

Plant Model Application

Example PWR



Topics of Discussion

- Steady-State Modeling Techniques
- Transient Modeling Considerations



Plant Model Application

The course of discussion and the exercises will be centered around a TRACE input model of a pressurized water reactor (PWR). All of the major components in a PWR are included in the model.



PWR Plant Model Description

The TRACE model consists of the following:

- Three Primary Loops
- A Vessel Component
- Emergency Core Cooling System
- Balance of Plant Components
- Control System

PWR Plant Model Description

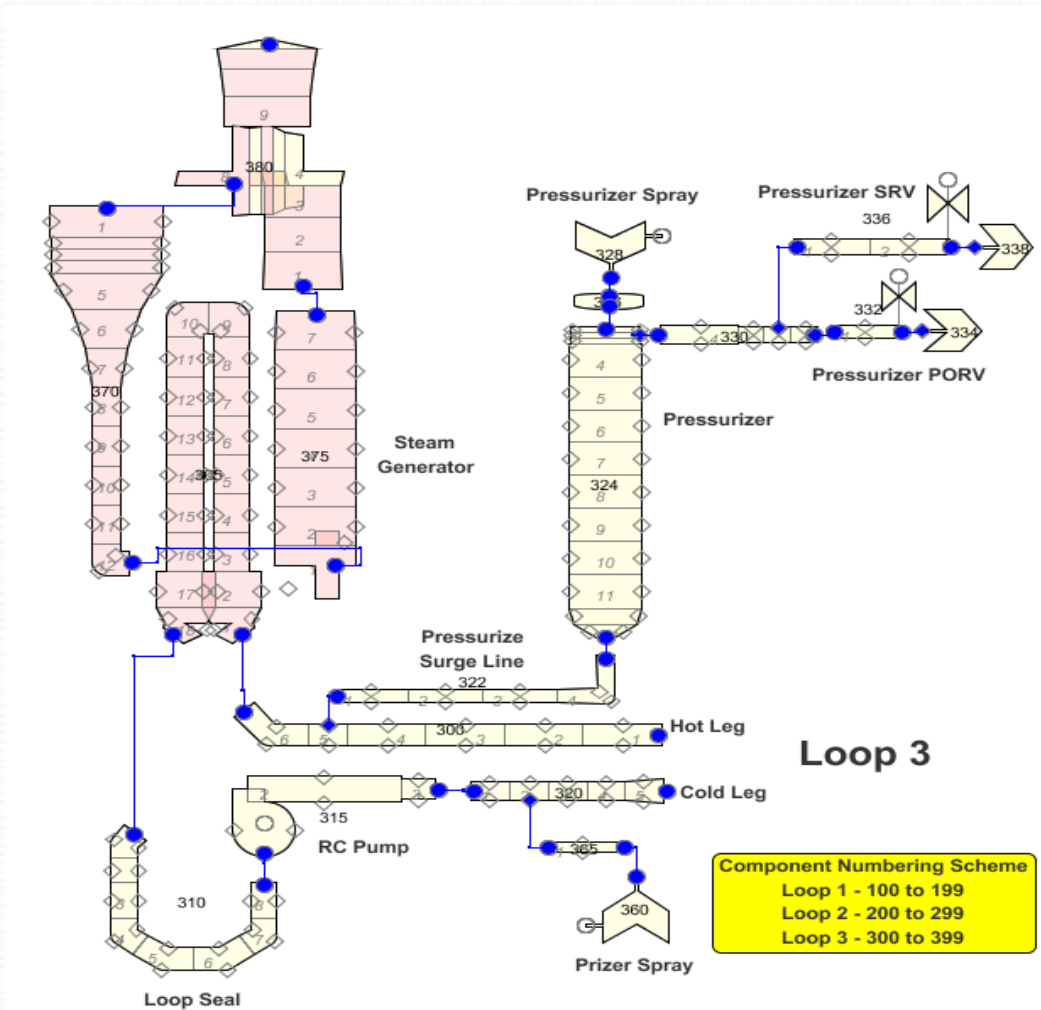
Each Primary Loop consists of:

- Hot Leg
- U-Tube Steam Generator
 - Inlet/Outlet Plenum
 - U-Tubes
 - Downcomer
 - Boiler Region
 - Steam Separator
 - Steam Dome
- Loop Seal
- Reactor Coolant Pump
- Cold Leg

