Utilization of Slam Shut Regulators for LP System Over-Pressure Protection

What are the challenges?

Unitil’s Comprehensive Approach to Over Pressure Protection

System Equipment, Configuration & Design
Slam-Shut Regulators—Are they the Answer?

### Single system supply
- Immediate stopping of the flow of gas
- Protection for end-user
- Customer impacts
  - Relights required for all end-users
  - Effect on business & critical care constituents
  - Maintaining System Continuity

### Multi-system supply
- SCADA monitoring an absolute must
- Inherent risk associated with pressure loss to parts of the system
  - Customer Appliance Pilots
  - Management of shut-offs/relights
  - Maintaining System Continuity
UNITIL’S COMPREHENSIVE OPP STRATEGY
UNITIL OVER PRESSURE PROTECTION STRATEGY

Five Step Approach:

1. Prevention – Station Design & OPP Redundancy
2. Prevention – Monitor & Detection (Gas Control)
3. Prevention – New Technology & System Upgrades
4. Prevention – Physical Damage & Human Error
5. Emergency Response
WORKER/ MONITOR CONFIGURATION

➢ A Worker & Monitor Regulator (Industry Standard)
➢ Code Minimum (49 CFR §192.195)
➢ Provides for over pressure protection if the primary regulator fails (failure +1 level of protection)
WORKER / MONITOR / SUPER MONITOR
(Station Design & OPP Redundancy)

➢ A Worker Regulator, Monitor Regulator & A 3rd Regulator (Super Monitor)
➢ Provides for over pressure protection if the primary regulator fails (failure + 2 levels of protection)
➢ Unitil Standard Design Since 2010
REGULATOR STATION DESIGN STANDARD
SUPER MONITOR WITH RELIEF VALVES
(STATION DESIGN & OPP REDUNDANCY)

➢ New Design Standard Since Merrimack Valley

➢ Provides for over pressure protection if the primary regulator fails
  (failure + 4 levels of protection)

➢ Industry Leading Design

➢ Four Stations in Design or Ready for Construction
  1. Forrest St, Plaistow NH
  2. Forrest St. @ Riverside St., ME
  3. Eastern Road, ME
  4. Mardell Ave, NH

Note: Not Suitable for all existing locations
Unitil’s Gas Control Center is located in Portsmouth, NH

Staffed 24/7 & 365

Monitors system operations for all gas service areas (MA; ME; NH)

Responsibilities of Gas Control:
1. Continuously monitor pressures and flows
2. Initiates internal notifications for emergency’s
3. Dispatches emergency crews to the field
4. Direct line of contact for Police/Fire
• Regulator Set points Points:
  - Worker – Below MAOP
  - Monitor – Below MAOP
  - Super Monitor – At MAOP

• SCADA Alarms:
  - High Alarm – Before Monitor Regulator Set point
  - High High Alarm – At Monitor Regulator Set Point
  - Technicians Dispatched at High Alarm Notification

Example:
- System MAOP – 60 PSIG
- Worker Regulator – 55 psig
- Monitor Regulator – 58 psig
- Super Monitor – 60 PSIG
(Conservative & Industry Leading)
NEW TECHNOLOGY & SYSTEM UPGRADES

• Cast Iron/Bare Steel Replacement Programs
  - NH Complete, ME- 2024, MA – 2035
  - Elimination of the Majority of the Low Pressure Systems
  - Excess Flow Valves
  - Service regulators on IP systems

• Relocate meters from inside to outside

• Evaluating End User Piping Protection Devices (Over-Pressure Shut Offs (“OPSO”) on Risers)
(3) Primary Assessment Categories:

- Operational Hazards & Vulnerability
- Operational Security & Protection
- Operational Integrity

Multiple Sub-categories embedded in each Primary Category:

- Each risk in a specific sub-category is assigned a specific numeric value
- A higher numeric risk value is associated with an increased/higher overall circumstance or outcome
- Each specific sub-category total point output is weighted as part of the overall Primary Categories total numeric risk value

➢ The output algorithm incorporates the weighted numeric point value from all the sub-categories in each weighted primary category to develop an over-all risk assessment score for each regulator station.

