IESO Winterization Guideline

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Table of Contents

1. Introduction

Extreme cold weather conditions can cause operational issues at generation and transmission facilities. That, in turn, impacts the Independent Electricity System Operator's ("IESO" or "us") ability to reliably operate the grid. This document serves as a guideline for facility operators ("Operators" or "you") on cold weather preparedness to better prepare them for winter operations.

Unplanned generator and transmission outages are not uncommon during extreme cold weather conditions where frigid temperatures can inhibit the operation of facilities through frozen equipment and fuel supply limitations. In particular, cold weather events caused by the southward movement of the polar vortex have proven to cause significant impacts to the grid and its facilities. In January 2014, Ontario experienced a polar vortex weather event that proved challenging for both asset operators and the IESO in their efforts to ensure grid reliability while enduring a number of de-rates and forced outages. Additional extreme cold weather events have occurred since then with varying impacts to the electricity grid.

Due to the January 2018 cold weather event that impacted the south-central region of the United States, the Federal Energy Regulatory Commission ("FERC") and North American Electric Reliability Corporation ("NERC") jointly developed a report to identify lessons learned and best practices, and stressed the need to adequately prepare for winter weather conditions to ensure grid reliability. The report concluded that the majority of equipment limitations experienced were attributable, either directly or indirectly, to the cold weather itself, and about one-third of the generation lost during the event was due to lack of a winterization plan from asset operators.

Ontario experienced an extreme cold weather event in January 2019, where approximately 2,100 MW of generator capacity was lost in the span of two hours due to cold weather-related issues. On December 24, 2022, Winter Storm Elliot caused the Ontario gas-fired generation to experience cold-weather-related forced outages / derates affecting approximately 2,300 MW of capacity.

Extreme cold weather conditions and events are expected to continue, and it will be a combined effort between the IESO and asset owners to help mitigate its impact on Ontario's electricity grid. The IESO is committed to improving Ontario's resilience to cold weather events, and this guideline is one of many initiatives to improve Ontario's cold weather preparedness.

2. Disclaimer

Notwithstanding anything otherwise stated herein:

- these guidelines are provided for general information and guidance purposes only and do not constitute legal or other professional advice, nor do they amend or vary the Market Rules for the Ontario Electricity Market, applicable Reliability Standards, or any applicable law or regulation (together, **"Applicable Laws"**) or any IESO contracts;

- the IESO cannot provide Operators with legal or other professional advice, and the IESO recommends that you seek independent legal or other professional advice as you consider prudent and appropriate with respect to the matters described herein;

- the IESO provides no guarantee, representation, or warranty, express or implied, with respect to the quality, accuracy, or completeness of these guidelines or the information contained herein and disclaims any and all liability in connection therewith;

- these guidelines are not binding on the IESO and in no way vary or impact our interpretation of any Applicable Laws or any IESO contract;

- in the event of any conflict or inconsistency between anything in these guidelines and any Applicable Laws or IESO contract, the Applicable Laws or contract will govern;

- the costs, risks, and responsibility to operate a facility in accordance with Applicable Laws and any applicable IESO contract rests solely with Operators, and the IESO accepts no liability in this regard; and

- compliance with these guidelines does not, and shall not be considered to, constitute an acknowledgement by the IESO of any Operator's compliance with Applicable Laws or any IESO contract.

3. IESO Winterization Procedures

The following are examples of practices adopted by the IESO to help prepare for extreme cold weather conditions:

- Gas-Electric Coordination Protocol – Monitor the gas transportation system and identify any impacts to operating the IESO-controlled grid in coordination with gas pipeline operators.

- Unit Readiness – Test non-quick start units to ensure they are indeed available and operable.

- Operating Reserve – Increase scheduled operating reserve in response to anticipated conditions of uncertainty and/or heightened risk of grid events.

- Outage Planning – Reject, defer, and recall outages in anticipation of and during extreme conditions. Assess outages based on an extreme forecast rather than a normal forecast and consider pre-approved independent actions to mitigate reliability risk to the IESO-controlled grid.

4. General Winterization Guideline for Asset Operators / Owners

4.1 Evaluation of Potential Problem Areas

The IESO encourages Operators to have their plant and station operations personnel evaluate all equipment that could be impacted by cold weather. Performing this task will provide the facility operator with a better understanding of their exposure to cold weather conditions. Operators are encouraged to consider evaluating equipment that could:

- Be involved with initiating an automatic unit trip
- Impact unit start-up
- Be critical to the operation of the facility that may cause a de-rate, full or partial outages
- Involve protections
- Adversely affects the delivery of fuel to the units (e.g., gas valves)
- Adversely affects the delivery of cooling to the units (e.g., water intake pumps)
- Result in a common mode failure
- Create a safety hazard

In addition, the IESO reminds Operators to notify the IESO of any conditions or outages that could impact the grid as per the outage reporting requirements specified in Market Manual 7.3 - Outage Management.

