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CFB Simulation Success Story

NRG Seward Plant

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Seward – New Clean Coal Facility

- Seward power plant is an environmental and engineering marvel.
- Clean-Coal Technology
- Circulating Fluidized Bed
- Largest waste-coal fueled plant in the world (521 MW net)

Seward Burns Waste-Coal

In the early days of coal mining, waste-coal was discarded because poor quality coal could not be burned using the technology of the day.

Much of this refuse was left in large waste piles near the coal mines.

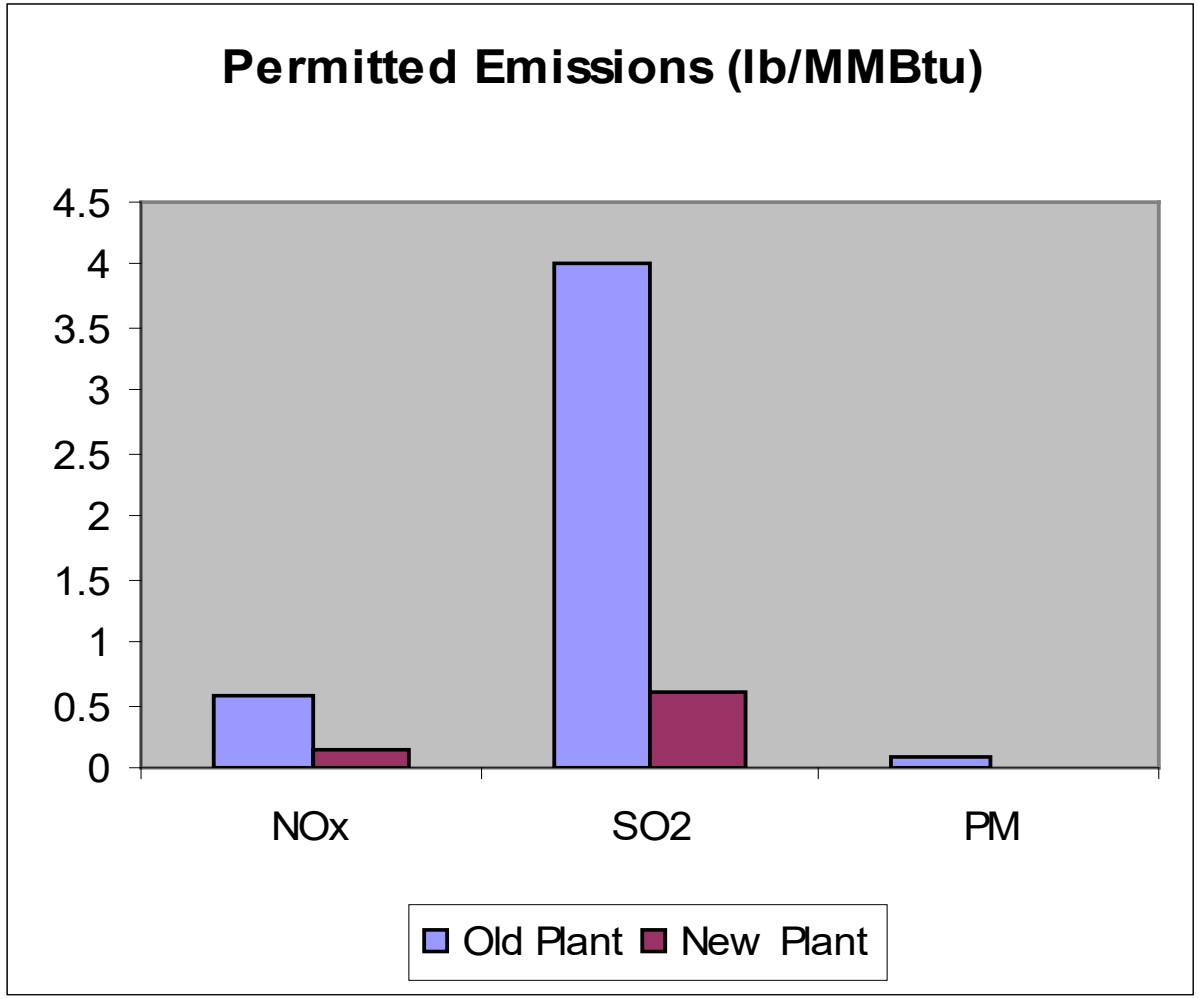
These waste piles are up to 300 feet tall and can run for thousands of feet.