➢ The data that is inputted into the model is derived by an individual analysis conducted at each station by the Operations Supervisor /technicians.

➢ The Risk Assessment Model has been developed to sort and prioritize the over-all risk at a station by quantifying a weighted numeric input/output.

➢ In addition, specific risk areas can be prioritized based on sorting the numeric value associated with a specific sub-category embedded within any of the three Primary Categories.

➢ The Regulator Station Risk Assessment Model is a data driven, flexible tool to identify multiple risks and to prioritize remediation of these risks.
## STATION RISK ASSESSMENT

(OPERATIONAL HAZARDS AND VULNERABILITY)

<table>
<thead>
<tr>
<th>Sense Line Accessibility, Station Configuration and Material</th>
<th>Point Value</th>
<th>Point Rating Given</th>
<th>Total Points</th>
<th>Weighted Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above ground Sense Lines</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Vault configuration: sense lines parallel- marked out</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Within Vault configuration: sense lines separated- marked out</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burried Sense Lines- Parallel</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burried Sense Lines- Separated</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sense lines: plastic</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sense lines: steel</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sense Line Location- Proximity to Station</th>
<th>Point Value</th>
<th>Point Rating Given</th>
<th>Total Points</th>
<th>Weighted Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10 feet</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 feet to 25 feet</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 feet to 50 feet</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 feet to 100 feet</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 100 feet</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Station Location- Environmental Concerns (All that apply)</th>
<th>Point Value</th>
<th>Point Rating Given</th>
<th>Total Points</th>
<th>Weighted Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wetlands- flooding potential</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unstable soil conditions- landslide</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sloped access</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial accident potential</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Susceptibility to vandalism</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Environmental Concern</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tree Hazards- Canopy</th>
<th>Point Value</th>
<th>Point Rating Given</th>
<th>Total Points</th>
<th>Weighted Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>No trees</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Some canopy concerns- trimming to mitigate</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overgrown vegetation- trimming to mitigate</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large scale trimming to mitigate damage- Within 50'</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vehicular Traffic Hazards (All that apply)</th>
<th>Point Value</th>
<th>Point Rating Given</th>
<th>Total Points</th>
<th>Weighted Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light to moderate traffic</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy traffic</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intersection</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Near parking area</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highway/embankment concern</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Vehicular Traffic Concern</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Corrosion- Visual Inspection</th>
<th>Point Value</th>
<th>Point Rating Given</th>
<th>Total Points</th>
<th>Weighted Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very poor</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material loss</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cathodic Protection: Corrosion Protection</th>
<th>Point Value</th>
<th>Point Rating Given</th>
<th>Total Points</th>
<th>Weighted Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Corrosion- Visual Inspection</th>
<th>Point Value</th>
<th>Point Rating Given</th>
<th>Total Points</th>
<th>Weighted Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very poor</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material loss</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cathodic Protection: Corrosion Protection</th>
<th>Point Value</th>
<th>Point Rating Given</th>
<th>Total Points</th>
<th>Weighted Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## STATION RISK ASSESSMENT
### (OPERATIONAL INTEGRITY)

