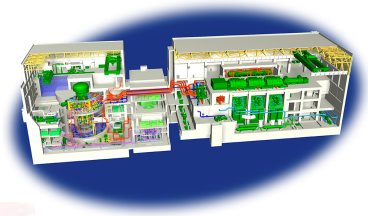


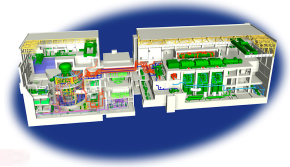
Advanced Boiling Water Reactor (ABWR)

South Texas Project Units 3 and 4

Nuclear Operating Company

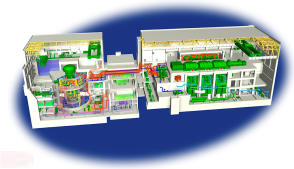
Jay Phelps
STP Units 3 and 4 Operations Manager

Overview



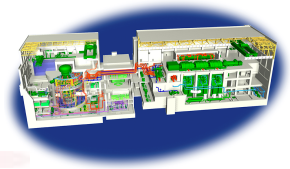
- Advanced RPV design eliminates external recirculation loops
  - Achieved by use of Reactor Internal Pumps (RIPs)
  - Improved LOCA response
- Improvement in safety profile – Core Damage Frequency (CDF) reduction by an order of magnitude
- Advanced containment design
- Advanced digital control room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

Comparison of CDFs



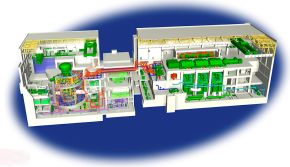
Plant or Group	CDF in per reactor-year
Sequoyah (PWR)	5.7×10^{-5}
Surry (PWR)	4.0×10^{-5}
Peach Bottom (BWR-4)	4.5×10^{-6}
Grand Gulf (BWR-6)	4.0×10^{-6}
ALWR Goal	1.0×10^{-5}
ABWR	1.6×10^{-7}

ABWR to BWR Comparison



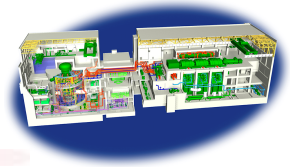
	ABWR	BWR
Recirc Flow	10 Internal recirc pumps (RIPs)	2 External recirc loops – Variable recirc pumps – Flow control valves
Control Rods	Fine motion control rod drives – Group or "gang" control capability – Electrical fine motion drive, hydraulically scrammed	Hydraulically operated control rods with single 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



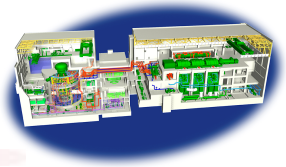
	ABWR	BWR
ATWS Mitigation Features	Advanced design: – Alternate Rod Insertion (ARI) – Recirc Pump Trip (RPT) – Auto Standby Liquid Control (SLCS) initiation – Fine Motion Control Rod Drive auto run-in – Auto feedwater pump runback	10 CFR 50.62 required RPT, ARI and SLCS requirements (exceptions – NMP2,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

