RAILROAD COMMISSION OF TEXAS

RRC Weatherization Practices Guidance Document – Gas Supply Chain Facilities and Pipeline Facilities

July 2023

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INTRODUCTION

Note from Director

According to the Texas State Climatologist in August 2022, widespread snow across Texas is rare. There are only three other known instances of frozen precipitation as widespread and as heavy as during February 2021. Those instances were 1895, 1926, and 1929. A clear relationship between Texas frozen precipitation and La Niña has not been established. Therefore, an estimate of the future likelihood of a similarly widespread snowstorm is based on historical trends and computer model simulations. There is an estimated 1 in 50 chance of widespread frozen or freezing precipitation comparable to 2021's Winter Storm Uri this upcoming winter, and a 1 in 17 chance sometime during the next three years. Based on the climate assessment, most regions across the state are expected to have average to above average winter temperatures over the next three years.

Purpose

The purpose of this guidance document is to provide gas supply chain and gas pipeline operators within the State of Texas a series of common practices and considerations designed to enhance an operator's ability to comply with 16 Texas Administrative Code § 3.66 ("Rule 3.66"), relating to Weather Emergency Preparedness Standards.

It is the operator's responsibility to properly prepare their facilities to ensure sustained operation during a weather emergency. An operator may choose to implement weatherization practices outlined in this guidance or implement other weather preparation measures. Regardless of the specific measures implemented, the operator is ultimately responsible for complying with Rule 3.66.

Applicability

The weatherization common practices and considerations in this guidance document may be used by the operators of the following facilities to achieve compliance with Rule 3.66: (1) gas supply chain facilities, as defined in Tex. Nat. Res. Code § 86.044 and Rule 3.66(b)(3); and (2) gas pipeline facilities as defined in Tex. Util. Code § 121.2015 and Rule 3.66(b)(2).

At the request of council, this document is intended to provide guidance to operators with facilities meeting these definitions regarding potential weatherization practices for the implementation of weather emergency preparation measures to ensure sustained operation during a weather emergency in accordance with Rule 3.66.

The Railroad Commission will maintain this guidance as a living document that will be updated as new and effective practices become available.

WINTER WEATHERIZATION PRACTICES

1.1 Tracing - Process Piping and Vessels

Overview	Electric and steam tracing are used to help maintain a minimum temperature within process equipment and to prevent freeze-offs during cold weather operations. Inlet slug catchers, production separator water dumps, compressor unit dumps, fuel gas dumps and vapor recovery unit dumps should be considered for heat trace and insulation to prevent freeze-off.
Electric Tracing	Electric tracing may be used on electric components to maintain desired temperature. It can be applied where liquid in the gas stream may cause freeze-offs. Electric tracing is dependent on power. When electric tracing is used, operators should consider on/off visual indication of when to turn it on and off - to protect operations from freeze-offs.
Steam Tracing	Steam tracing is more prevalent in older facilities and presents a series of operations and maintenance challenges including ice and icicles formation that present slips and falling objects hazards to workers. Where steam tracing is used to maintain minimum temperatures and prevent freeze-offs of equipment and processes, operators should maintain a steam tracing management program that addresses the following: • Leaks and effectiveness of the steam traps • Timeliness for turning steam tracing on and off • Condensate collection and recycle where applicable
Glycol Heating Systems	For large facilities, where applicable, a closed loop glycol heating and tracing system can be extremely beneficial in preventing freeze-offs of critical equipment, assets and processes.

1.2 Insulation

Insulation	Insulation materials such as insulation blankets can be installed on critical components of a facility.

