

Modeling Off-gas Systems for the Hanford Waste Treatment Plant



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Frank G. Smith

Chemical Process Technology Department

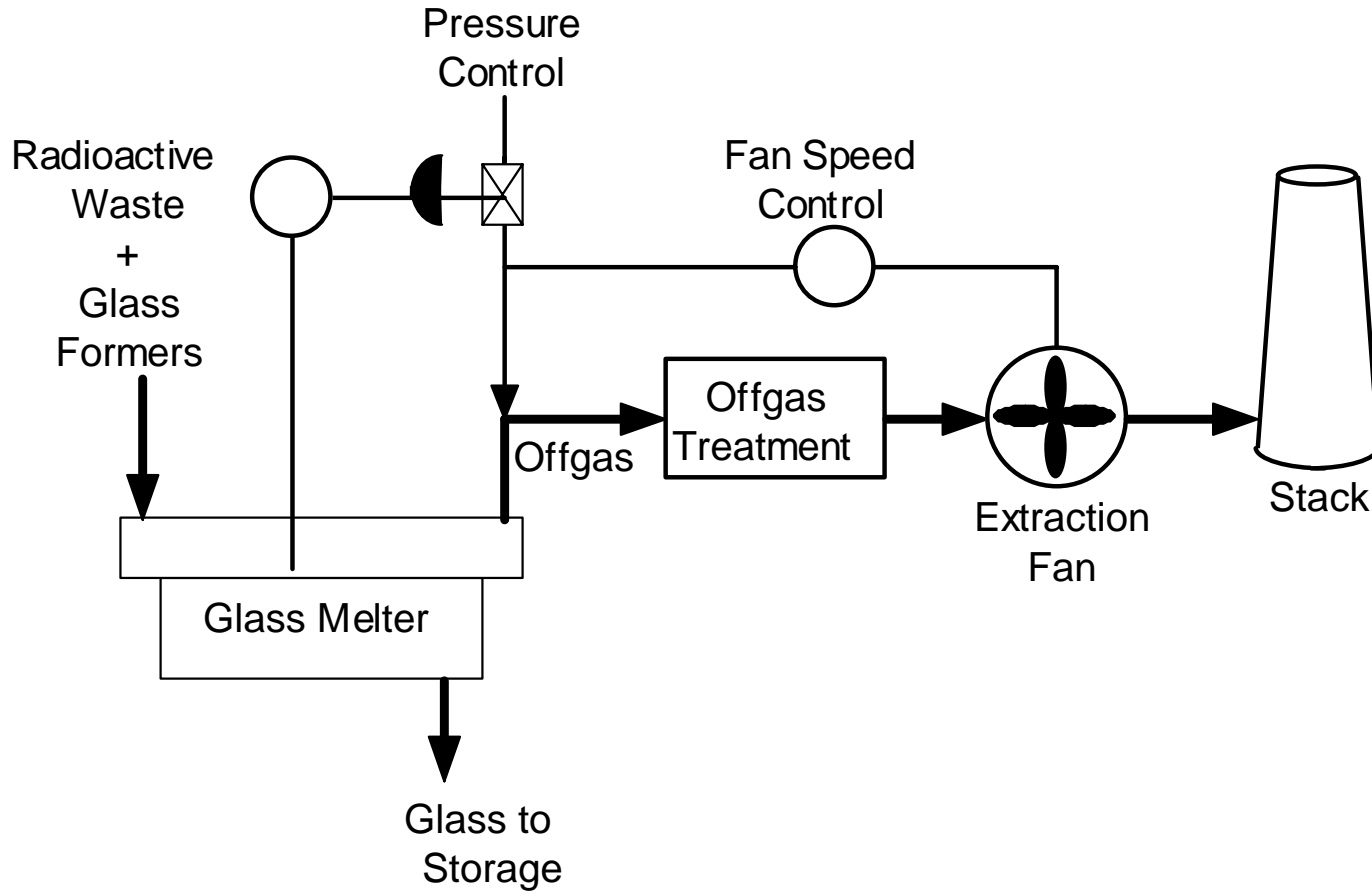
November 2, 2005

- **Dynamic models of three off-gas systems for the Waste Treatment Plant at the Hanford site using Aspen Custom Modeler™.**
- **Verify that steady-state based designs performed satisfactorily under dynamic operating conditions.**
- **Analyze normal and off normal operating conditions**
 - **Startup**
 - **Steam surges**
 - **Fan failures**
 - **Maintenance operations**
- **Evaluate control system designs**