### Operational Integrity

<table>
<thead>
<tr>
<th>Number of Customers</th>
<th>Point Value</th>
<th>Point Rating Given</th>
<th>Total Points</th>
<th>Weighted Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 50</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-500</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>500-1000</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 1000</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single/Multi Feed System</td>
<td>Point Value</td>
<td>Point Rating Given</td>
<td>Total Points</td>
<td>Weighted Points</td>
</tr>
<tr>
<td>10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single-feed</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-feed</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LP or IP System</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LP system</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IP system</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HP System</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Station Heat Capability</td>
<td>Point Value</td>
<td>Point Rating Given</td>
<td>Total Points</td>
<td>Weighted Points</td>
</tr>
<tr>
<td>10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not required</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilot required (none)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pilot required (active)</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-heat required (none)</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-heat required (active and sufficient)</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPP/Fire Valve (levels)</td>
<td>Point Value</td>
<td>Point Rating Given</td>
<td>Total Points</td>
<td>Weighted Points</td>
</tr>
<tr>
<td>20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire valve present</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No fire valve</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker/monitor only</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker/monitor/supemonitor</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker/monitor/supemonitor/releif valve</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worker/monitor/supemonitor/releif valve/burst disk</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Run/Multi-Run System</td>
<td>Point Value</td>
<td>Point Rating Given</td>
<td>Total Points</td>
<td>Weighted Points</td>
</tr>
<tr>
<td>10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single run</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multi-run</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Station Foot-Print (Upgrade and Growth Potential)</td>
<td>Point Value</td>
<td>Point Rating Given</td>
<td>Total Points</td>
<td>Weighted Points</td>
</tr>
<tr>
<td>5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No room for expansion</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited availability (+50%)</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Availability (+100% - double)</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unlimted with no restrictions</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaults vented (no obstruction)</td>
<td>Point Value</td>
<td>Point Rating Given</td>
<td>Total Points</td>
<td>Weighted Points</td>
</tr>
<tr>
<td>10%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaults vented</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaults not vented</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No by-pass (Vault or aboveground)</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buried By-pass</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enclosed By-pass (Confined within Vault)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>By-pass (Aboveground)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above Ground, Vault, or Confined Space Vault</td>
<td>Point Value</td>
<td>Point Rating Given</td>
<td>Total Points</td>
<td>Weighted Points</td>
</tr>
<tr>
<td>5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above Ground</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vault</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Confined Space Vault</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Operational Security and Protection

<table>
<thead>
<tr>
<th>Vehicular Traffic Protection (For Vehicles and Trains (where applicable))</th>
<th>Point Value</th>
<th>Point Rating Given</th>
<th>Total Points</th>
<th>Weighted points</th>
</tr>
</thead>
<tbody>
<tr>
<td>None required</td>
<td>0</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>None (but required)</td>
<td>5</td>
<td></td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Bollard</td>
<td>3</td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Guard rail</td>
<td>2</td>
<td></td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Jersey barrier</td>
<td>1</td>
<td></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Station Monitoring</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None required</td>
<td>0</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Required- none available, or tell tale only</td>
<td>7</td>
<td></td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Chart only</td>
<td>5</td>
<td></td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>ERX with Modem</td>
<td>3</td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Tell-tale gages- w/other</td>
<td>3</td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Pressure only</td>
<td>3</td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Heat and temperature with pressure</td>
<td>2</td>
<td></td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Controlled access and fully monitored</td>
<td>1</td>
<td></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Cameras with controlled access and fully monitored</td>
<td>1</td>
<td></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Physical Station Security</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None required</td>
<td>0</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>None</td>
<td>5</td>
<td></td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Locked vault/enclosure</td>
<td>2</td>
<td></td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Fence only with locked gate</td>
<td>3</td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Fence and barbed wire with locked gate</td>
<td>2</td>
<td></td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Controlled access facility- site or building</td>
<td>1</td>
<td></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Telemetry Power</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Direct AC</td>
<td>0</td>
<td></td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Battery/solar array with solid exposure</td>
<td>2</td>
<td></td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Battery/solar array with limited exposure</td>
<td>4</td>
<td></td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>System telemetry with power backup</td>
<td>1</td>
<td></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Communications</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Landline</td>
<td>1</td>
<td></td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Cell modem</td>
<td>3</td>
<td></td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Cell modem with failover</td>
<td>2</td>
<td></td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

### Total Station Risk Assessment

**Total Weighted Points**: 0