Maintained and effective insulation reduces the impact of cold temperatures on process equipment. When piping, vessels and equipment are electric and steam traced, insulation is an effective means of minimizing heat loss from tracing. For effective insulation management and performance, sites should consider the following:

- Recommend a routine insulation inspection program as defined by your company's procedures
- Preventive maintenance programs for addressing insulation deficiencies
- Avoid use of steam lances under insulation to thaw out frozen equipment or assets
- Consider other methods of heating and thawing such as hoarding tarps and electric / portable air heaters

1.3 Windbreaks and Cold Weather Barriers

Windbreak, Temporary Housing, Barriers, and Hoarding

In extreme cold weather environments: windbreaks, temporary housing, barriers and hoarding tarps can reduce the impact of cold weather on process operations. Hoarding is the use of tarpaulins to wrap a job site so that the site can be heated. Positioning critical equipment inside heated buildings is required for much of the year and provides necessary safeguards for points along the path of natural gas flow.

Cold weather barriers and hoarding provide short term relief and are generally short-term solutions.

Cold weather barriers, such as wind walls, may be installed around compressors to reduce wind-chill impacts that may exacerbate freezing conditions.

Hoarding (wrapping and insulating surface equipment), injection lines, supply valves, water lines, and other sensitive equipment may also help to prevent freezing and stoppage of both natural gas and produced water flow.

Cold weather barriers should be systematically reviewed, designed, and implemented based on weather conditions.

1.4 Critical Instrument List

Operations and Maintenance Activities

For extreme weather conditions, maintaining a critical instrument list is an important part of safe and reliable operations. A critical instrument list may be based on the impact of failure on the safety and reliability of facility's operations.

A critical instrument list is designed to inform operations about critical controls necessary to sustain safe and reliable operations during extreme weather conditions. During extreme cold periods, operator rounds should increase in site visit frequency – to inspect critical instruments.

Operators and maintenance personnel should be trained and competent in the operations and care of critical instruments - including the application and use of interlocks, shutdown keys, bypass operations and maintenance of instruments. Operators should know how to respond to cascading failures within the process for critical instrumentation. Consider installing monitoring devices for cold weather critical components, including circuitry providing freeze protection or preventing instrument air moisture. Confirm the operability of instrument air prevention systems.

1.5 Process Fluids – Dry Gas, Wet Gas, Produced Water and Disposal Wells

Overview

The Environmental Protection Agency (EPA) has jurisdiction over the discharge of all fluids and solids into waters of the United States. The Texas Commission on Environmental Quality (TCEQ) typically has authority to issue permits for all discharges into state waters. During extreme cold weather conditions, disposal of produced water is often a leading challenge for operators and has led to forced shutdowns by many operators.

Careful attention to addressing extreme cold on Loss of Primary Containment (LOPC) of process fluids is essential for regulatory compliance.

Limiting the amounts of water in process fluids is extremely important for sustainable operations during extreme cold weather.

Operators may consider the following installations and actions to minimize unplanned outages during extreme cold weather:

- Drain tank battery prior to weather event
- Line heaters
- Drip pots
- Glycol contact towers - scrubbers and absorbers
- Water removal by solids absorption

Drain Tank Battery Prior to Cold Weather Event

Minimizing the onsite produced water inventory before a cold weather event is an effective common method to enhance cold weather operation and avoid outages from produced water storage limitations. Oil and gas producers, midstream gatherers and pipeline transmission operators should use best efforts to reduce tank levels and increase uptime prior to extreme weather event.

Line Heaters

Line heaters are a common form of equipment in the production of natural gas for some geographic areas, specifically for gas wells that are being choked back at the wellhead, during early production. Line heaters are used to avoid freezing immediately downstream of the wellhead. They are commonly used in wells that flow predominantly gas and small amounts of water with no appreciable oil.

The equipment uses a gas fired flame to heat a fluid filled chamber inside the body of the line heater. Gas passes through a coil that is immersed in a chamber of warmed fluid, which increases the temperature of the natural gas as it passes. Line heaters can be sized for high or low pressured wells that pass natural gas through a wellhead choke, which can cool gas to the point of freezing—a Joule-Thompson effect that functions much the same as a conventional refrigeration system.

