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:

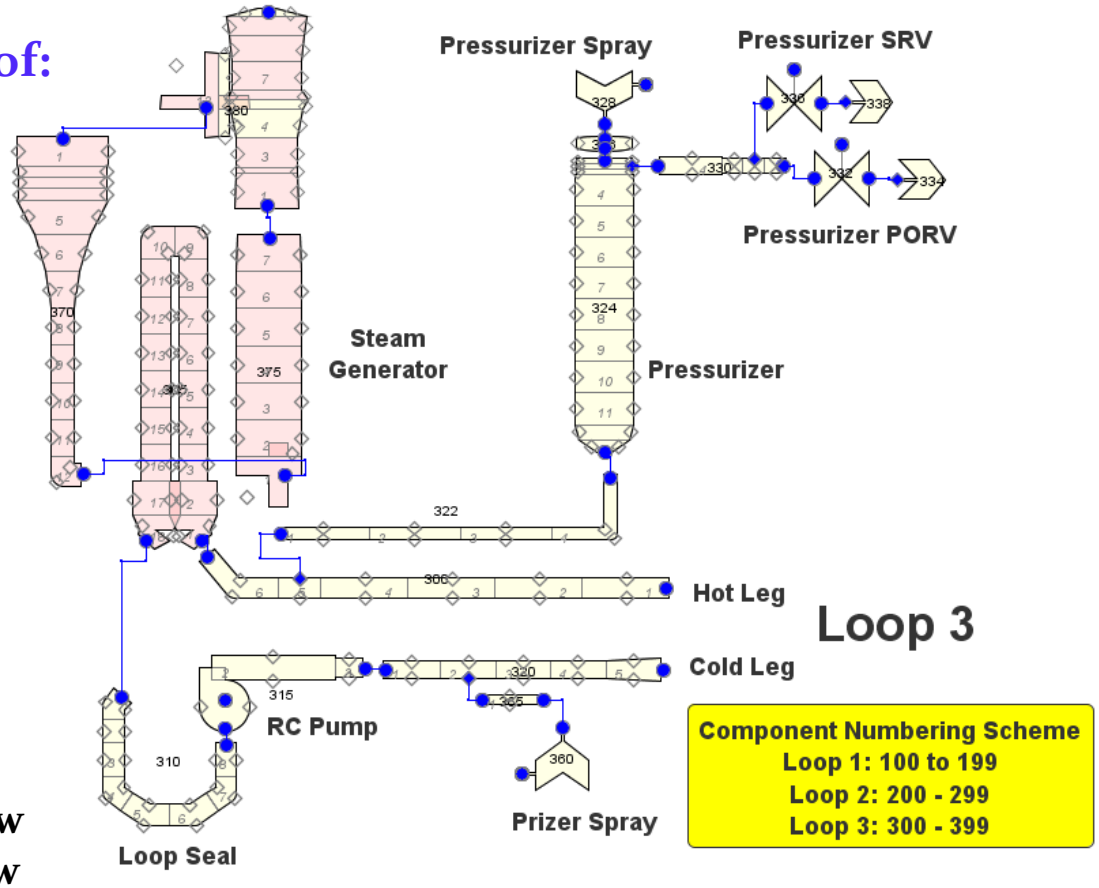
- Three Primary Loops
- A Vessel Component
- Emergency Core Cooling System
- Balance of Plant Components
- Control System