Loop 3 contains the pressurizer and pressurizer spray system

Loop 2 contains the makeup flow

Loop 1 contains the letdown flow

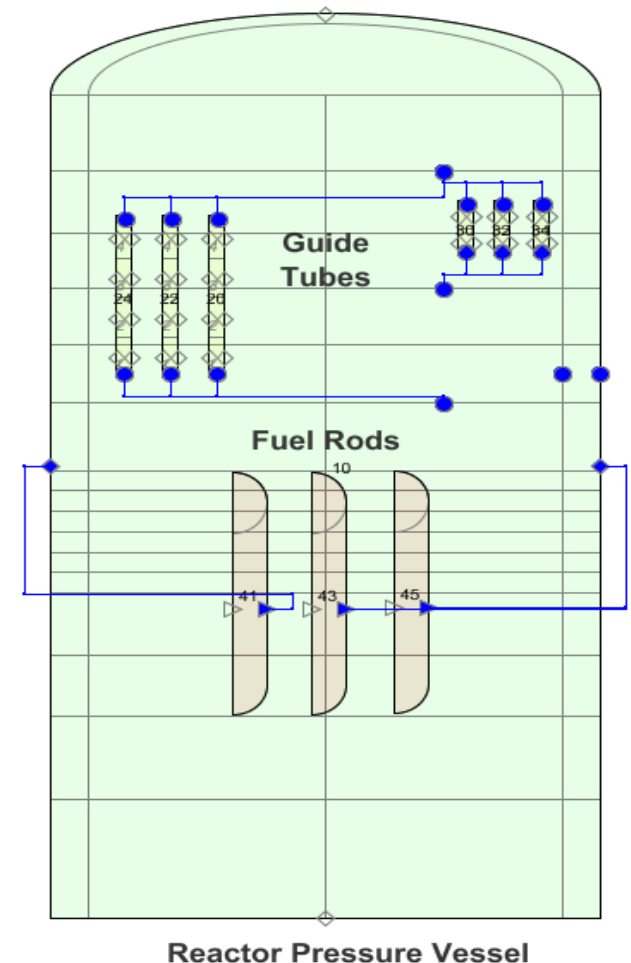


PWR Plant Model Description

The Vessel Component Contains:

- 16 axial levels, 2 radial rings, 3 azimuthal sectors
- Ring 2 models the downcomer
- Axial levels 1 - 2 model the lower plenum
- Axial levels 3 - 10 model the core
- Axial Levels 11 - 14 model the upper plenum
- Axial Levels 15 - 16 model the upper head

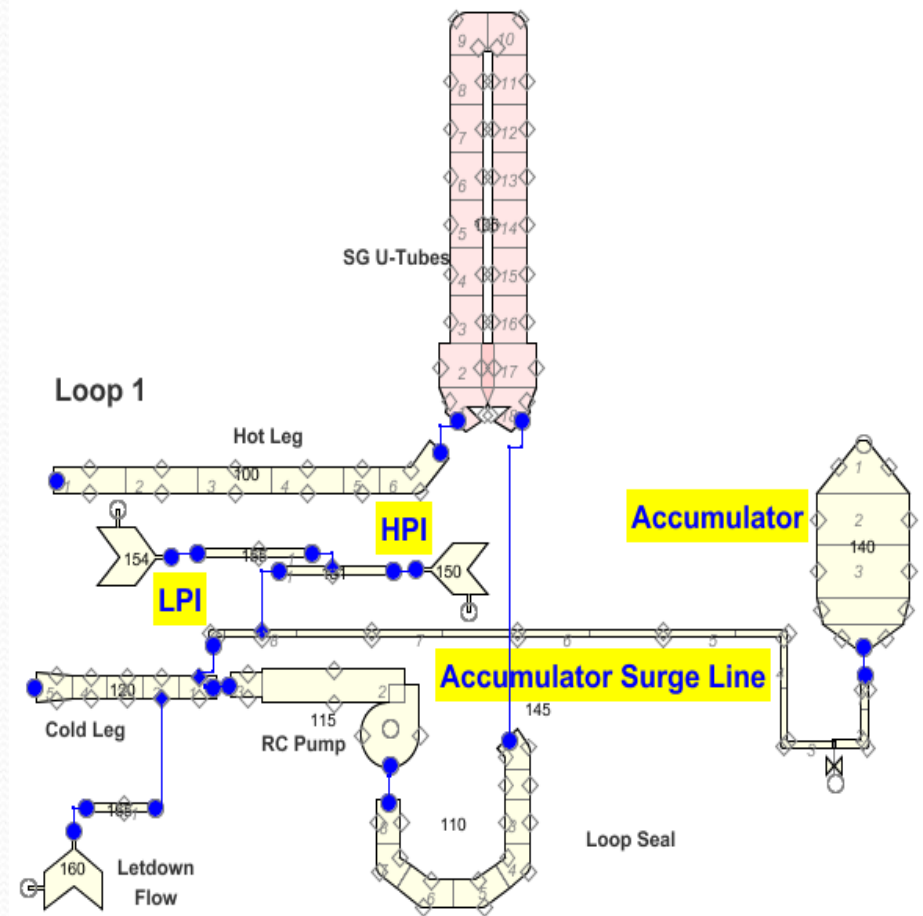
3 HTSTRs model the Fuel Rods
6 PIPEs model the guide tubes



PWR Plant Model Description

The Emergency Core Cooling System - Each Loop Contains:

- Accumulator
- Accumulator surge line
- High pressure injection system
- Low pressure injection system