This type of cooling can create ice formation, particularly when ambient temperatures around the choke are at or below freezing. Line heaters, when sized appropriately for the volume of gas being produced, effectively heat gas in the vicinity of the wellhead before it reaches downstream separation or treating equipment. Downstream of a line heater the potential still exists for freezing with low ambient temperatures, but a line heater can effectively mitigate freezing at the first potential point of freezing off the wellhead.

Drip Pots

Drip pots are common and can be incorporated along with other winterization practices. Drip pots and coalescers reduce the amount of water/liquid in an instrument gas supply. With extreme cold, Natural Gas Liquids (NGLs) may fall below dew points and can lead to compressor failures. Monitoring drip pot levels - and dumping capacities - becomes a critical operations activity.

Drip pots are made primarily from the same materials as the flowlines carrying natural gas. They are typically located immediately after pressure drops, abrupt increases in flow area, or the lowest elevations in a continuous producing system. Drip pots work by gravity separation of water from gas where the temperature of gas decreases following a significant pressure change. Generally entering at the bottom of the drip pot and exiting at the top, a demister mat enhances the effectiveness of the drip pot. The cooling effect of a notable pressure change can cause liquids to fall out of the gas stream to the bottom of the drip pot.

The natural effects of gravity can cause water to drop from gas at low spots in a flow line. These low spots in flow lines can be an ideal place to locate a drip pot where water is likely to collect. A manual valve or level-controlled collection system can reduce water in a gas stream. A collection system on a timer with servo controls can also automatically dump accumulated water. Drip pots primarily remove larger volumes of water that collect in flow lines,

which can cause a hydraulic impedance increasing the pressure drop along a flowline. Drip pots do not generally dry gas or winterize a producing system, but they can reduce the water loads that reaches downstream natural gas separation or treating facilities. The removal of water will reduce the potential for freezing at points along the gas producing and transportation/transmission systems.

Drip pots should be traced and insulated to protect against freeze-offs.

Glycol Contact Towers -Dehydrators

Glycol units are an accepted industry standard practice and are effective at removing water from a stream of natural gas to meet typical pipeline and process specifications. Dry gas that leaves a glycol unit has little propensity to freeze. Relatively low-cost glycol absorption towers can be installed quickly with a single skid able to service more than one well. This allows a range of options and flexibility to configure systems to address a broad range of gas flow rates and water volumes.

While operational costs are generally proportional to the flowing natural gas volumes, such systems can vent releases of both steam and a measurable quantity of hydrocarbon gases. Used as a liquid desiccant, glycol can be introduced through a series of trays, or stages within a unit placed downstream of the wellhead before gas enters a commercial pipeline.

Wet gas enters at the bottom of an absorber tower and ascends through a mist extractor where water is removed. As the gas rises through the tower's packing or bubble cap trays water is absorbed by the descending lean glycol, which is continually pumped to the top of the tower. Drier gas exits the top of the tower and passes through a heat exchanger to the gas outlet. Water is removed from the glycol and recycled through the process. The removal of water by glycol is an effective method for creating dry natural gas with little potential to freeze downstream of the separators.

Water Removal by Solids Absorption

In a vapor state, all gases have the capacity to hold water. Drier gas devoid of water molecules can freeze in low temperatures. Under properly managed conditions, a solid absorption system can reliably work in any weather condition to absorb water as natural gas passes through dry chemical beds. Water removal by solids absorption (desiccant bed) methods can achieve a very dry natural gas stream under certain conditions.

On a producing location at the well pad, wet gas is directed into an inlet separator to ensure removal of contaminants and free water from the original gas stream. After the separator, the gas stream is directed into an adsorption tower where water is adsorbed by the desiccant. Adsorption is the adhesion of atoms, ions or molecules from a gas, liquid or dissolved solid to a surface. When the adsorption tower approaches maximum loading, the gas stream is automatically switched to another tower allowing the desiccant in the first tower to be regenerated. This method usually requires at least two desiccant

towers to ensure that a tower is always full of a dry desiccant, rather than a water saturated desiccant.

