



Frontera Space Emergency Procedure: Vapor Cloud Release

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1 PURPOSE

This procedure defines required response actions for a vapor cloud release, including the uncontrolled release, dispersion, or accumulation of hazardous vapors originating from fuel, oxidizer, or reaction byproducts at the PTSD stand or associated systems.

The objective is to protect personnel, prevent ignition or escalation, control dispersion, and ensure compliance with emergency notification and reporting requirements.

2 SCOPE

This procedure applies to:

- All PTSD operations involving MMH, MON-3 (N₂O₄), purge fluids, or decomposition products
- All tanks, lines, valves, test articles, vent paths, and flare systems
- All personnel working within or supporting PTSD operations

This procedure applies during active operations, post-test conditions, and post-incident recovery.

3 TRIGGERING CONDITIONS

This procedure shall be initiated immediately upon any of the following:

- Detection of hazardous vapor concentrations by fixed or portable sensors
- Visual observation of colored vapor clouds (e.g., brown NO₂ plume)
- Odor or sensor alarm consistent with MMH or oxidizer vapors
- Loss of containment with vaporization or evaporation
- Modeled dispersion indicating potential off-site impact

Any such condition shall be treated as a Vapor Cloud Release Event until verified otherwise.

4 IMMEDIATE CONTROL ROOM ACTIONS

Upon detection of a vapor cloud release:

- The Control Room shall announce “Vapor Cloud Release”.
- An emergency stop shall be initiated immediately.
- The stand shall be placed into a fully safed configuration, including:
 - Termination of testing or flow
 - De-energization of ignition sources
 - Isolation or venting of fluid systems via fail-safe logic

The stand shall be considered evacuated if personnel were present.

5 REMOTE ASSESSMENT AND MONITORING

All assessment shall be conducted remotely using:

- Fixed toxic-gas detectors
- Camera systems
- Telemetry and pressure data
- Weather instrumentation (wind speed and direction)

Personnel shall not approach the stand during active vapor release.

6 DISPERSION EVALUATION

An estimated release and dispersion assessment shall be performed using the site ALOHA dispersion analysis and real-time weather data.

Assessment shall:

- Assume conservative release conditions until verified
- Treat hazard zones as wind-direction dependent
- Identify potential migration beyond the property boundary

7 EMERGENCY NOTIFICATION & TIER II / LEPC REQUIREMENTS

If dispersion modeling or sensor data indicates the potential for harmful vapor concentrations beyond the property boundary, the following notifications shall be made immediately:

- 911 for emergency responder awareness and coordination
- Notification in accordance with EPCRA Tier II and Local Emergency Planning Committee (LEPC) requirements
- Fire Marshal notification as applicable

Responders shall be informed of:

- Chemicals involved
- Nature of the vapor release
- Current stand and evacuation status
- Wind direction and dispersion considerations

8 PERSONNEL ACCOUNTABILITY AND EXCLUSION ZONES

The Control Room shall:

- Confirm all personnel are accounted for
- Confirm stand evacuation status
- Log personnel status and time

The stand and downwind hazard zone shall remain restricted until clearance is granted.

9 VERIFICATION OF OFF-SITE MIGRATION

When the stand is safed and monitoring systems are functional, a SCAPE-suited technician is permitted to walk the inner fence line only to verify whether vapors are leaving the property.

This activity:

- Shall be limited strictly to verification
- Shall use calibrated portable detectors
- Shall not involve corrective action or leak mitigation

10 VAPOR MITIGATION AND STAND STABILIZATION

As conditions permit:

- Vent and purge systems may be used to reduce vapor concentration
- Nitrogen passivation shall be applied to suppress further vapor generation
- IPA flushing may be permitted only if approved by the Safety Officer and no ignition risk exists
- All actions shall be conducted remotely where possible.

11 TRANSITION TO SAFE STATE

The vapor cloud release shall be considered resolved only when:

- Vapor concentrations return to 0.0 ppm for applicable species
- Dispersion modeling no longer indicates off-site impact
- Stand systems are purged and passivated
- Safety Officer authorizes transition out of emergency posture

12 DOCUMENTATION AND REPORTING

Following stabilization:

- Record the release scenario and assumptions
- Document sensor data, weather conditions, and modeled dispersion
- Record notifications made (911, LEPC, Fire Marshal)
- Include findings in the formal incident report

13 RETURN-TO-OPERATIONS AUTHORIZATION

Operations may resume only when:

- Vapor release is fully resolved
- Stand is in a verified safe state
- Safety systems are operational
- Safety Officer grants clearance
- Test Director issues return-to-operations authorization

14 PROGRAM MAINTENANCE

This procedure shall be:

- Reviewed annually
- Updated following any vapor release event
- Revised upon system, hazard, or regulatory changes