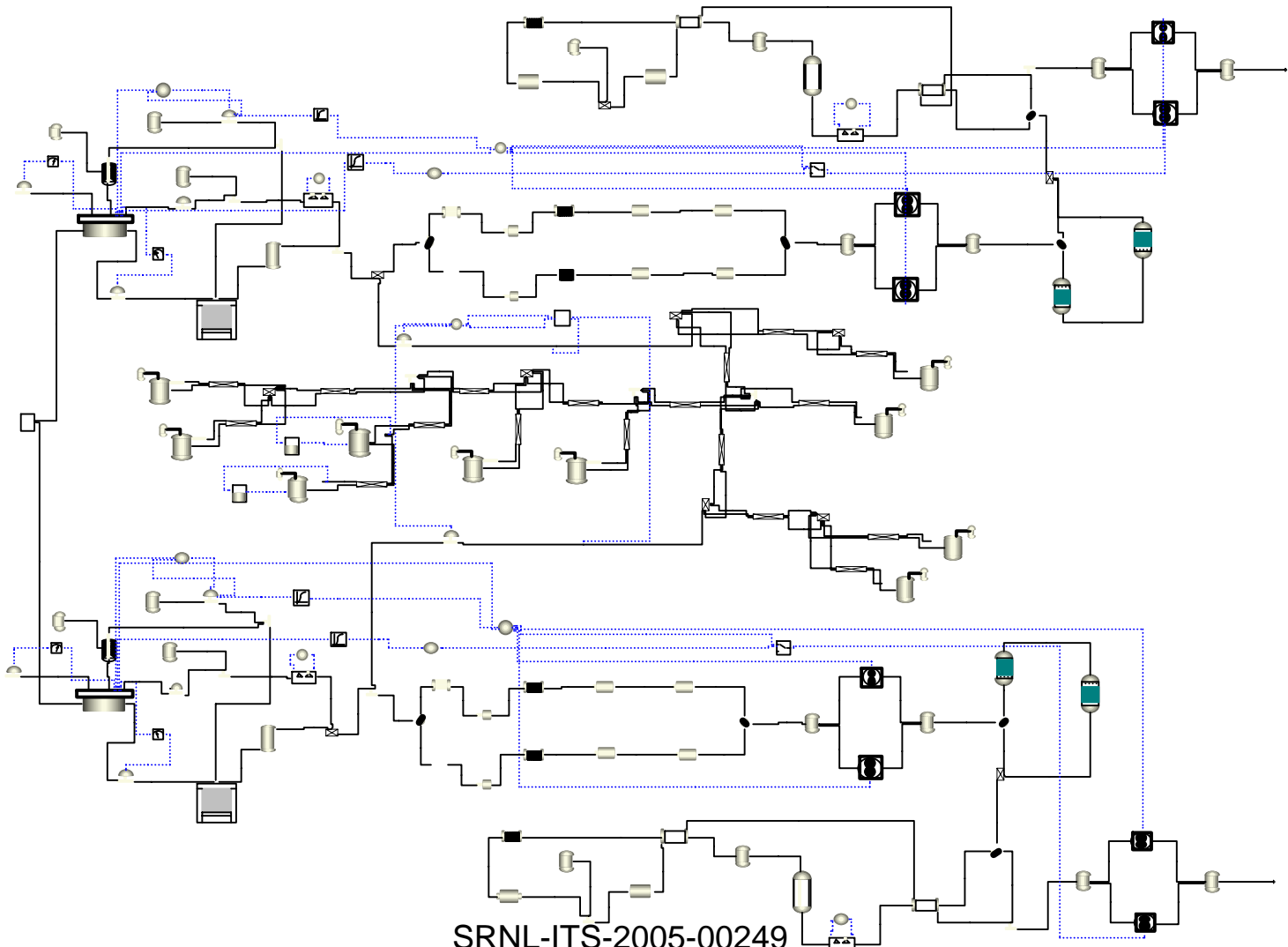
Basic Model Characteristics

- **Two components:**
 - Air and water vapor
- **Dynamic behavior:**
 - Transient material and energy balances
 - Transient driving forces such as time dependent gas flows and vessel volumes
 - Transient control system response
- **Models calculate gas flow, pressure, temperature, and composition throughout the off-gas systems.**

