Frontera Space Emergency Procedure: Over-Pressure Events

Revision: 01

Frontera Space Document: 000016

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1 PURPOSE

The purpose of Document 000016 is to define required response actions for any over-pressure event occurring within propellant-adjacent or pressurant systems at the PTSD (Portable Test Stand by Dan).
This procedure establishes:

- Response to burst-disk activation
- Response to uncommanded venting or rapid depressurization
- Response to abnormal or runaway pressure rise
- Exclusion-zone establishment and vessel-integrity assessments
- Stabilization, hazard isolation, and return-to-operations requirements

These actions ensure personnel safety and prevent escalation to structural failure or secondary hazards.

2 SCOPE

This document applies to:

- All personnel working in or around the PTSD stand
- All pressurant systems, regulated lines, and pressure vessels
- Any system capable of experiencing over-pressure, including propellant-adjacent pressurization loops
- All hardware associated with burst-disk activation, relief valves, and regulator assemblies

Compliance with this procedure and associated training is mandatory for all personnel.

3 IMMEDIATE OVER-PRESSURE RESPONSE

Over-pressure events present both mechanical energy hazards and hazards from uncommanded venting. Immediate coordinated response is required.

3.1 Initial Response Workflow

Upon detection of a burst-disk activation, rapid vent, or abnormal pressure rise:

1. Announce “Over-Pressure Emergency”
2. Immediately stop hazardous operations
3. Safe the stand—halt all flow and pressurization commands
4. Evacuate to the designated safe standoff location

5. Don minimum PPE Posture B
6. Activate emergency shutdown systems (remote actuation only)
7. Notify the Safety Officer and Operations Controller

The Safety Officer assumes control of the response.

3.2 Uncommanded Venting & Burst-Disk Activation

Uncommanded venting or burst-disk activation indicates an active over-pressure condition or upstream regulation failure.

- Treat all venting as hazardous until verified otherwise
- Evacuate the stand until the Control Room and Test Director confirm system status
- Use camera systems to remotely evaluate vent source, rate, and hardware condition
- Maintain minimum PPE Posture B until the stand is verified safe and depressurized
- Stand remains closed to PPE Posture A until formal approval is issued

Any abnormal vessel noise (pinging, groaning, rapid vent cycling) requires immediate evacuation of exclusion radius.

3.3 Abnormal Pressure-Rise Events

If instrumentation indicates rapid or unintended pressure increase:

- Immediately inhibit all pressurization commands
- Verify regulator and valve positions remotely
- Stop sequencing that may drive further pressure rise
- Do not approach any vessel showing deformation, frost-patch formation, or unstable venting patterns
- Maintain remote monitoring until pressure stops rising and stabilizes

Any symptomatic personnel (ODH effects, cold-gas exposure, mechanical trauma) require EMS evaluation.

4 PRESSURE VESSEL STABILIZATION & EXCLUSION ZONES

4.1 Scene Safety Assessment

Before any personnel enter the area:

- Confirm the stand is placed in a safed configuration through remote instrumentation and camera systems
- Verify venting behavior, vessel condition, and system pressure remotely
- Ensure all personnel entering the PTSD fence line are in **PPE Posture B or C**, which include supplied breath air

- Because Posture B and C provide their own breathing air, ODH monitoring is not required for responders
- Establish a safe movement path inside the fence line if equipment or debris obstructs normal routes

No responder shall approach hardware or systems directly until the Safety Officer confirms stabilization and safe-entry conditions.

4.2 Exclusion Zone Requirements

During any burst-disk activation, uncommanded venting, or abnormal pressure-rise event:

- The PTSD fence line defines the exclusion zone
- All non-essential personnel must remain outside the fence line
- Personnel operating inside the fence line must be in PPE Posture B or C
- The stand is automatically closed to PPE Posture A at the onset of the incident
- The exclusion zone remains in effect until:
  - System pressure is stable or zero
  - Venting has ceased
  - Remote evaluation confirms no progressing deformation or mechanical instability
  - Safety Officer issues clearance

Re-entry under PPE Posture A is prohibited until full system stabilization and ODH validation are complete.

4.3 Stabilization Procedure

Once the exclusion zone is established and personnel are in proper PPE:

- Allow the affected vessel to fully depressurize or reach stable equilibrium
- Do not attempt manual vent manipulation, disconnection, or mechanical adjustments
- Use remote instrumentation only to confirm pressure decay and temperature stabilization
- After stabilization:
  - Inspect tanks, regulators, fittings, and burst-disk assemblies
  - Identify any deformation, cracking, cold-soak effects, or compromised components
  - Tag out and remove any hardware showing signs of failure or exceedance
- Document all findings for follow-up analysis

5 COORDINATION WITH EXTERNAL RESOURCES

5.1 EMS Integration

EMS shall be activated for:

- Any personnel injury resulting from pressure release
- Mechanical trauma, frostbite-type injury, or debris impact

- Loss of consciousness or respiratory difficulty
- Any condition beyond on-site treatment capability

A designated escort must meet EMS at the access point and guide responders safely to the stand.

5.2 Hazard Communication

Provide EMS with:

- System information and pressure-state summary
- SDSs for any propellant-adjacent chemicals involved
- A description of the hardware that pressurized or vented
- Notification of any components still carrying stored energy

6 DOCUMENTATION & INCIDENT REPORTING

6.1 Immediate Documentation

After the scene is stabilized:

- Record the incident time, system involved, and personnel present
- Capture pressure data, detector readings, and vent characteristics
- Photograph hardware damage if safe to do so
- Preserve failed components such as fittings, regulators, or burst-disk fragments
- Document remote camera observations and system-state telemetry

6.2 Formal Incident Report

A formal incident report must be submitted within 24 hours and shall include:

- Narrative description of the event
- Timeline of system behavior and actions taken
- Witness statements and responder notes
- PPE posture used by all personnel in the fence line
- Summary of injuries, if any, and EMS involvement
- Photos, system logs, and recorded instrumentation data

6.3 Root-Cause Analysis & Corrective Actions

Root-cause analysis is required for:

- Any burst-disk activation
- Any regulator malfunction or runaway pressure rise
- Any uncommanded venting event
- Any injury or near-miss associated with over-pressure conditions

Corrective actions must be:

- Assigned to responsible individuals
- Tracked until closure
- Integrated into training, operational protocols, or hardware design changes as required

7 RETURN-TO-OPERATIONS AUTHORIZATION

Operations may resume only when:

- All pressurant or over-pressure hazards have been eliminated
- System pressure is confirmed stable and at required safe levels
- Hardware assessments are completed and any compromised components are replaced
- ODH clearance is obtained only prior to reopening the stand to PPE Posture A
- All documentation requirements are met
- The Test Director issues formal authorization to return to operations

8 PROGRAM MAINTENANCE

Document 000016 shall be:

- Reviewed annually
- Updated after any over-pressure event or system redesign
- Revised whenever operating pressures, system configurations, or safety requirements change