When the equipment is designed and installed properly, and the desiccants are systematically replenished, the removal of water by mechanical and solids absorption is an effective method for creating a dry stream of natural gas with little potential to freeze downstream of the separators. Care must be taken to analyze the amount of water remaining in the gas stream after leaving the separator.

1.6 Out of Service Equipment

Preventing Damage

Ensuring that non-operating, out of service and redundant equipment are protected against freeze-offs is essential in preventing unplanned outages.

Passing valves, low water collection points and other non-operational conditions may inadvertently create dead-legs and water collection points that may result in disastrous failures during extreme cold periods.

Operators should consider positive isolation methods when protecting out of service equipment within an operating facility.

Consideration for blind installations, double block, open bleeds and air breaks may prevent inadvertent cold weather failures.

1.7 Fuel Gas Systems and Wellstream Flow

Preventing Hydrates and Ice Plugs

Moisture in the fuel gas system can lead to hydrate formation and ice plugs. When the fuel gas system fails, the operation of the entire facility is in jeopardy. To prevent fuel gas supply related failures:

- Perform an overall fuel gas system winterization assessment and implement routine corrective actions
- Knockout drums remove free liquids while driers dehydrate natural gas
- Evaluate the possibility of hydrate formation and moisture content in fuel gas and off-gas systems and develop methods to prevent hydrate formation
- Low point areas, where moisture collects, should be identified and accommodated, i.e., draining, tracing and insulation
- The use of methanol in these streams should be evaluated and used properly as clearly defined in procedures

Note: Maintain and consider replacing temporary methanol injections systems each year.

Methanol Injection or Drip and Hydrates Prevention

Methanol injection is a well-documented, practical method to reduce the negative impact that hydrates can have on gas flow. Hydrates are ice-like solids produced from the interaction of hydrocarbon, gas and water under the right pressures and temperatures. Hydrates result from physical combinations of water and other small natural gas hydrocarbon molecules that can produce a solid similar to ice at temperatures higher than that of ice formation.

Injecting methanol into gas flow streams can lower the freeze point of hydrates, which will effectively inhibit the formation of ice-like structures in the flow stream:

- At low ambient temperatures, hydrates can develop a structure able to block normal gas flow in lines and orifices
- Liquid methanol can be cost effective to prevent the accumulation of these ice-like structures when injected in a low-pressure point in the gas flow stream
- The amount of methanol required to inhibit hydrates is directly related to the amount of water that is found in the gas stream
- Methanol injection can replace the need for upstream glycol dehydration in some gas streams and allow gas to flow until it arrives at a processing facility where the remaining water is removed, and gas is conditioned to meet pipeline specifications
- Methanol can also be used in gas atomizers to assist with gas lift for high-volume liquid (oil and water) horizontal wells
- Keeping inventory of hydrate or freeze protection chemicals readily available and accessible is a key strategy to emergency preparedness.
- Maintain adequate spent chemical disposal storage (totes).

1.8 Low Point Drains and Dead-legs

Low Point Drains

Like drip pots, low point drains provide opportunities for removal of collected water in process systems. Drip pots and low point drains should be:

- Included in operator rounds for routine draining
- Properly insulated and traced to prevent freezing of collected water
- Maintained with automatic level-controlled water dumping

Dead-legs	A systematic approach to dead-leg identification and removal is essential for safe and reliable operations during extreme cold conditions. Dead-legs may also occur in low-flow zones. Operators should establish a process to: • Identify and remove dead-legs during turnarounds / shutdowns • Dead-legs should be properly heat traced • Check and drain dead-legs routinely

1.9 Tankage, Terminals, and Distribution

Winter Tank Management and Care	Tanks, terminals, and distribution systems are essential in maintaining continuous operations of the gas supply chain and processing facilities during extreme cold conditions. To ensure sustainable and continuous operations, terminal operators and critical infrastructure gas supply chain and processing facilities should: • Implement steps to ensure roof drains and other water draws on tanks are adequately protected from freezing • Consider hail damage and immediate drain restrictions after hailing • Removal snow after heavy snowfalls • Ensure steam coils and/or hot oil coils in tanks are operating properly • Ensure sphere tanks have their snuffing steam systems properly winterized • Ensure tank vents are properly winterized to ensure breathing • Plugged screens can prevent breathing • Ensure gauges are functioning properly – levels, flows, temperatures, etc. • Maintain proper oil and antifreeze levels • Conduct routine winter inspections and rounds