Melter Off-gas System Schematic

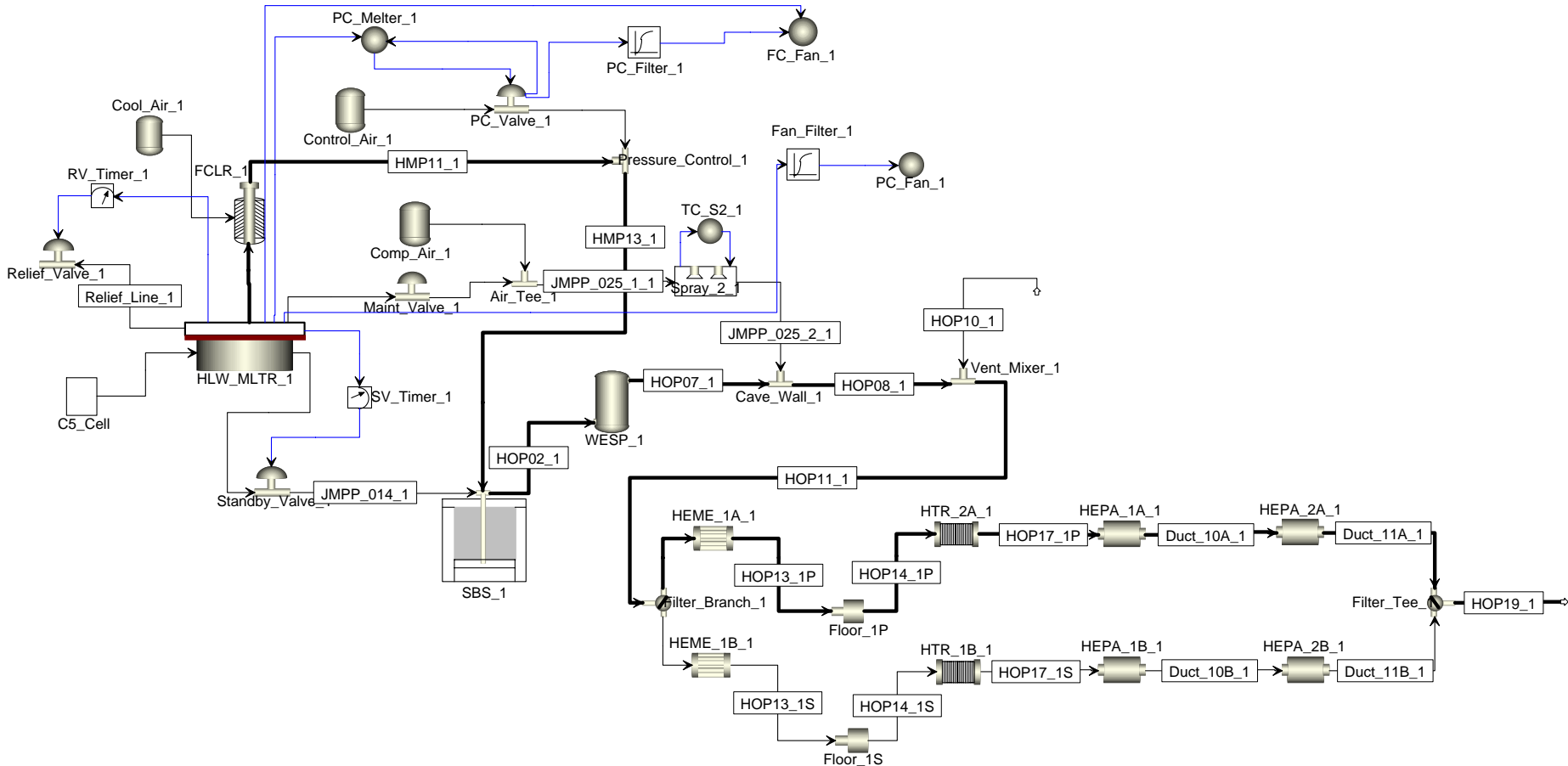


HLW Off-gas System

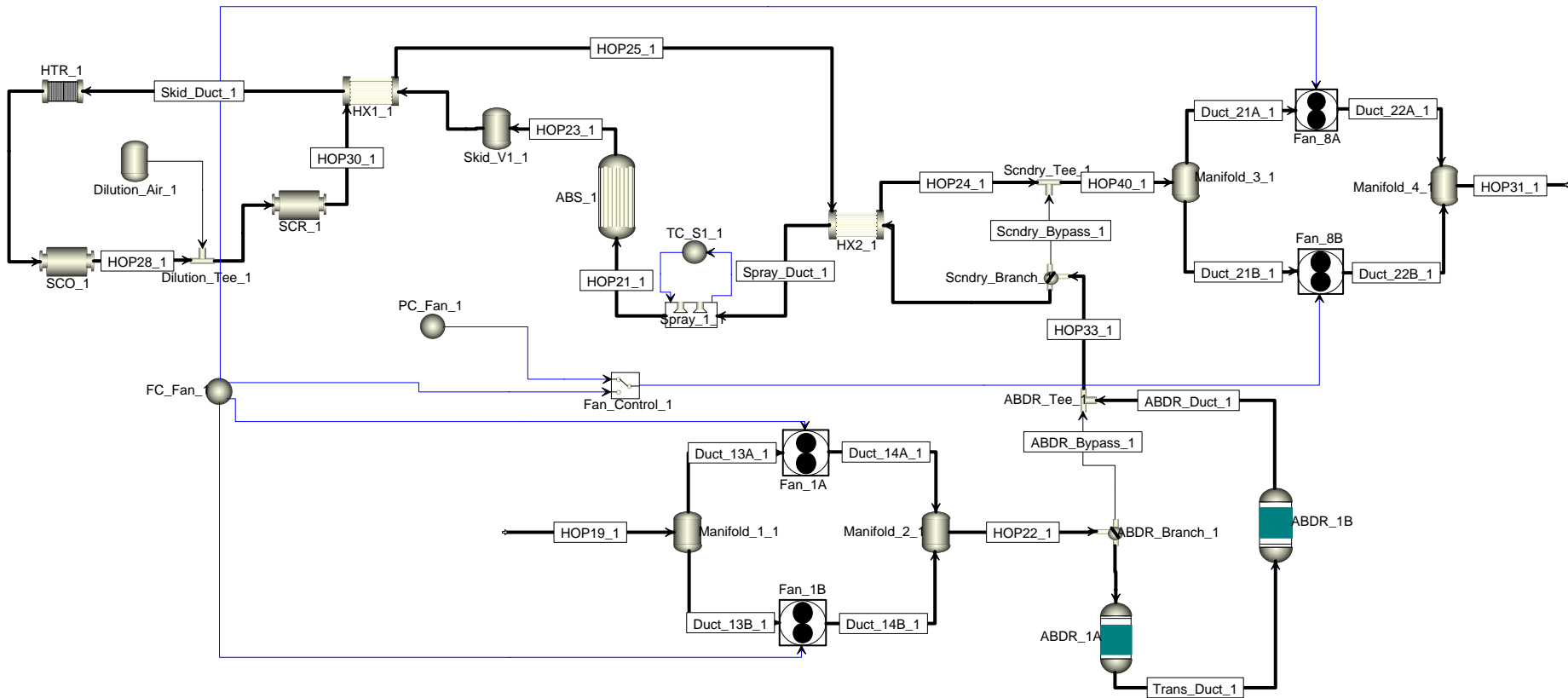