Waste Fuel Specification:

- HHV 5800 BTU/LB
- Ash **51.0%**
- Sulphur 3.00%
- Moisture 8.7%
- VOL 11.0%

Seward – Air Emissions

- NOx – Down 74%
  - CFB low temperatures
  - Selective Non-Catalytic Reduction (SNCR)
- SO2 – Reduced 85%
  - Refuse screening
  - Limestone injection
  - Novel Integrated Desulfurization System (NIDS)
- Particulate Matter – Down 90%
  - Fabric filter (baghouse)
  - Enclosed fuel storage



Some Facts and Figures

- Construction Started 6/01
- First “Oil Fire” 3/04
- Gained “Care, Custody and Control” 11/04
- Cost $800,000,000
- 595 MWs Gross
- 72 MWs Station Load
- 521 MWs Net
- Avg Bed Temp 1620º F
- Gas Outlet Temp (To Stack) 160º F

Simulator Training Capabilities

The simulator has the capability of simulating the following with high fidelity:

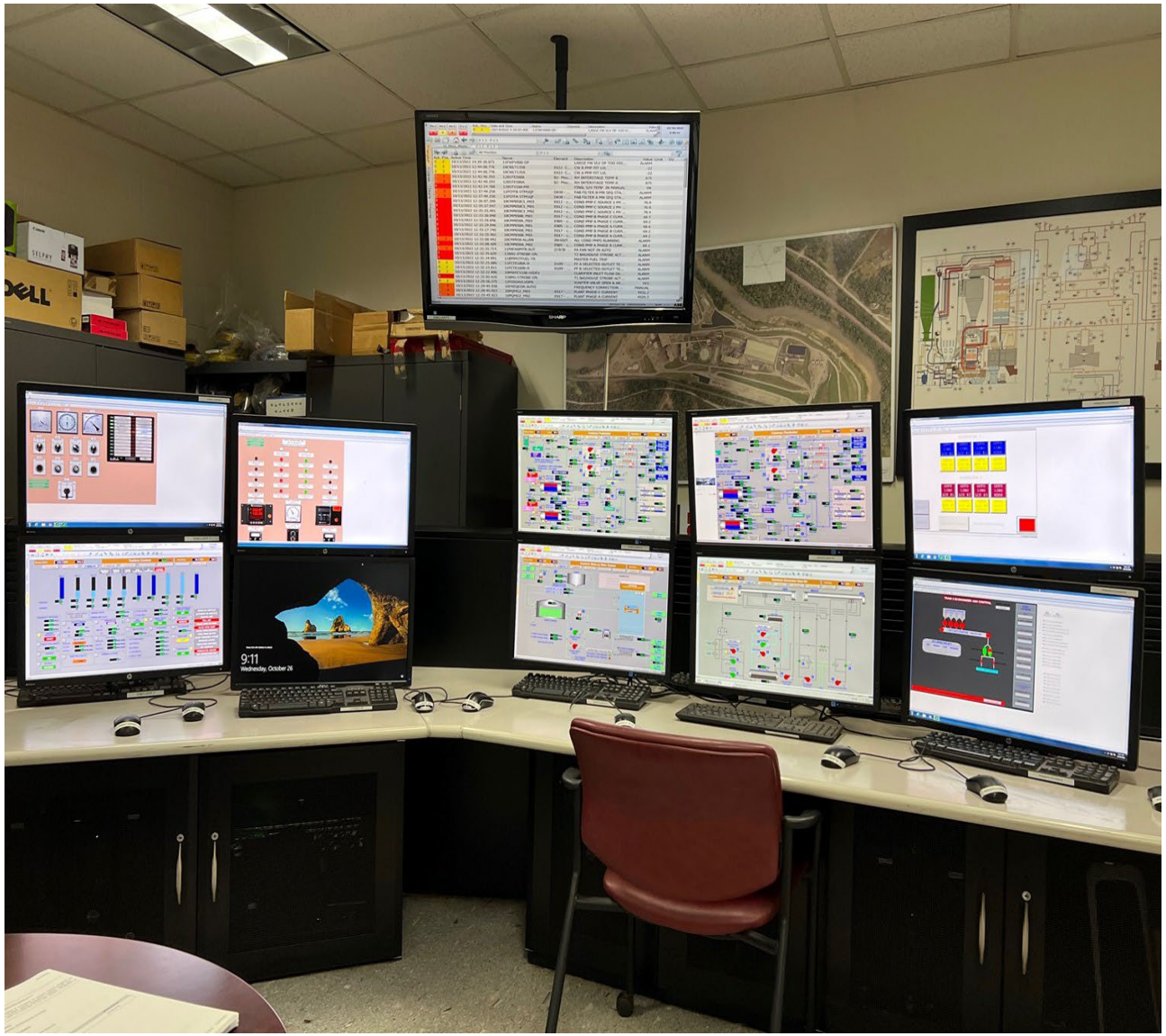
- Complete cold and hot startups
- Shutdowns
- Load changes
- Normal operating conditions
- Abnormal operating conditions
- Emergency operating conditions
- New equipment and logic can be loaded on the simulator and tested before being installed in the plant and on the DCS