1.10 Instrument Air Management

Dry Instrument Air to Critical Controls Systems	Instrument filters are a critical part of natural gas producing systems and should be installed, maintained and serviced routinely. Instrument air moisture can lead to condensation and ice buildup within impulse lines, resulting in equipment failure and outages. A control panel freeze could send a false reading, including shut down of equipment. Continual supply of instrument air during all weather conditions is essential for safe and reliable operations of pneumatic control systems.

To prevent instrument air and control system failures during cold weather operations, operators and processing facilities should consider the following:

- A pre-winter instrument air systems readiness assessment and corrective actions implementation program
- Drier desiccant expiration / saturation
- Routine verification of dew point
- Air driers / gas dehydrators / filter dryers are in-line devices that hold either a shaped filter made from a material that will restrict both fluids and solid particles of known sizes
- Gas driers – fuel gas piped to site for heating and instrument controls
- Electronic controls on newer plants or retrofitting of critical instrumentation with electronic controls
- Benefits of a Preventive Maintenance (PM) system for air driers and desiccant
- Develop work practices for the air plant operation that verifies elimination of moisture in the plant air system
- Knockout drums drained more frequently during winter
- Level control systems on knockout drums may also be considered where moisture content may be high in the ambient air
- Portable air compressors and redundant compressors should be properly maintained and included in the PM program
- Block heaters and battery chargers on portable air compressor may be required to assure they will run at a moment's notice
- Follow the manufacturer's recommendations
- Procedures for methanol injection and conditions that warrant its use should be maintained
- Low point drains on instrument air system should be checked and drained during routine operator shift rounds
- Consider the use of closed loop Nitrogen Instrument Air System for critical instruments in larger facilities

Instrument Air Filters	Instrument and process control of the producing system can often be maintained remotely if control panels are receiving high quality responses from their various sensors. Instrument filters clean small volumes of instrument gas or air. Filter redundancy allows for shut off and diversion during filter replacement. A PM program is generally required for the continuous stable function of inline filters. Inline filter and driers provide a clean, dry gas to instrumentation and controllers that functions using instrument gas.

1.11 Electrical Systems Management

Electrical Systems	Critical infrastructure gas supply chain and processing facilities should consider a documented work practices checklist to determine the health of the electrical system prior to winter season. This should include the following: • HVAC (heating vacuum air conditioning) systems in substations, powerhouses, analyzer buildings, variable speed drive buildings and any other temperature sensitive areas to remain functioning properly during extreme cold • A PM program for monitoring the HVAC systems of these assets • A backup power supply for temporary heating may be required to keep a facility warm during a forced outage

1.12 Water Systems Management

Winter Water Management Consideration	Water management during extreme cold weather is critical to preventing freeze-offs and equipment damage. Most freeze-offs can be avoided by careful attention to water systems checks. Operators should consider winter management principles for the following water operations and activities: • Cooling towers and process cooling water systems • Freeze protection lines • Safety showers and face washes • Fire water systems • Utility water systems • Wastewater systems

- Produced water storage and disposal
- Potable water systems where applicable

1.13 Air Intake Management

Ice Buildup and Cascading Failures

Restricted air flows due to ice buildup on the inlets of fans and compressors can lead to cascading equipment failure during winter periods. To minimize the chances of failure, operators should consider having documented work practices to address the buildup of ice and frost in the vanes and inlets systems of air intake systems.

Considerations for ice buildup on the following:

- Fan inlets of electric motors
- Air register inlet of fuel gas burners on furnaces and boilers
- Air inlets to induced draft and forced draft fans on furnaces and boilers
- Filter inlets associated with motors, blowers, or compressors

1.14 Utility Connections

Utility Hoses and Supplies

Steam, air, and occasionally water hoses, are important in dealing with winter freeze-off situations. To ensure readiness for winter, have a proper inventory management program so that hoses are available on demand.