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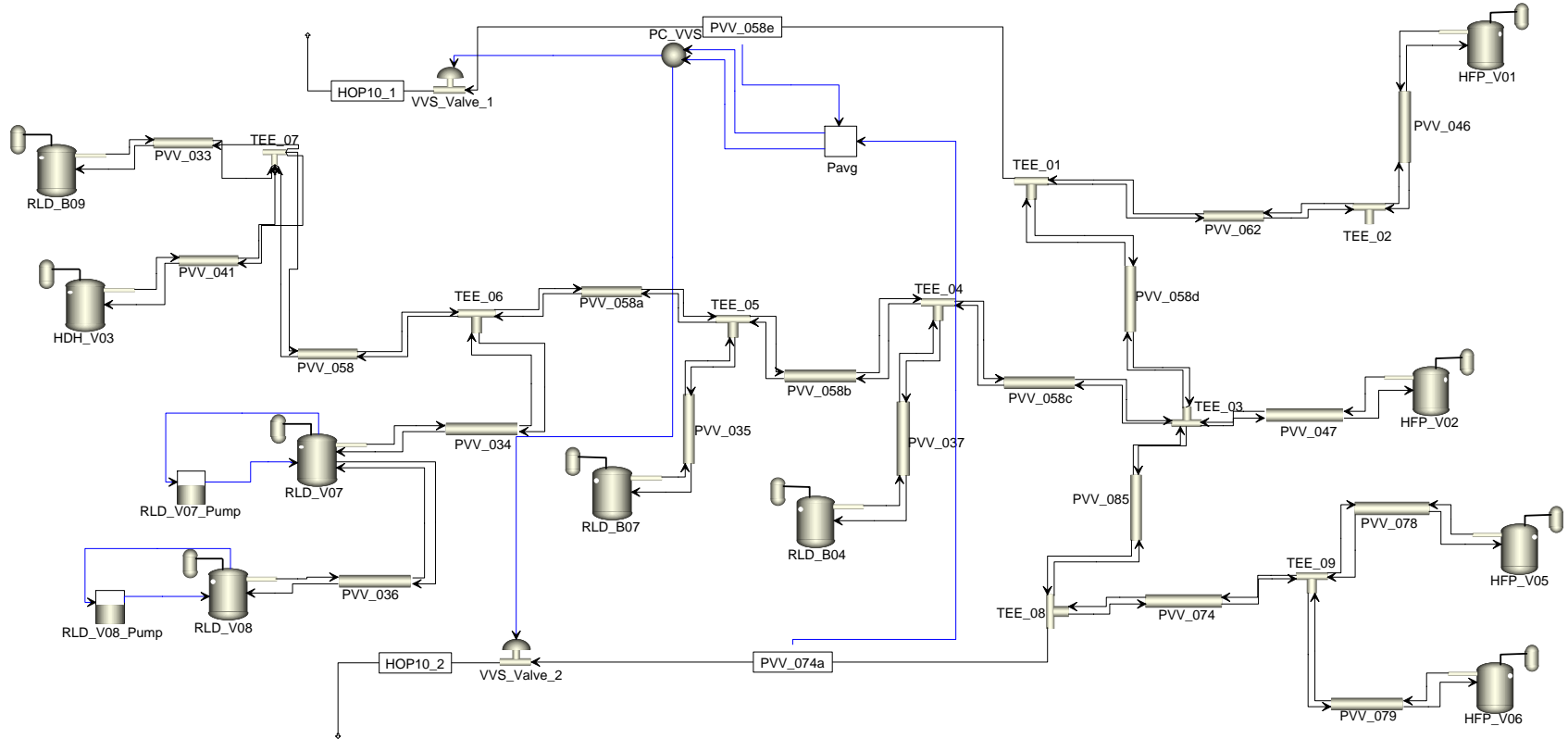
Primary Off-gas System for One Melter