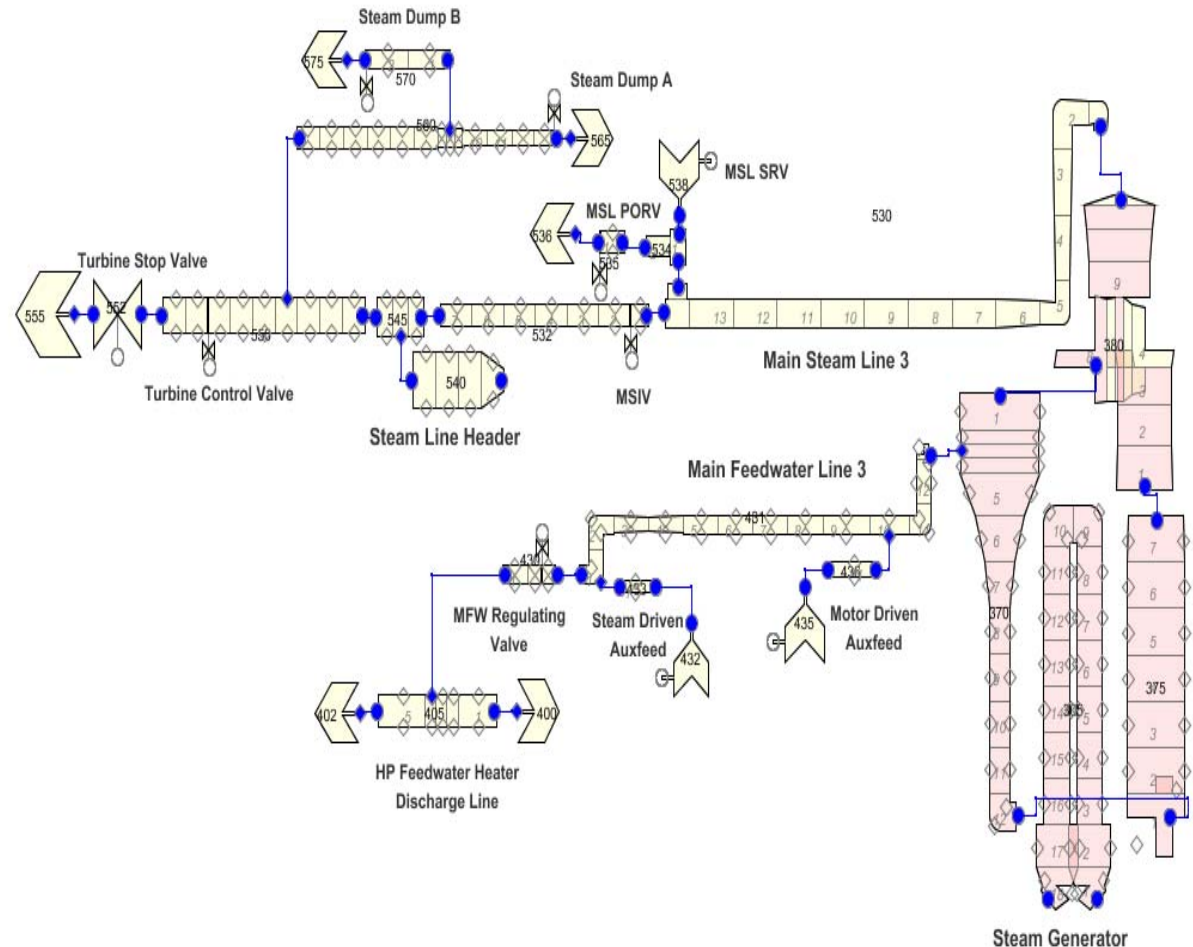


PWR Plant Model Description

Balance of Plant

Components Include:

- Main feedwater header
- Main feedwater line per loop
 - MFW regulating valve
 - Steam driven auxfeed
 - Motor driven auxfeed
- Main steam line per loop
 - MSIV
 - PORV
 - SRV
- Steam line header
- Steam dump system
- Turbine control valve
- Turbine stop valve



PWR Plant Model Description

Control System Consists of the Following Component Controllers and Trip Logic:

- **Loop Tave Control Logic** – modulates turbine control valve to adjust SG secondary pressure as needed to achieve desired Tave.
- **Primary System Pressure Control Logic** – pressurizer spray, makeup and letdown
- **Pressurizer PORV/SRV Control Logic**
- **Reactor Trip Logic**
- **Reactor Coolant Pump Trip Logic**
- **ECCS Trip Logic**
- **Main Feedwater Flow Control Logic**
- **Main Feedwater Regulating Valve Trip Logic**
- **Steam/Motor Driven Aux Feedwater Trip Logic**
- **Turbine Stop Valve Trip Logic**
- **Main Steam Isolation Valve Trip Logic**
- **Main Steam Line PORV/SRV Control Logic**
- **Steam Dump Valve Control Logic**