Simulator Components

- DCS System
- Turbine Controls and PLC Controls
- Instructor Station

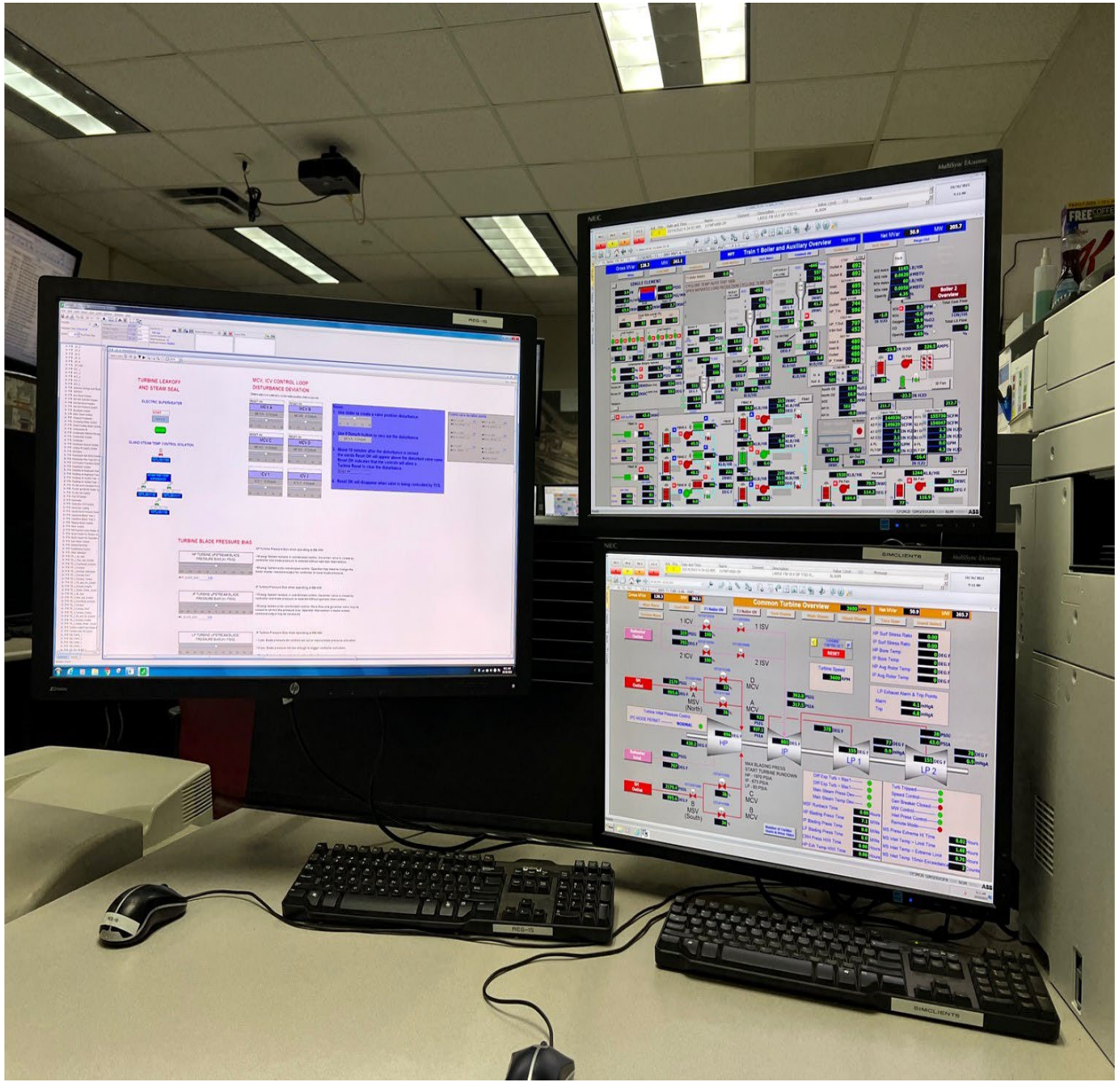
Purpose of Simulator Training

- Designed to ensure that operating personnel have the required knowledge and skills
- Developed based on an analysis of the control room job duties
- Allows the participants to “feel” like they are in the actual control room without affecting plant operation
- Present a wide variety of operational and emergency scenarios
- Provide the opportunity to practice effective communication, teamwork, and troubleshooting diagnosis



SIMULATOR TRAINING PROTOCOL

- Simulator training can be a very powerful means for training control room personnel.
- For the simulator to reach its full effectiveness it is important that the simulator training be implemented consistently and professionally.
- The simulator training classes must be conducted in a realistic and professional manner.
- The simulator sessions should be conducted as if the simulator were the actual power plant.