1.15 Pumps, Compressors, and Turbines

Operating and Standby Equipment and Operator Rounds

To prepare for sustained operations the following weatherization considerations related to pumps, compressors, and turbines apply:

- Documented work practices are available to monitor pumps and steam turbines to ensure adequate cooling water supply to seal flush coolers, oil coolers, gland condensers, etc.
- Procedures are available to monitor hot standby pumps and steam drivers to ensure ready to run status:
    - Consider warm up lines and condensate traps and drains
    - Pump rotation
    - Monitor and manage glycol systems
    - Pulsation bottle drains

- Block heaters installation on engine drivers
- Cooling fans pitch to be reduced and even turned off during cold periods
- Operator rounds are modified to ensure more frequent checks to critical equipment and adjustments to operating parameters during extreme cold weather

Equipment Protection

Large pieces of oil and gas field equipment, such as pumps or compressors, rely on lubricants to move under pressure - as they are designed to reduce metal on metal contact. Lubricants keep these large pieces of equipment from overheating using fluids that are much more viscous than standard engine oils. When equipment is running, lubricant is warmed by the mechanical action of the moving parts.

At normal operating temperatures viscosity can be relatively low, but when ambient temperatures drop to near freezing, viscosity can increase causing lubricants to begin to appear as a solid. When machinery is shut down the lubricant temperature can drop, increasing its viscosity.

At freezing temperatures pumps designed to circulate lubricant have difficulty functioning. Installing external block heaters with an external energy source such as a gas fed flame or electricity can maintain lubricants at an appropriate temperature, even when the equipment is not operational, making it easier to restart the equipment by keeping the oil/fuel in the engine at an elevated temperature. Using these techniques, operators can keep pumps and compressors functional and prevent freeze-offs.

1.16 Chemical Tanks and Porta Feeds

Chemical Injection Tanks and Systems

Chemical injection systems are designed to enhance process operations and protect the integrity of operating assets. This may also include treatment to prevent freeze-offs in process operations. Operators should consider the following for effective operations and availability of chemical injections systems during extreme cold periods:

- Each chemical should be evaluated to determine the proper method of winterization based on the manufacturer's recommendations
- Work practices are available to ensure proper flow of in-service chemicals
- Cold weather barriers (hoarding), housing and temporary cold mitigation structures may be required to ensure the effectiveness of certain chemicals

1.17 Venting and Flare Systems

Venting and Flare Systems Management

If flares are used for venting and pressure relief systems, then the following work practices should be considered:

- Monitor adequate flare piping sweeps
- Ensure flare knockout drum levels are monitored and if so equipped, to visually verify levels
- Implement more frequent flare knockout drum level checks during extreme cold periods
- Verify seal drains lines are not frozen
- Manage seam flows and temperatures to prevent freezing of seal drains
- Conduct frequent flare system steaming to prevent ice buildup and piping constrictions
- For sour gas systems (H2S), ensure continuous flare to prevent release of H2S gas
- Windsocks should be available and monitored during flare outages to protect workers (wind blowing away from workers and not towards communities)

1.18 Safety Systems Including Showers and Facewash

Safety Systems Readiness

Operators should ensure extreme cold weather readiness includes that safety showers and face washes are functional. Routine inspection of safety showers and eye wash stations should ensure the free flow of water to these devices during below freezing conditions - water temperature checks should be implemented when heated.

Sanding of roadways and walkways are suggested for vehicle and worker access and egress. Ice melt should also be available at operator shelters, maintenance shops, laboratory and office buildings.

1.19 Maintenance Preparation and Readiness

Spare Parts and Onsite Fuel

Critical spares are a key component to maintenance preparation and readiness. Oil and gas is demand driven and spare parts are an essential asset to high productivity. Preseason inventories of spare parts are suggested.