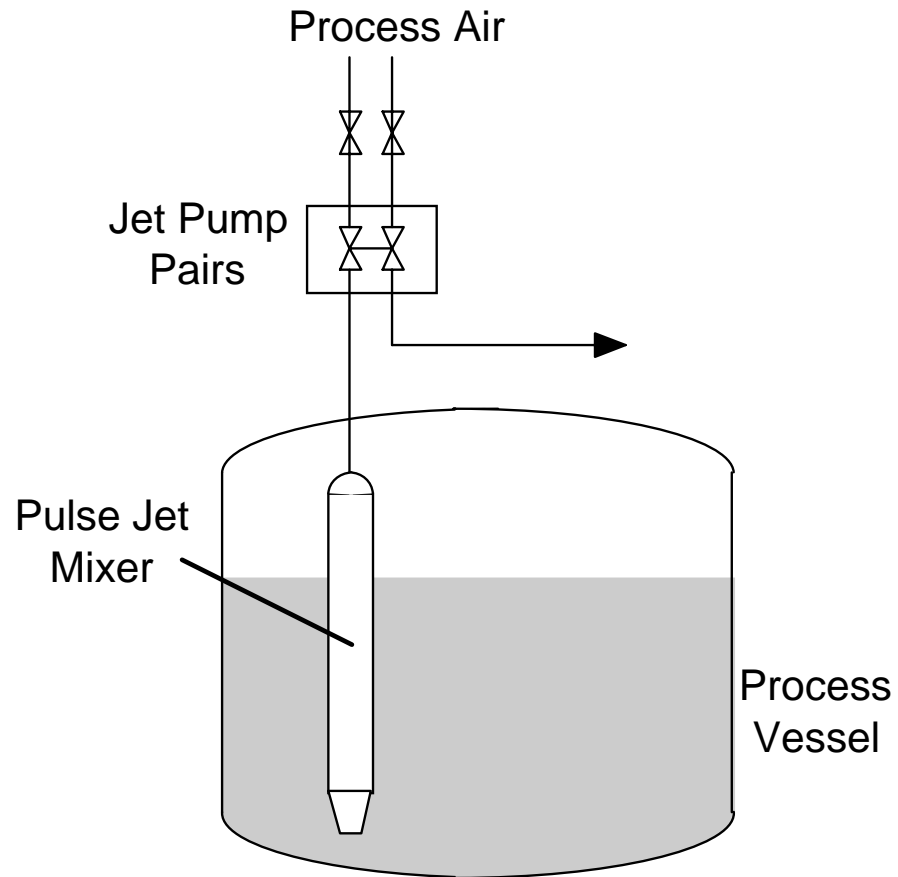
Secondary Off-gas System for One Melter



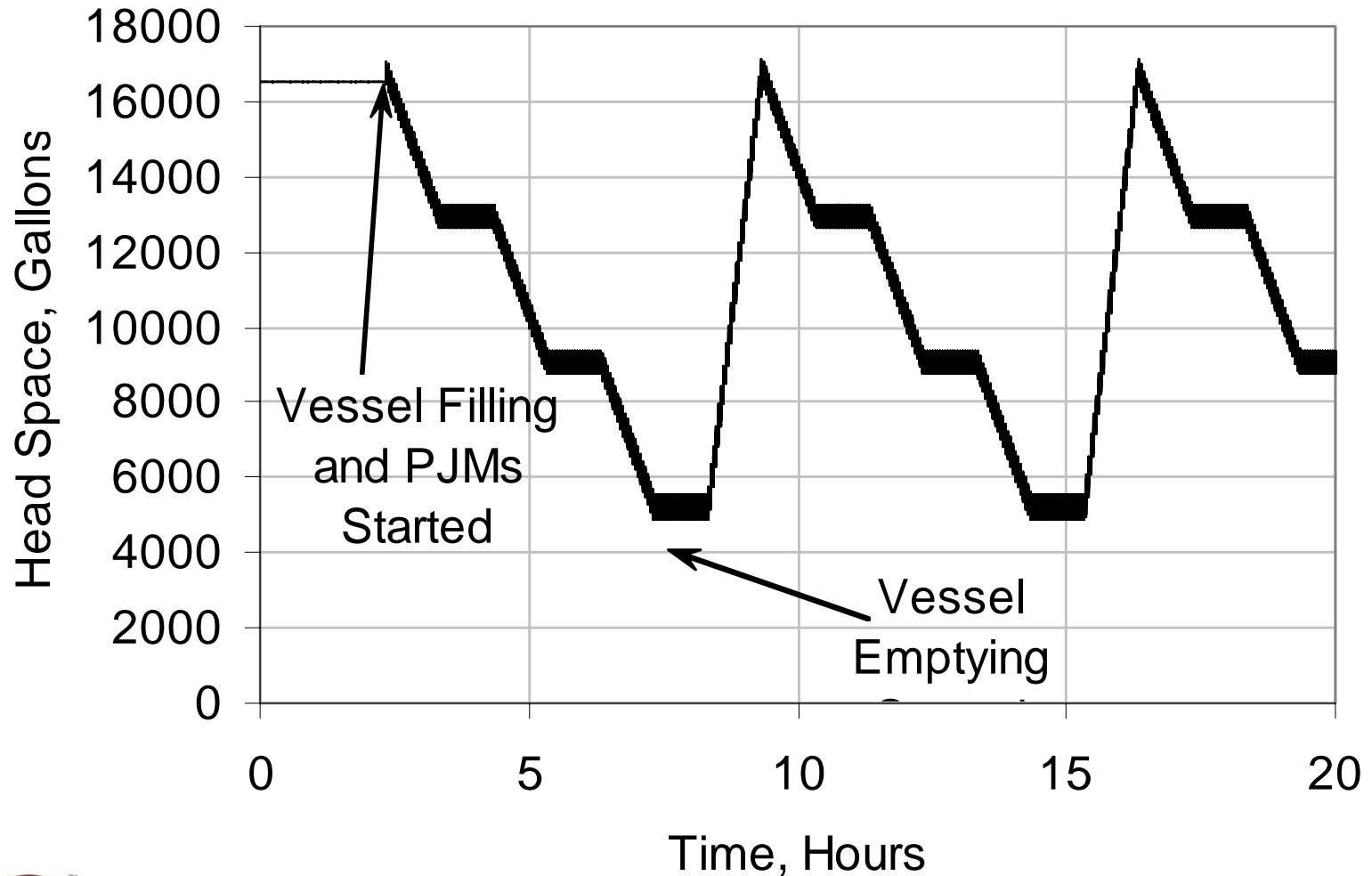
Vessel Ventillation System



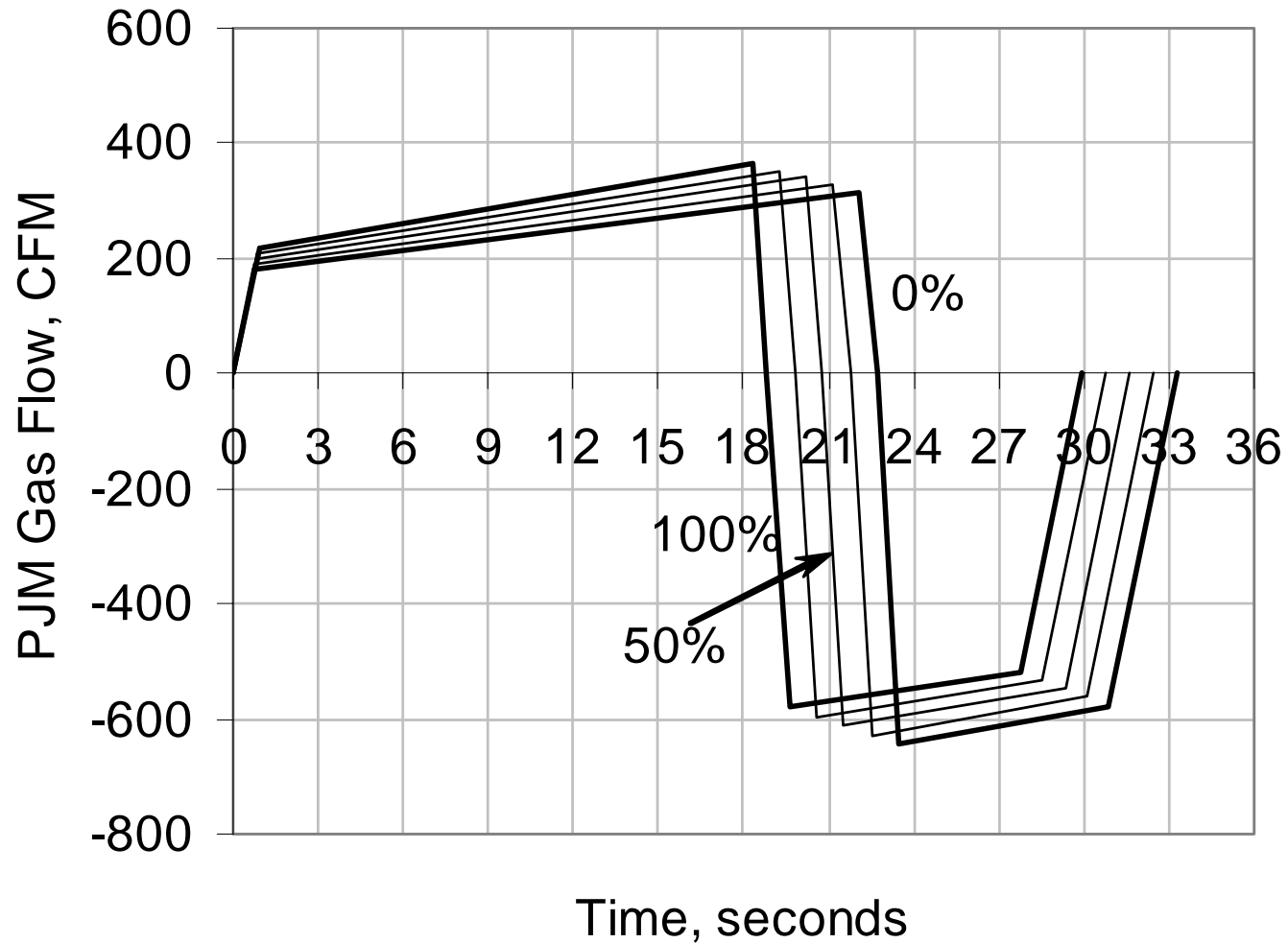
Pulse Jet Mixer



Compressed Vessel Volume Transient



Pulse Jet Mixer Gas Flow Transient