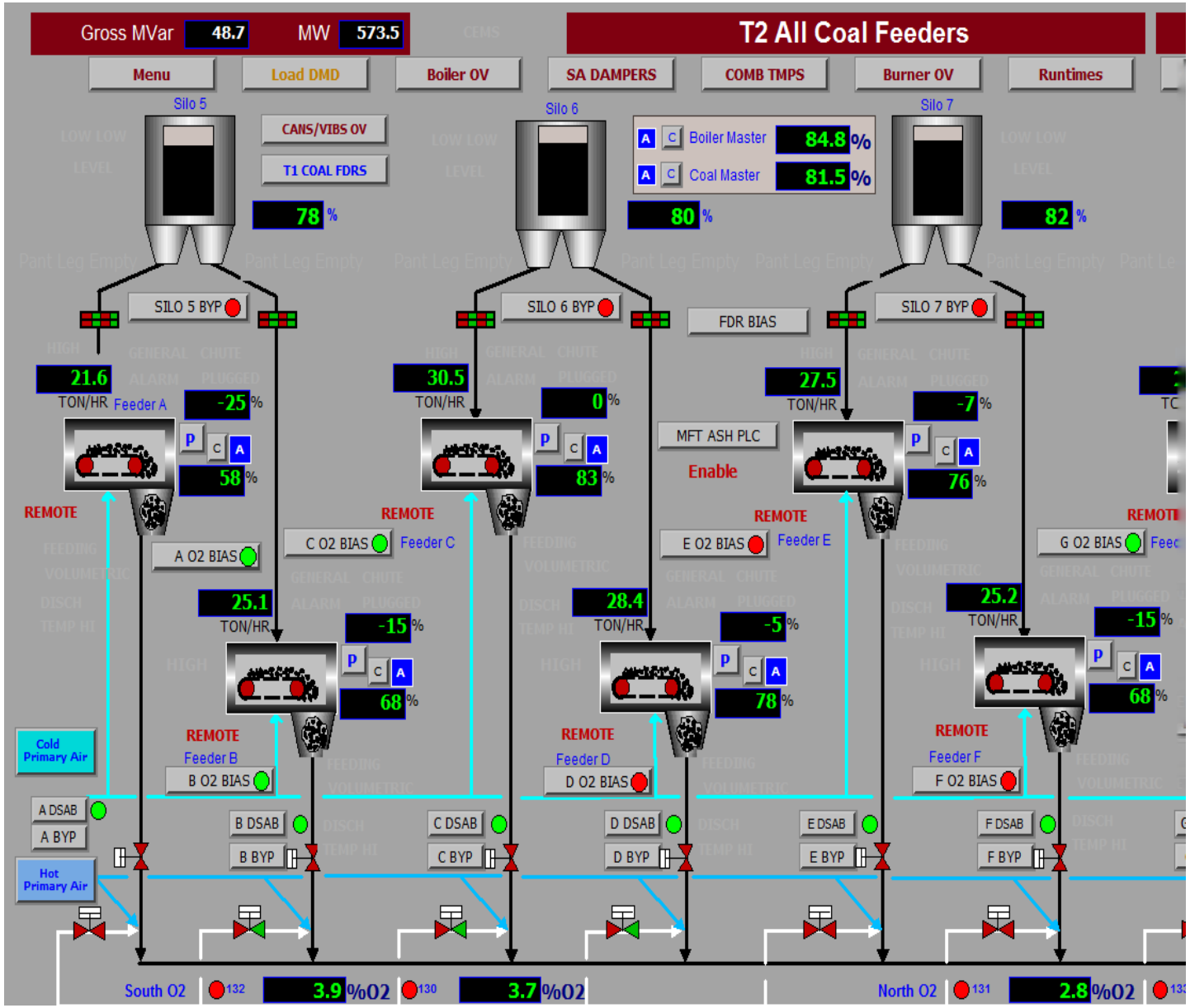


Simulator Training Program

- Training program is 5 weeks of 5 -10-hour days to become fully qualified.
- Training consists of
  - Week 1 – Training program overview, job overview, system review and explanations
  - Week 2 – Boiler and turbine start ups
  - Week 3 – Boiler and turbine shutdowns
  - Week 4 – Abnormal conditions. System upsets and recoveries
  - Week 5 – Trainee spends time in the actual control room
- Written testing is completed at the end of each section
- Training starts with instructor assistance and by the end the instructor is just an observer.
- The instructor plays the role of dispatcher, field operator, maintenance department and plant management as appropriate.

