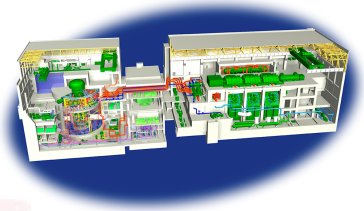


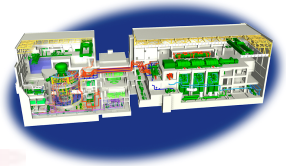
Advanced Boiling Water Reactor (ABWR)

South Texas Project Units 3 and 4

Nuclear Operating Company

Jay Phelps
STP Units 3 and 4 Operations Manager

Overview

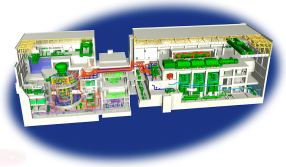


- Advanced RPV design eliminates external recirculation loops
  - Achieved by use of Reactor Internal Pumps (RIPs)
  - Improved LOCA response
- Improvement in safety profile – Core Damage Frequency (CDF) reduction by an order of magnitude
- Advanced containment design
- Advanced digital control room design – provides capability for plant automated operation

Comparison of CDFs

Plant or Group	CDF in per reactor-year
Sequoyah (PWR)	5.7×10^{-5}
Surry (PWR)	4.0×10^{-5}
Peach Bottom (BWR-4)	4.5×10^{-6}
Grand Gulf (BWR-6)	4.0×10^{-6}
ALWR Goal	1.0×10^{-5}
ABWR	1.6×10^{-7}

ABWR to BWR Comparison

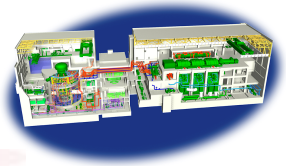


	ABWR	BWR
Recirc Flow	10 Internal recirc pumps (RIPs)	2 External recirc loops – Variable recirc pumps – Flow control valves
Control Rods	Fine motion control rod drives – Group or "gang" control capability – Electrical fine motion drive, hydraulically scrammed	Hydraulically operated control rods with single rod operation (exception - BWR6 with limited gang capability)
Plant Control	Automated operation capability	Manual
LOCA Design	RPV water level post-blowdown above top of active fuel (TAF)	RPV water level post-blowdown 2/3 core height with spray cooling
ECCS	3 divisions high pressure + 3 divisions low pressure flooding	1 division high pressure + 2 divisions core spray and low pressure flooding

ABWR to BWR Comparison

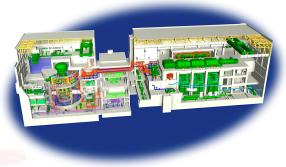
	ABWR	BWR
ATWS Mitigation Features	Advanced design: – Alternate Rod Insertion (ARI) – Recirc Pump Trip (RPT) – Auto Standby Liquid Control (SLCS) initiation – Fine Motion Control Rod Drive auto run-in – Auto feedwater pump runback	10 CFR 50.62 required RPT, ARI and SLCS requirements (exceptions – NMP2, Perry, LGS, and Hope Creek with Redundant Reactivity Control Systems)

Plant Startup



- Manual capability by control rod operation and recirc flow control from all rods in to 100% power
- Automated plant startup capability with Power Generation Control System (PGCS) and Automatic Power Regulator (APR)
  - PGCS controls BOP systems with "hold points" for operator confirmation
  - APR controls control rod movement and recirc flow control with "hold points" for operator confirmation
- Automated control requires input from the operator at the hold points to activate the function
- Operator can stop automated operation at any time and resume manual control