Computational Speed

Complex flowsheet

+

Need to simulate plant operating times (hours)

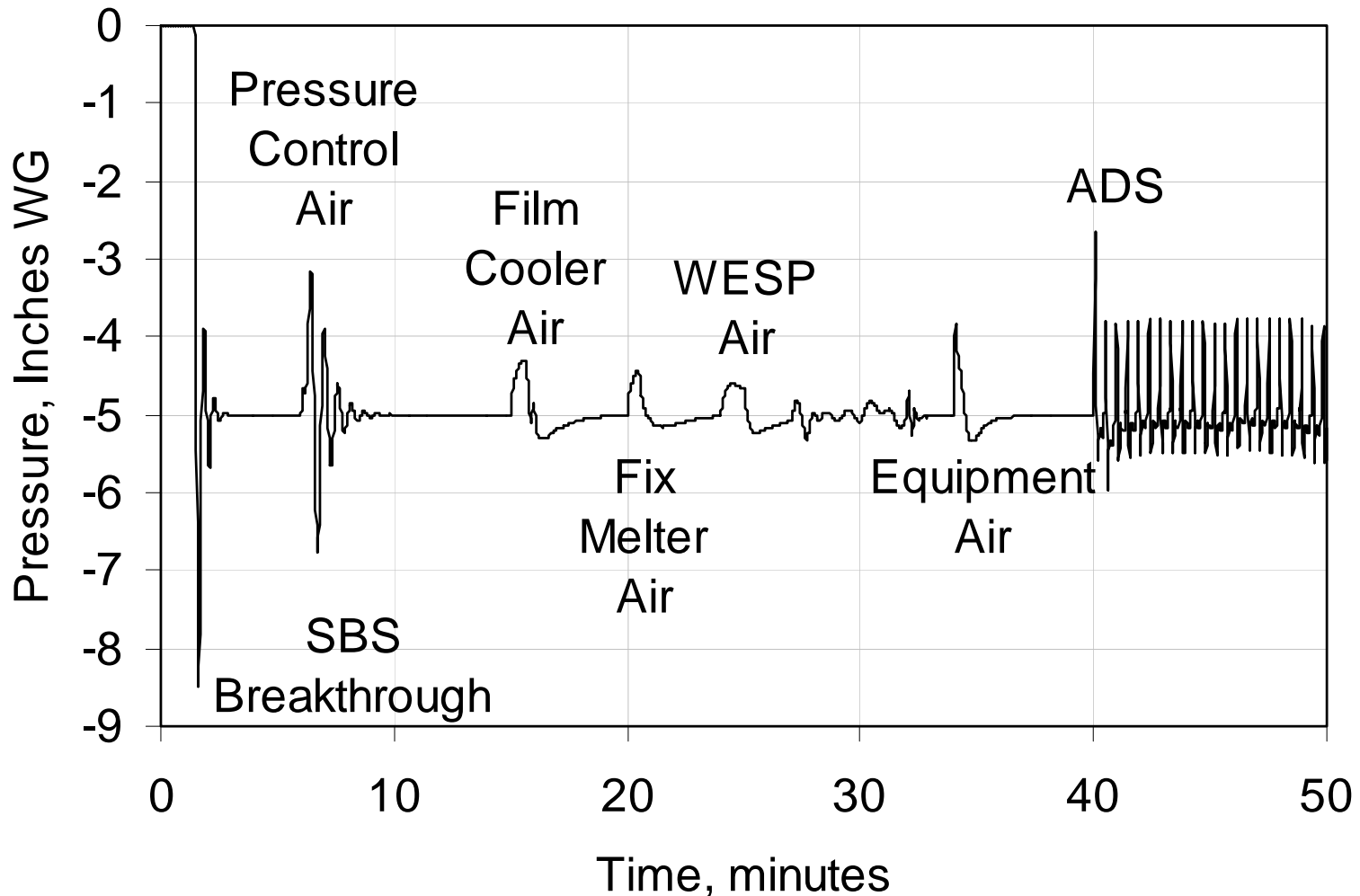
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Continuous fast transients (seconds)

=

Long simulation run times (hours)