Seward's Simulator Timeline

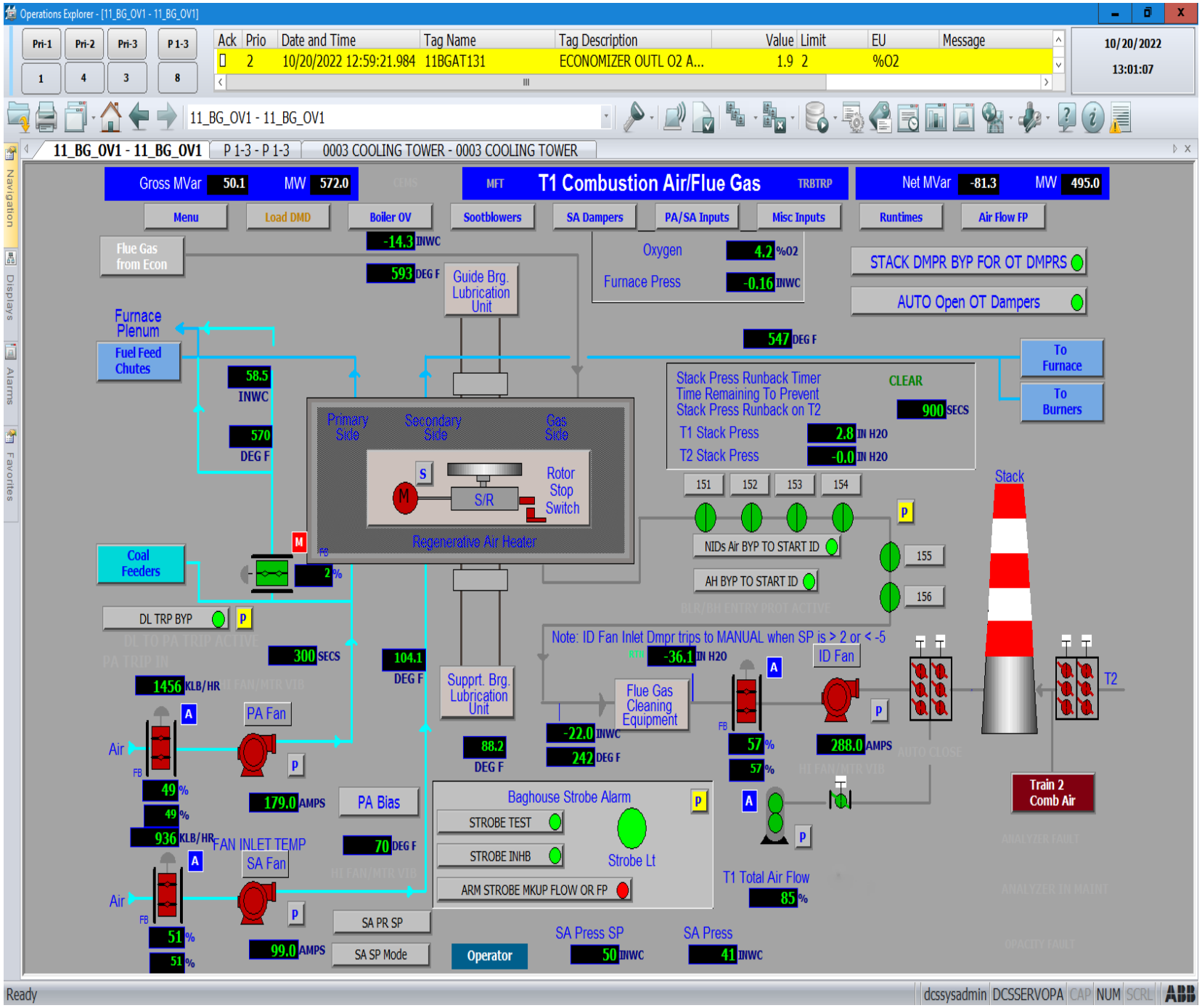
- Initial PO Placed - March 2008
- Simulator on-site & in service – Nov 2009
- Simulator software & hardware upgrade (ABB S+ HMIs and model updates) – Dec 2015
- Simulator software/model upgrade for new Turbine Control System (from Alstom P320 to ABB) – Sept 2018
- Simulator software & hardware upgrade - July 2022