- Maintain reserve diesel and fuel inventory and capacity as needed in preparation for a weather emergency

	• Establish a schedule for testing equipment prior to winter season and continually from December through March of each year
On-call Crafts and Trade Personnel and Equipment Readiness	Weatherization readiness includes maintaining a well-prepared support structure and team with capabilities for addressing equipment failures due to freeze-offs and damage. Maintain back up and redundant systems and equipment as needed for continued operations during weather emergencies. An on-call maintenance team during extreme cold weather situations may include the following trades and craft personnel: • Electricals and instrumentation technicians • Steamer trucks and operating personnel • Vacuum trucks and operators • Scaffolders for scaffold setup to access hard to reach instrumentation • Mechanical personnel for removing and cleaning piping, pumps and other pieces of equipment • Work practices are available for storing motorized equipment (e.g., backup instrument air compressors) and use of engine block heaters

1.20 New Pipeline Construction

Buried Pipelines	Operators are encouraged to properly weatherize new pipelines / infrastructure when constructed. Recommended practices include the following: • Ensure proper insulation and heat tracing for above ground piping • Supporting above ground infrastructure (flow transmitters and control valves) should be adequately traced and insulated • Structural and geotechnical engineer reviews to ensure protection against water hammer frost, etc. (ASME B31.3 Process Piping Guide p.162)

1.21 Freeze-offs List

Freeze-off Management	Freeze-offs occur when temperatures drop low enough to freeze water and other liquids in a well or pipe and halt gas flow. A bad actor is defined as any machine or stationary item that experiences one or more ESDs per year (unscheduled shutdowns or failures). This list helps operators in developing a structured approach to address equipment and processes that are prone to freeze-offs. Operators should consider developing a bad actor

list to address priority action and early winter preparation with corrective actions to develop permanent fixes.

1.22 Miscellaneous and Consumables

Consumables

The following are recommended for winterization preparation:

- Rolls of temporary blanket insulation
- Temporary wind breaks and hoarding
- Stock of steam traps
- Stock of steam hoses and fittings
- Extra PPE (gloves, ice and snow grips for boots, etc.)
- Winter gear preparation

Critical Services and Supplies

Operators should consider securing the following critical services to support continuous operations during extreme cold weather situations:

- Provide ingress / egress to operating sites and facilities
- Sanding and gravel supplies services
- Temporary infrastructure –procure tanks / piping / pumps and containment equipment / hot oil trucks / temporary structures as anticipated
- Process chemical supplies and inventory
- Portable compressors
- Portable power generators to meet critical equipment power demands - e.g., water disposal pumps
- Maintenance services for critical activities such as the following:
  - Heating / thawing services
  - Equipment repairs
  - Catering services for stranded workforces and teams

1.23 Emergency Operation Plans

Overview

Freeze-off driven unplanned outages during winter can result in significant equipment damage should equipment not be adequately protected during the outage. Operators should consider the following:

- Where possible, maintain minimum or idle flows in circulation to protect the asset while recovery and return to service is planned and implemented
- Minimize the duration of the unplanned outage
    - The longer the outage, the greater the likelihood of equipment and asset damage, further freeze-offs and equipment malfunctions
- Drain all equipment that are subject to freeze-off flow restrictions
- Drain all vessels and piping where water accumulation is possible and ice formation can occur
- Maintain procedures for cold weather shutdown and start-up of the facility, asset, or equipment
- Practice the procedures through simulation exercises

Adequate Response Personnel Resources

While weather specific technologies are critical to sustain natural gas production during cold weather conditions, the maintenance and operation of these technologies begins with training. This ensures that natural gas continues to serve its essential function in the electricity supply chain.