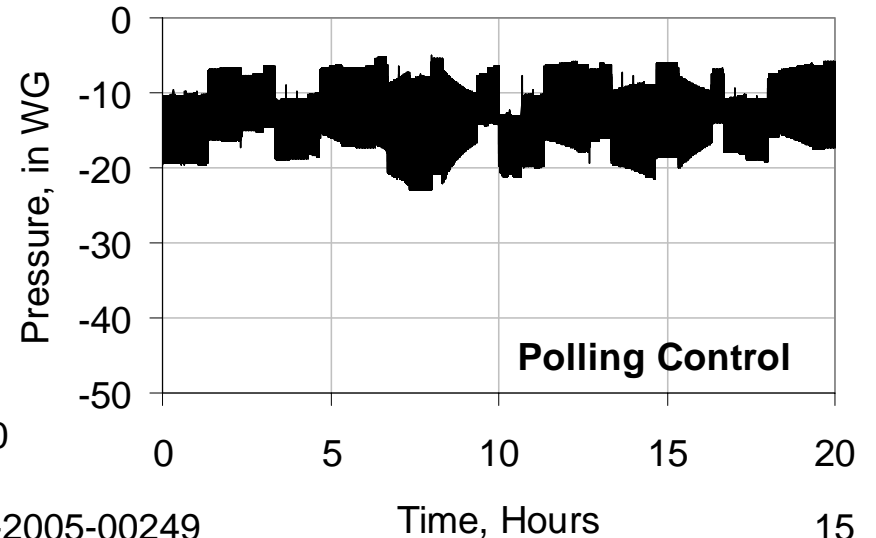
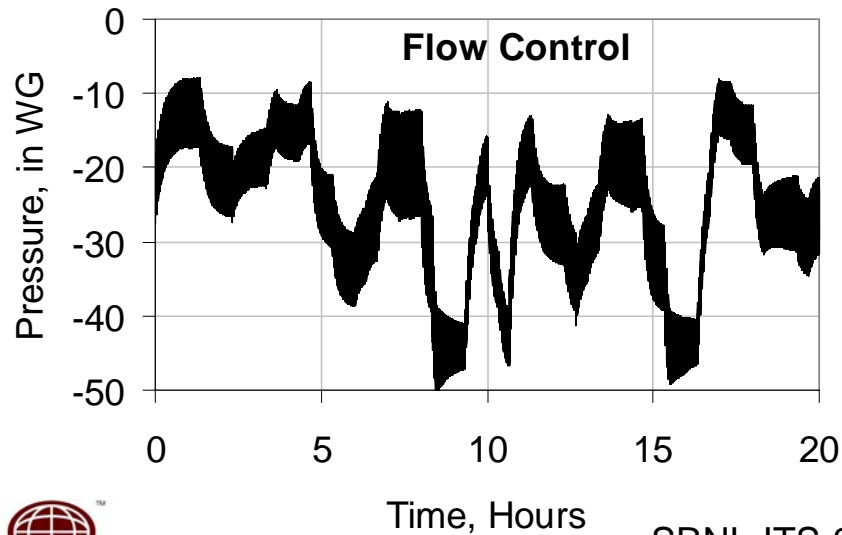
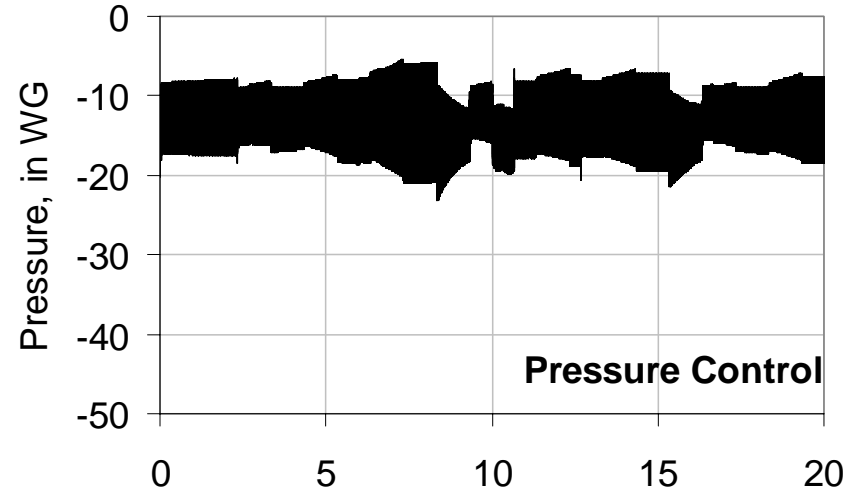
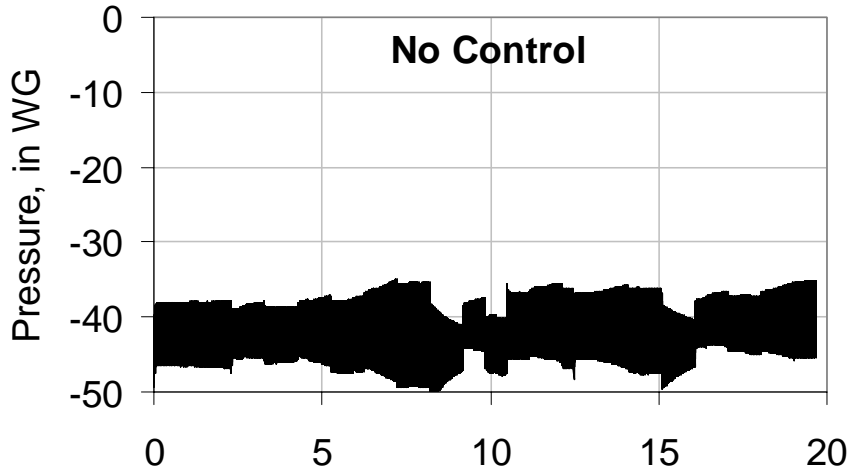
Melter Pressure During Plant Startup