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

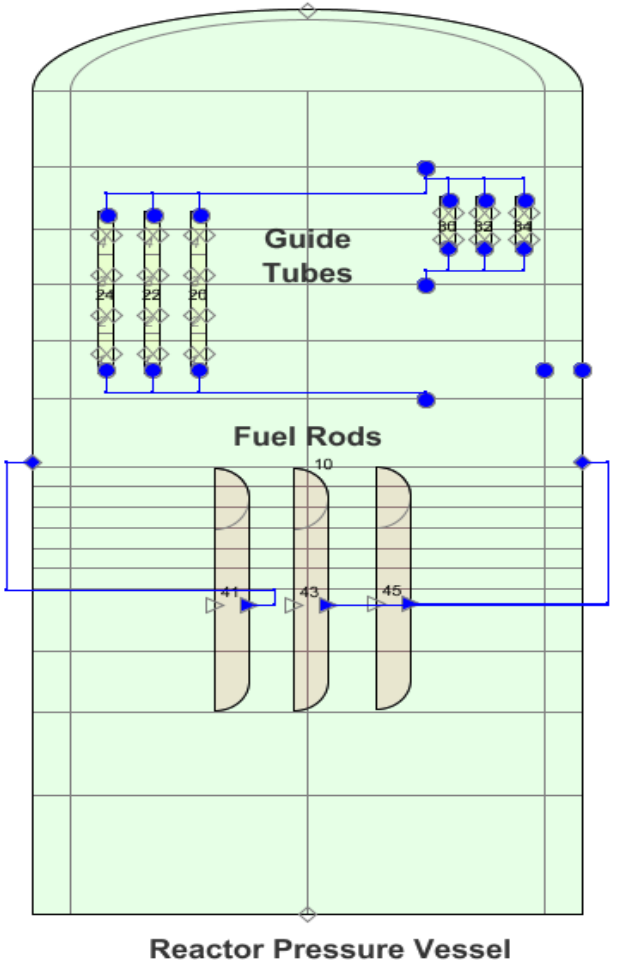


PWR Plant Model Description

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

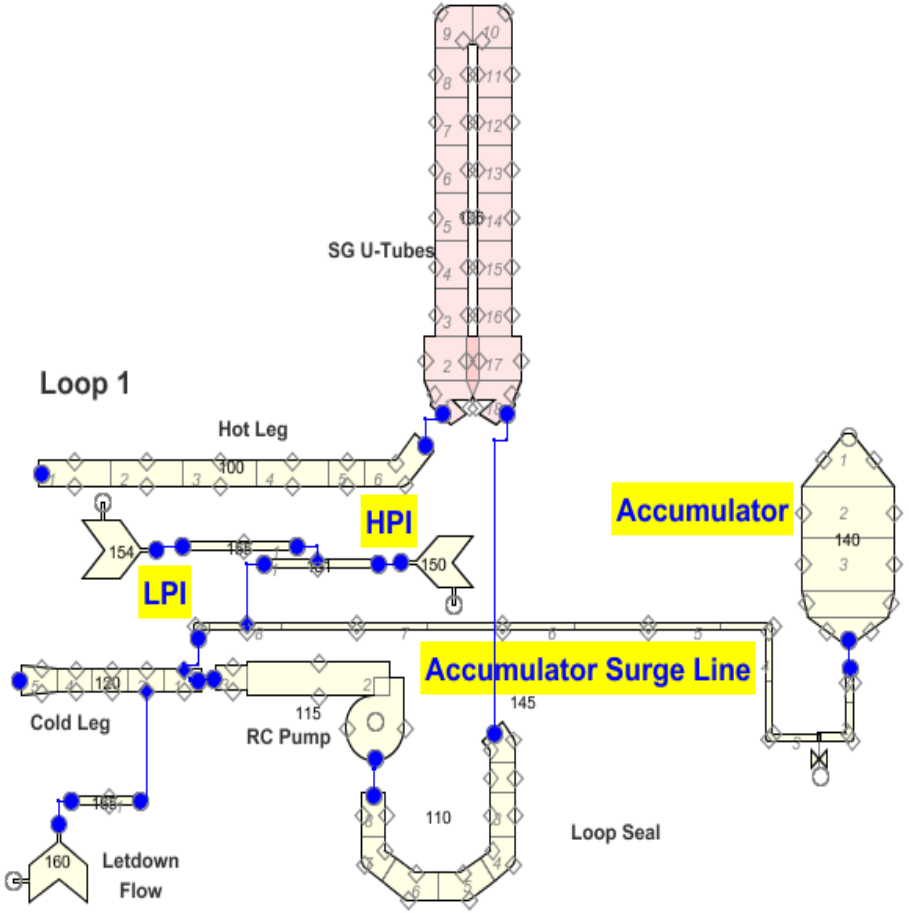
3 HTSTRs model the Fuel Rods
6 PIPEs model the guide tubes