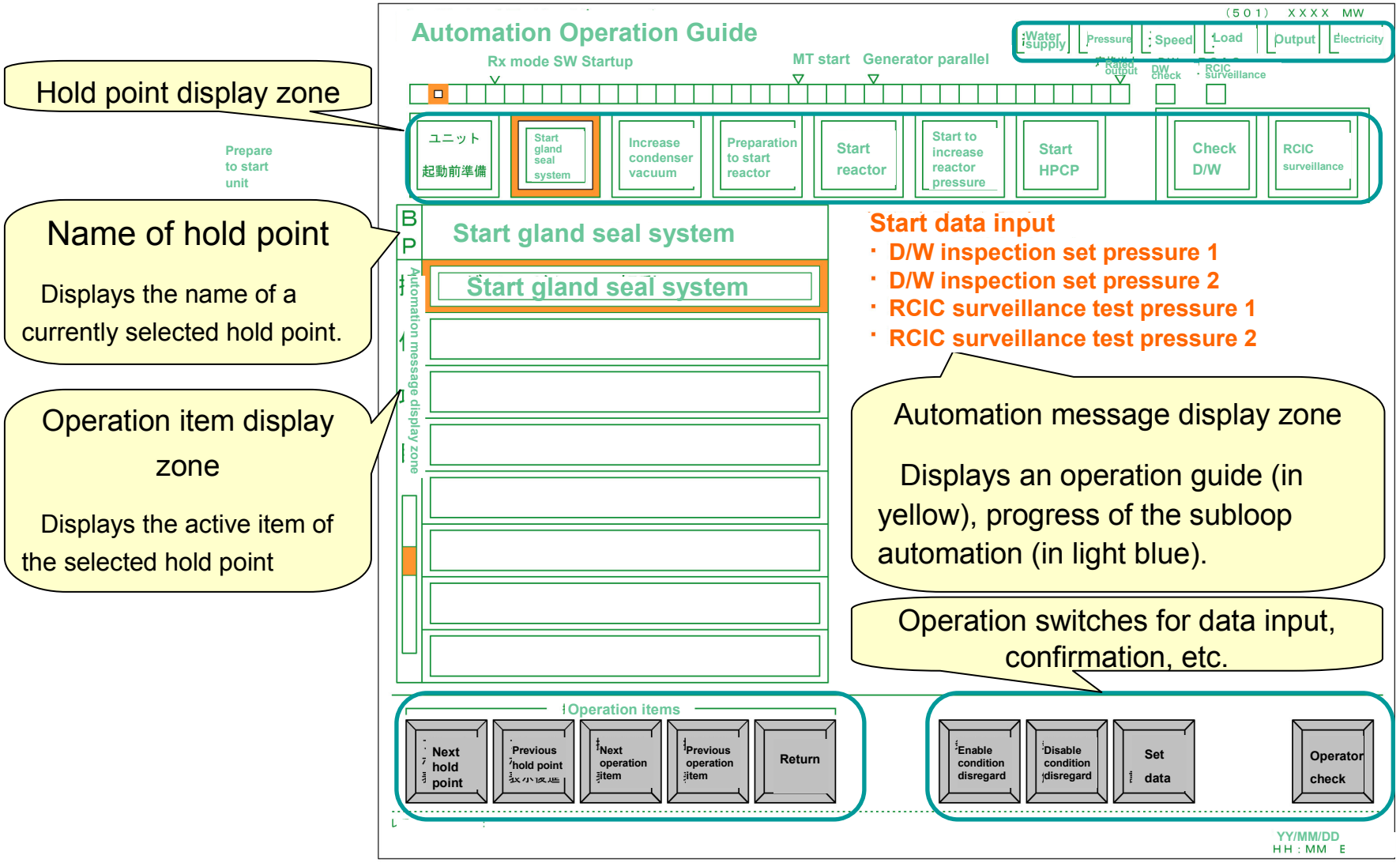
Plant Startup



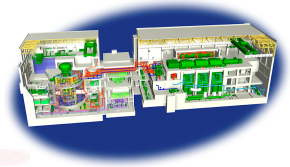
- Manual capability by control rod operation and recirc flow control from all rods in to 100% power
- Automated plant startup capability with Power Generation Control System (PGCS) and Automatic Power Regulator (APR)
  - PGCS controls BOP systems with “hold points” for operator confirmation
  - APR controls 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



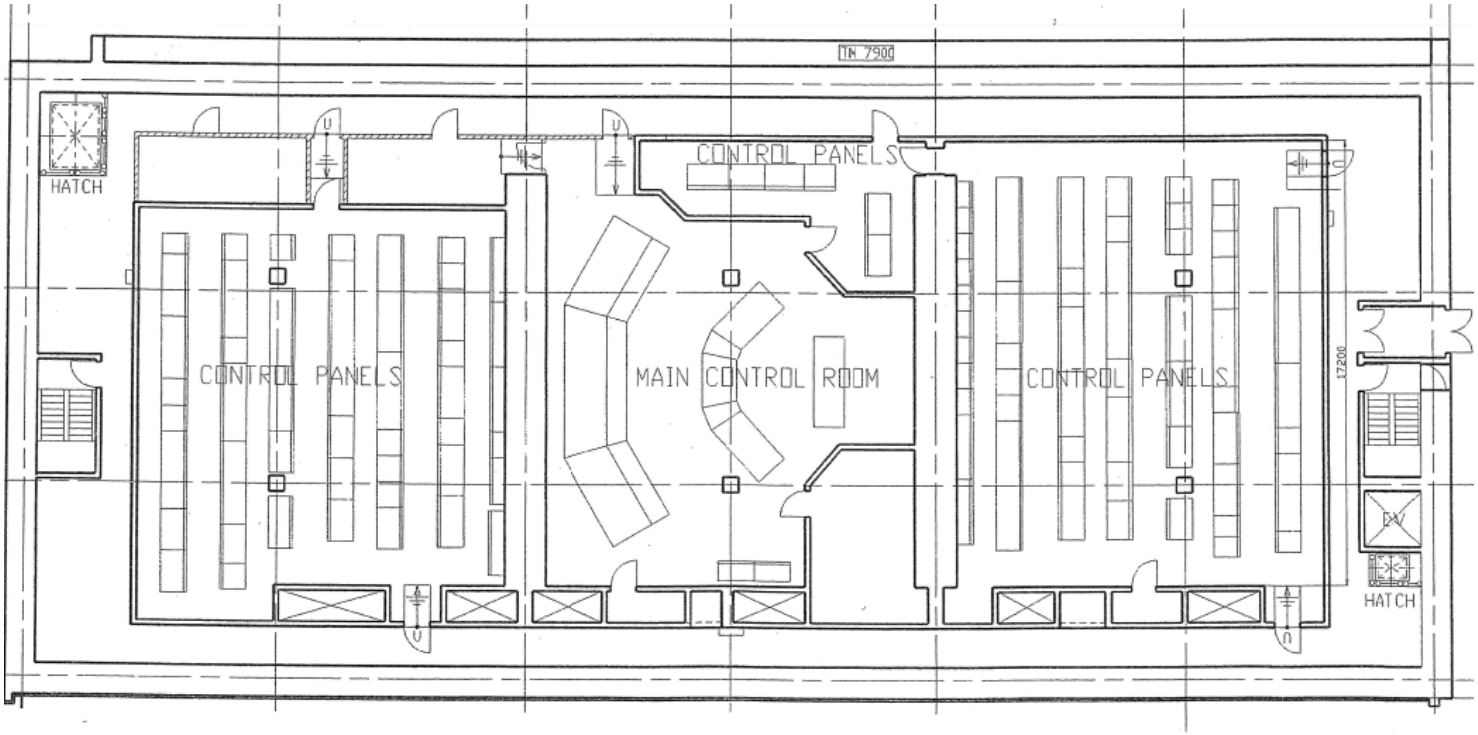


Procedures Capability



- 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