Example Automation Control Display



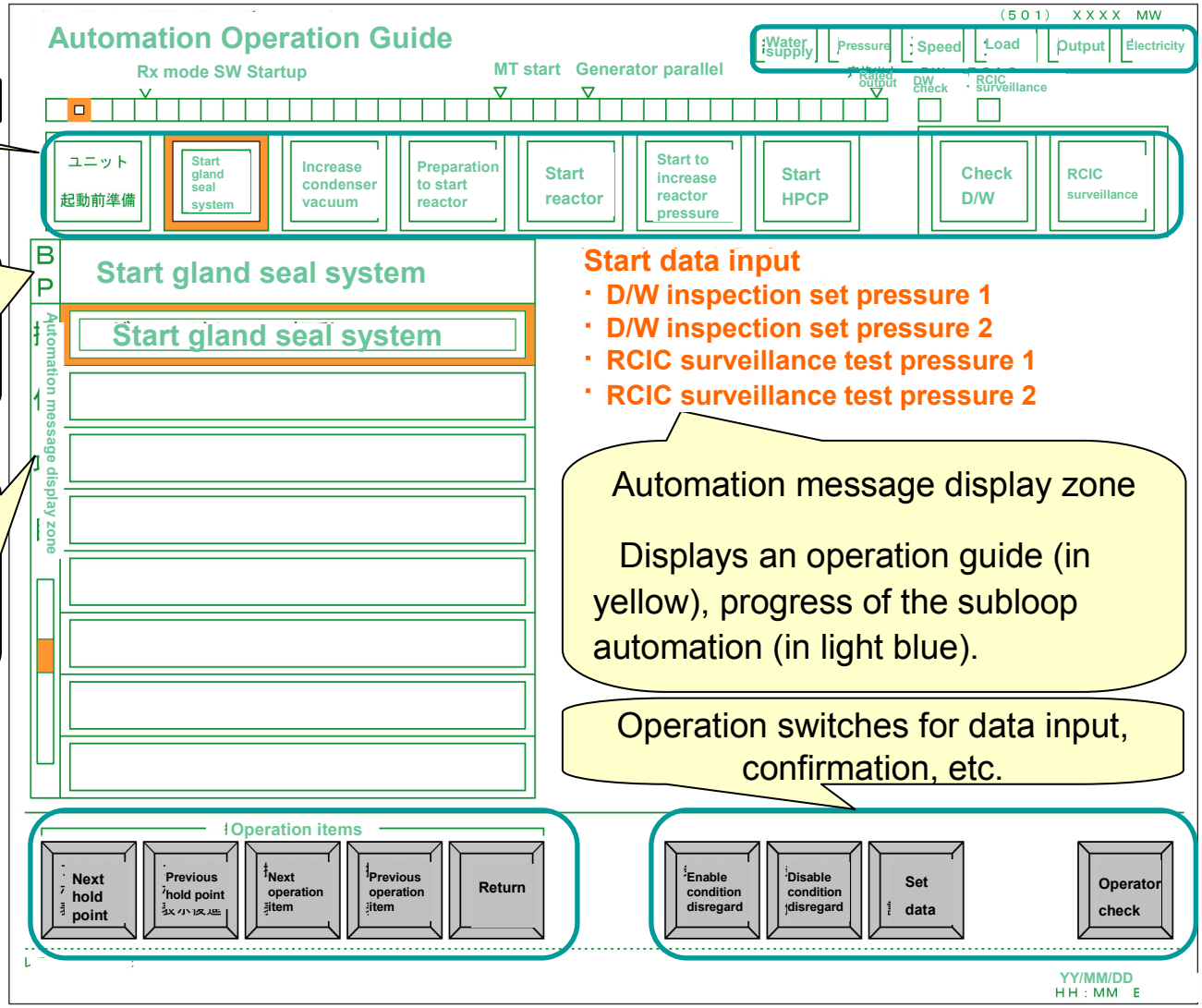
Hold point display zone

Name of hold point

Displays the name of a currently selected hold point.