Increasing staffing levels in advance of an extreme weather event helps to ensure that appropriately trained employees are readily available to respond to plant upset events. Should temperatures fall below an acceptable operating temperature, consider the following:

- Adequate personnel are available
- Coordinate with local law enforcement, fire departments, emergency response personnel, TxDOT, and RRC. Keep each agency's contact information readily available
- Troubleshooting and repairs (including materials and supplies)
- Safe start-up and return to operations
- Proper resource planning

Unit Shutdown / Start-up Procedures

Unplanned outage cold weather shutdown and start-up procedures should include safety and protecting the asset(s) during shutdowns and start-ups. This involves taking the time to ensure vessels, process piping and equipment are protected during and after shutdown for safe start-up.

Vessels, piping and process equipment containing water should be drained to protect damage that may result from ice formation and uncontrollable damaging expansion during ice formation within these assets.

Unit Startup Procedures	During start-up and return to service, operators should consider: • Systematic return to services from cold starts • When failure is not catastrophic (leading to a total plant / facility outage), returning equipment to service helps to prevent further cascading failure impacts
Procedure Testing Training	Operators should routinely test shutdown and start-up procedures and implement debrief / corrective actions as applicable.

1.24 Continual Improvements

Continual Improvements and Learning	Operators are encouraged to maintain a continual improvement and learning program - including investigation and root cause analysis to reduce outages.

EXTREME HEAT WEATHERIZATION PRACTICES

2.1 Proactive Heat Maintenance on Equipment

Proactive maintenance is a preparedness strategy in which an operator identifies potential future equipment failures and mitigates them. Proactive maintenance allows an operator to anticipate and correct the root causes of equipment failures ahead of time. Proactive maintenance can help ensure that operators continue to deliver natural gas during extreme hot weather conditions. Removal and careful storage of cold weather equipment during summer months can help ensure that an operator is able to effectively prepare for the next cold season.

2.2 Heat Maintenance on Equipment

This section provides common weatherization methods used during extreme heat conditions.

Backup Generators	• Where applicable, operator should have maintenance checklists, PM (preventative maintenance), etc. if they have backup generators as part of operations
Cooling Towers	• PM requirements for maximum cooling – Water pumps, louvers, algae removal etc. • Water quality management
Fin-Fan Coolers	• Blade tip shrouds to maximize air flows • Fins on exchanger are cleaned • Internal jetting of process to internally clean exchanger
Tank Management	• Ensure tank thief hatches, Enardo valves and tank vent lines are clean • Ensuring hot oil coils in tanks are turned off as required - checklist, etc. • Debris and birds' nests are removed from vents • Gauges are functioning properly – levels, flows, temperatures, etc. • Tank battery headers: proper isolation, disengaged heat trace on headers, check pipe integrity • Check tank integrity
Compressor Operations	• Shroud removal for maximizing cooling air flows on motors

	• Intercoolers for multistage compressors to minimize heat of compression • Inspection of cleaning of cooling systems to address the buildup debris
Saltwater Injection Pumps	• Reduce/ Eliminate spots where there is high risk of gas condensation or freezing up when temperature drops
Gas Processing Plants (GPP)	• Coolers are ahead of separators • Check coalescing filters in dehydration units for clogs and replace them, if necessary • Check coalescing filters in dehydration units for clogs and replace them, if necessary • Check heat exchangers near line chokes to eliminate liquid condensation

CONCLUSION

Conclusion

This guidance document on weatherization practices is intended for the gas supply chain facility operators and gas pipeline facility operators who are subject to Rule 3.66. This guidance document addresses weatherization concerns associated with extreme cold and hot weather conditions.

The content provided in this report is the combined outcome of industry practices, literature reviews, field experience of operations, maintenance personnel and industry subject matter experts.

This report collates the knowledge and experience of industry into a single document to enable operators to a repository of common methods to protect their assets during extreme weather conditions.

Information and knowledge provided in this report focuses primarily on administrative techniques and considerations that can be adjusted to meet the operator's scale of operations and criticality.

Operators may choose to apply all or some appropriate practices as a means of improving performance during extreme weather conditions based on the type and location of the facilities, as well as the specific equipment onsite.

The Railroad Commission will maintain this guidance as a living document that will be updated as new and effective practices become available.

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