PWR Plant Model Description

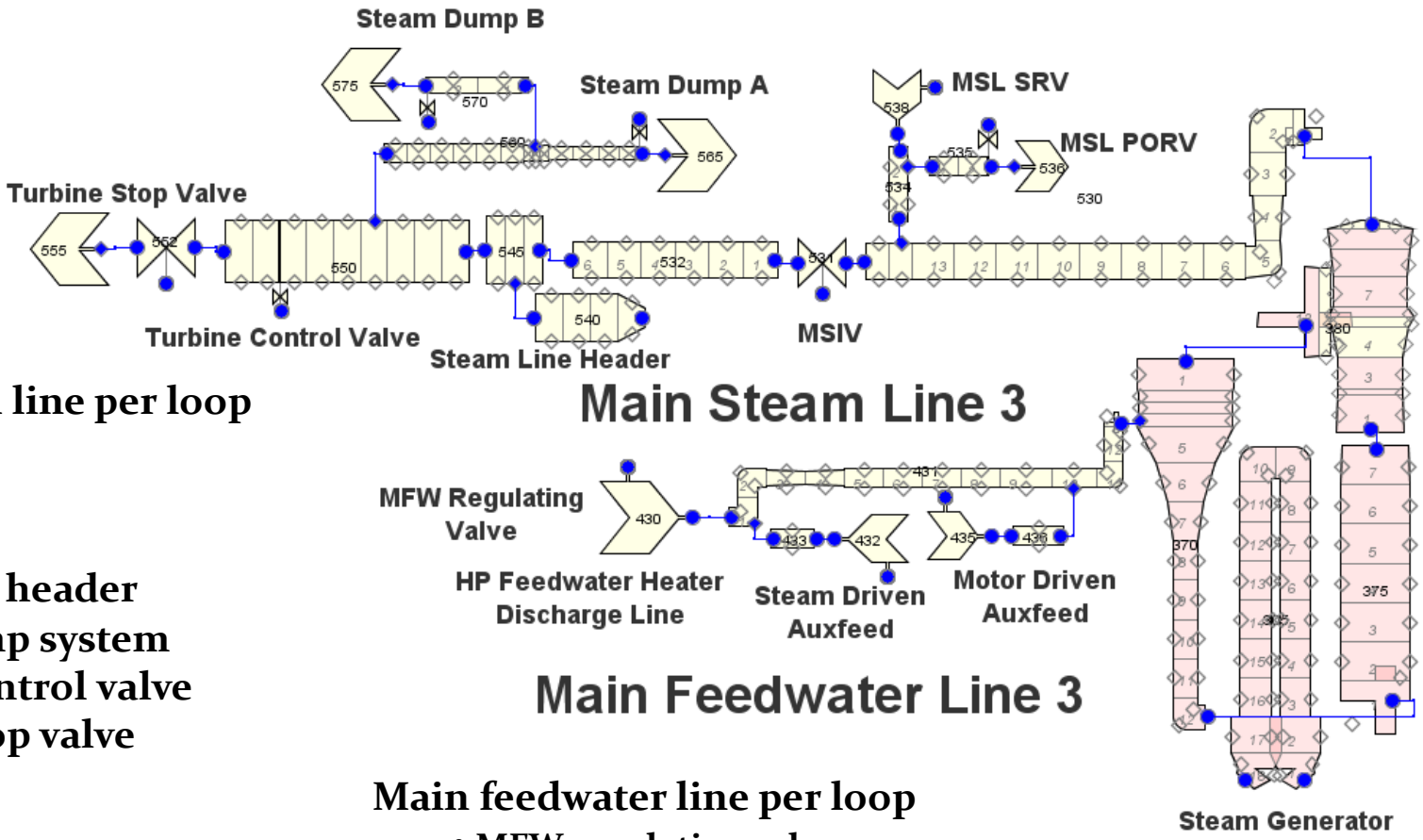
The Emergency Core Cooling Syste
Each Loop Contains:

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



PWR Plant Model Description

Balance of Plant Components Include:



Main steam line per loop

- MSIV
- PORV
- SRV

- Steam line header
- Steam dump system
- Turbine control valve
- Turbine stop valve

Main feedwater line per loop

- MFW regulating valve
- Steam driven auxfeed
- Motor driven auxfeed

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**