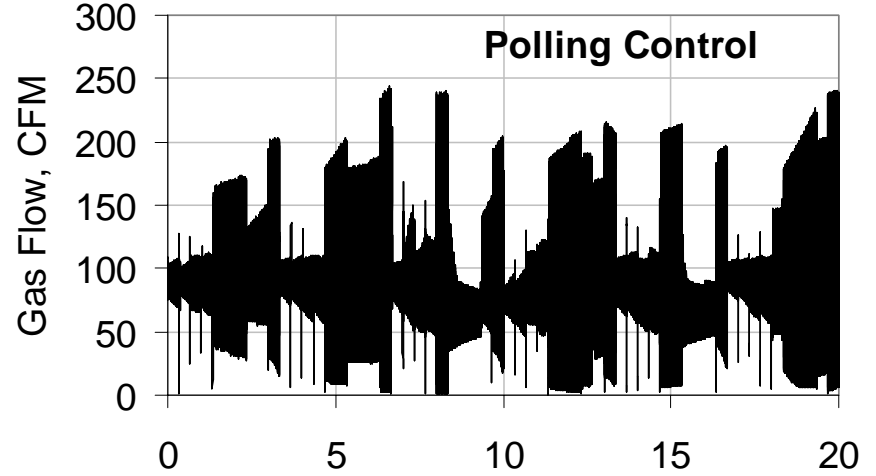
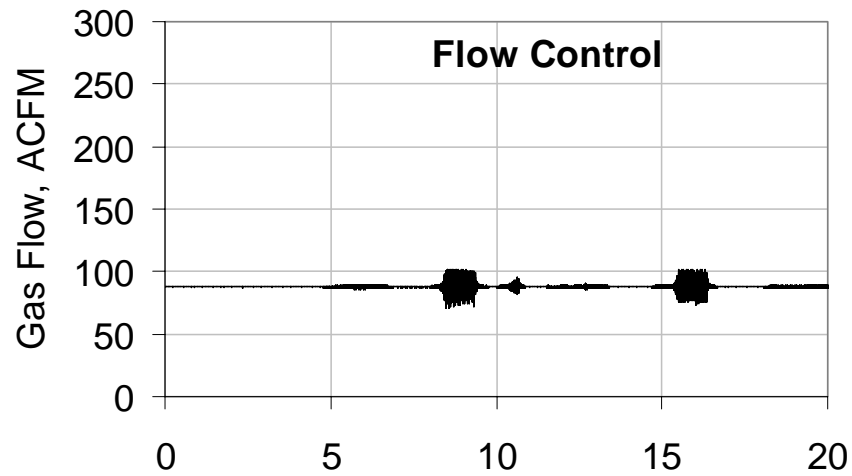
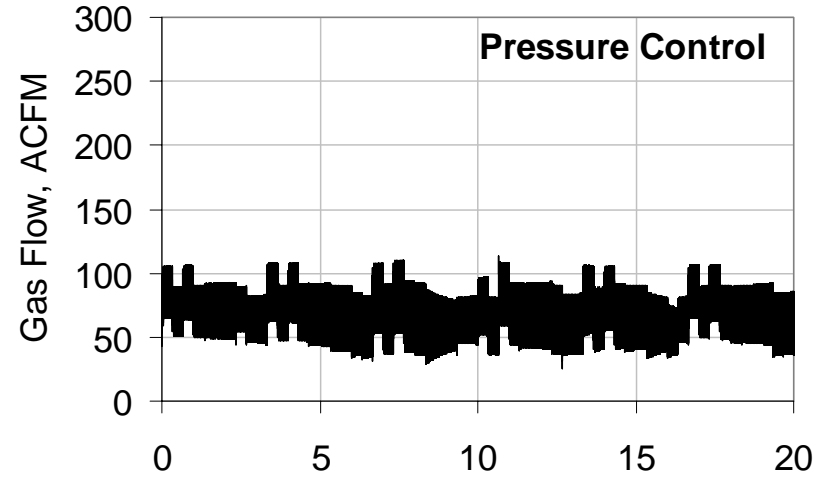
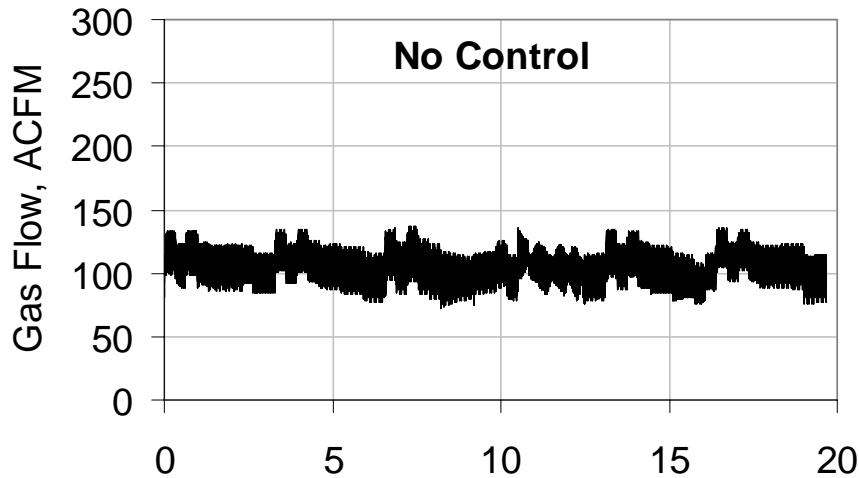
PVV Pressure Control Strategies

- **Maintain pressure in PVV vessels < -5" WG.**
 1. **No control**
 2. **Individual pressure controllers**
 3. **Individual flow controllers**
 4. **A single pressure controller using the average header pressure**
 5. **A single pressure controller using the minimum vessel vacuum (maximum vessel pressure)**

Pressure in Vessel RLD-7



Header Gas Flow



Conclusions

- Two examples of many simulations run over several years to provide a dynamic assessment of WTP off-gas system operations
- In some cases, dynamic results were used to modify the off-gas system design
- Dynamic modeling was also used to provide initial control parameters