Operation item display zone

Displays the active item of the selected hold point



Automation message display zone

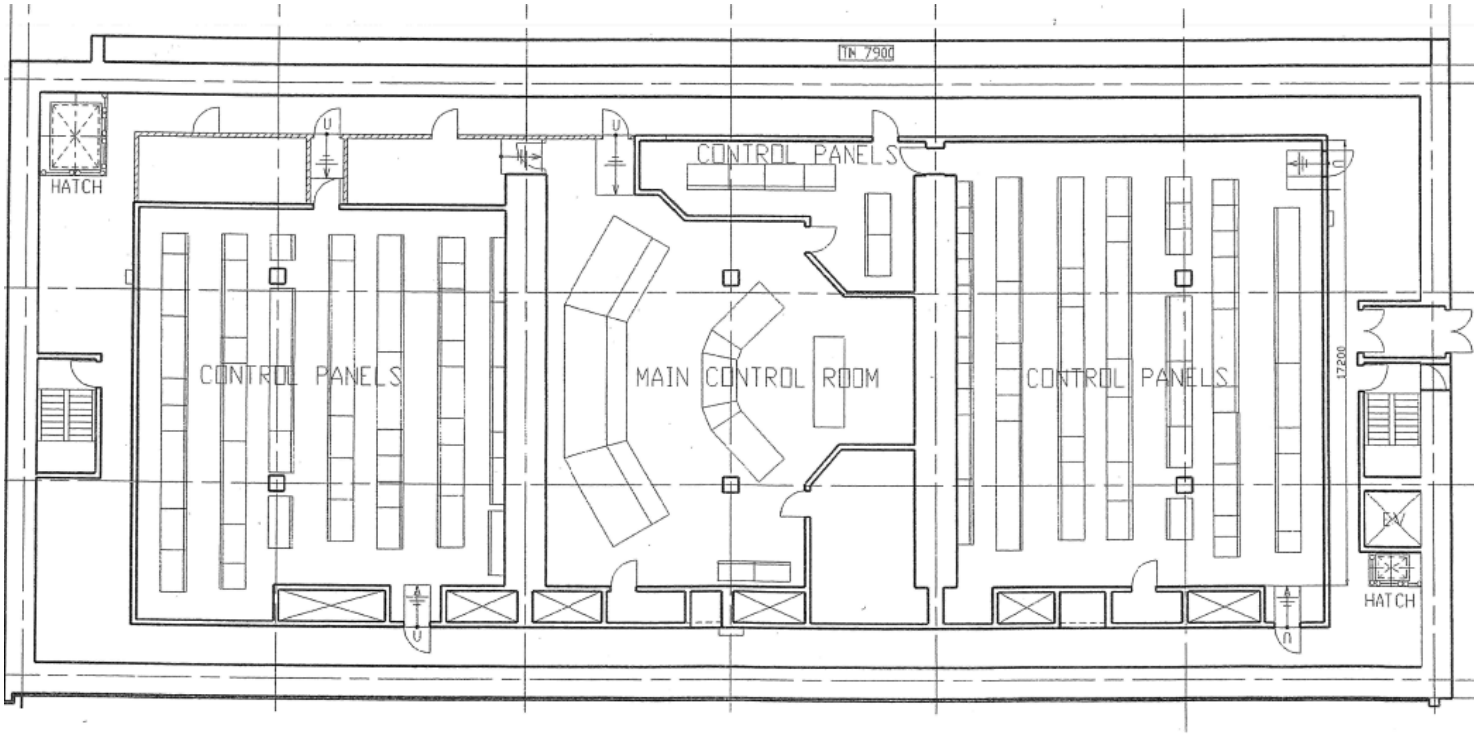
Displays an operation guide (in yellow), progress of the subloop automation (in light blue).

Operation switches for data input, confirmation, etc.

Procedures Capability

- Capability exists for a computer based procedure system
  - Example: from alarm page transfer to the associated Alarm Response Procedure
- Minimizes operator need to locate procedures
- Ability to remain at control panel and monitor proper plant response

Control Room Layout – Preliminary Drawing



Control Room Layout – Picture of Kashiwazaki-Kariwa Control Room Simulator

Control Room Layout – Picture of Kashiwazaki-Kariwa Control Room Simulator