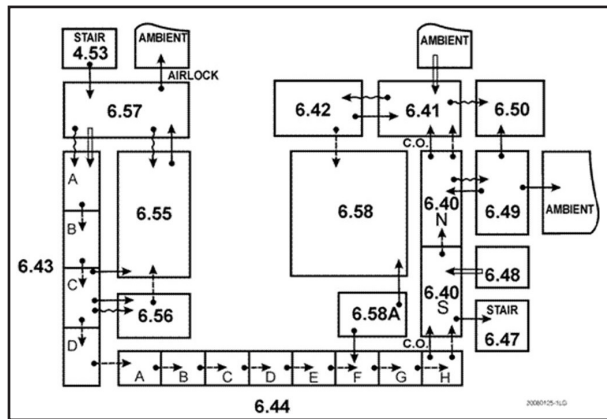


Plume and stratification phenomena

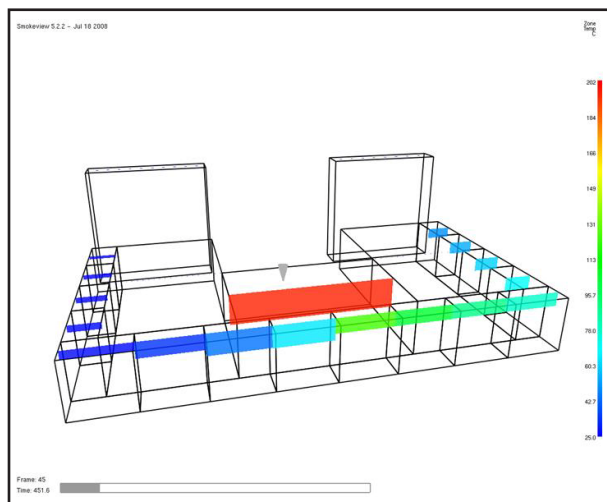
Experience

FATE software has been applied to numerous facilities and processes, including:

- Nuclear power plant detailed fire modeling for equipment response
- Nuclear reactor auxiliary building smoke migration and habitability analysis
- Mixed oxide fuel-fabrication facility fire analyses for prediction of contamination transport, including the effects of soot buildup on filters
- Nuclear waste storage tank hydrogen flammability, combustibility and contamination source-term consequences
- Nuclear waste tank solvent vaporization, vapor explosion and contamination source-term consequences
- Commercial spent nuclear fuel-drying and peak-temperature analyses for loss of flow
- Spent metallic uranium nuclear fuel-drying and pyrophoricity potential during accidents
- Nuclear waste vitrification plant waste tank and ventilation system process and accident analyses



Example of modeling every room; one elevation shown



Smoke migration during a fire

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