Simulator is also used by Plant's Engineering as a more accurate tool to

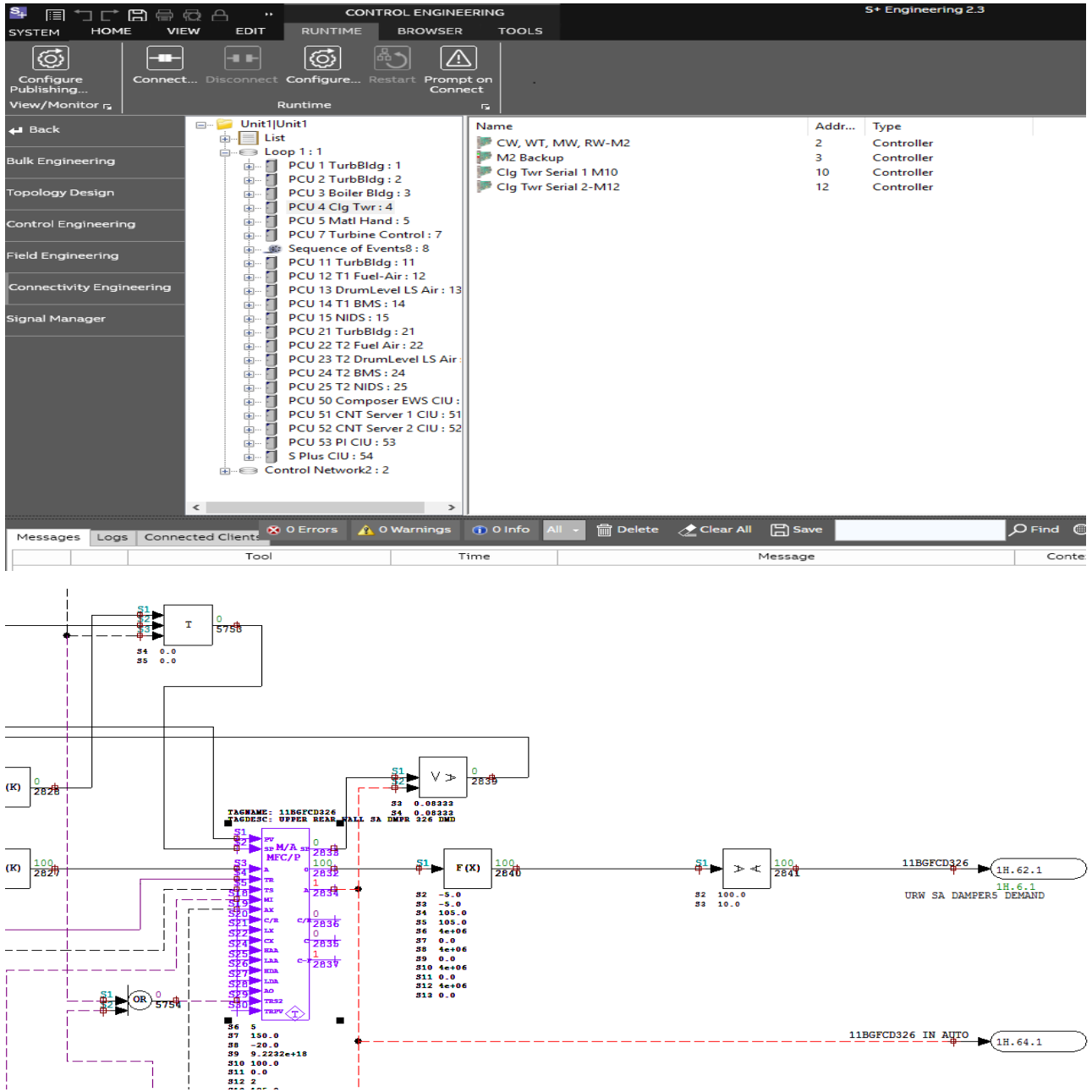
- New control strategies are developed & uploaded for testing and refinement on the simulator before implementation onto the plant floor (less costly way vs during commissioning of mods)

- Assist in determining root cause for plant upsets/trips



Simulator is also used by for training Plant's E&I Technicians of the following

- DCS Engineering software layout, tools and functionality
- Analyze DCS HMI architecture, graphic and tag database configuration
- Increase the understanding of the DCS's configuration drawings
- Discuss/examine/demonstrate the more complex function codes utilized in the DCS Controls
- Develop Troubleshooting Techniques and guidelines
- Has been utilized to train approx. 25 E&I Technicians



Seward Issues Resolved on Simulator

Challenge	Solution	Benefits
1.) In 2010, the plant was not able to start rolling up the turbine following a Turbine HMI conversion.	1.) Performed a turbine rollup on the simulator which illustrated the actions that needed to occur.	1.) Reduced the amount of downtime and allowed the unit to return to service.
2.) Over-temperature excursions during startup.	2.) Developed heat release logic and alarming/tripping settings on the simulator prior to implementation.	2.) Eliminated the over-temp excursions which caused boiler tube leaks and downtime.
3.) Boiler Fans shutting down on boiler upper steam leaks which led to HI pressure excursions in baghouse (equipment & safety concern).	3.) Utilizing the boiler model developed in the simulator, was able to develop logic and operational restrictions to keep the ID Fan running during an upper steam leak.	3.) Eliminated equipment damage (thousands of baghouse bags) and allowed personnel to safely work in the baghouse while boiler is operating.

Questions?

Please wait for the microphone.

State your name and company.

Please remember to…

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Thank you!