4.2 Extreme Cold Weather Protection Measures

There are a number of protection measures that are available to mitigate the effects of extreme cold weather. Following an evaluation of potential problem areas, facilities should evaluate and consider implementing measures applicable to their potential problem areas. Some examples of extreme cold weather protection measures are:

Heat Tracing

- Properly insulated and correctly installed heat trace elements can help prevent plant equipment from freezing

Wind Break

- Temporary wind break walls can help shield components from extreme cold weather conditions

Insulation

- Properly installed and maintained insulated weather barriers can prevent equipment from freezing

Heaters

- On-site temporary heaters can ensure heat is available where needed to protect critical equipment and instrument panels

Staffing

- Increasing on-site staff during extreme cold weather conditions will allow for prompt action during cold weather-related events

4.3 Winterization Plan

The IESO encourages Operators to develop and have readily available a winterization plan that provides their staff with information and procedures to prepare for and react to cold weather conditions. Operators are encouraged to consider a number of actions as part of their winterization plan, including, but not limited to:

- Installing/inspecting heat trace systems and/or adequate insulation around critical components
- Installing/inspecting covers on valve actuators to prevent freezing from ice accumulation
- Having sufficient staff onsite during severe weather conditions
- Erecting adequate wind-break structures around key components
- Testing equipment that could impact cold weather operation
- Installing equipment that can monitor and alarm for potential freeze-related problems in critical areas
- Training personnel in cold weather preparedness activities

The IESO encourages Operators to utilize the following material in developing their own winterization plan and preparing for cold weather conditions. Operators are encouraged to use the most up-to-date documents available.

- NERC Winter Preparedness
  https://www.nerc.com/pa/rrm/ea/Pages/Cold-Weather-Training-Materials.aspx
- NERC Reliability Guidelines
  https://www.nerc.com/comm/Pages/Reliability-and-Security-Guidelines.aspx
- NERC Reliability Assessments
  https://www.nerc.com/pa/RAPA/ra/Pages/default.aspx
- 2021 FERC NERC Regional Entity Staff Cold Weather Report
  https://www.ferc.gov/media/february-2021-cold-weather-outages-texas-and-south-central-united-states-ferc-nerc-and
- 2019 FERC NERC Cold Weather Report
  https://www.ferc.gov/legal/staff-reports/2019/07-18-19-ferc-nerc-report.pdf

For reference, included in Appendix A is the NERC Reliability Guideline regarding generating unit winter weather readiness. This NERC reliability guideline provides relevant detailed information on cold weather preparedness. In addition, Appendix B is an attachment to this guideline and covers key points to address in preparing a winterization plan. Both of these documents can be found under the 'NERC Reliability Guidelines' link above.

Appendix A – NERC Reliability Guideline – Generating Unit Winter Weather Readiness – Current Industry Practices – Version 4

Preamble

The NERC Reliability and Security Technical Committee (RSTC), through its subcommittees and working groups, develops and triennially reviews reliability guidelines in accordance with the procedures set forth in the RSTC Charter. Reliability guidelines include the collective experience, expertise, and judgment of the industry on matters that impact BPS operations, planning, and security. Reliability guidelines provide key practices, guidance, and information on specific issues critical to promote and maintain a highly reliable and secure BPS.

Each entity registered in the NERC compliance registry is responsible and accountable for maintaining reliability and compliance with applicable mandatory Reliability Standards. Reliability guidelines are not binding norms or parameters nor are they Reliability Standards; however, NERC encourages entities to review, validate, adjust, and/or develop a program with the practices set forth in this guideline. Entities should review this guideline in detail and in conjunction with evaluations of their internal processes and procedures; these reviews could highlight that appropriate changes are needed, and these changes should be done with consideration of system design, configuration, and business practices.

Purpose

This reliability guideline is applicable to electric sector organizations responsible for the operation of the BPS. This guideline will provide a general framework for developing an effective winter weather readiness program for generating units throughout North America. The focus is on maintaining individual unit reliability and mitigating future cold weather-related events. This document will provide a collection of recommended industry practices compiled by NERC. While the incorporation of these practices is strictly voluntary, developing a winter weather readiness program using these practices in keeping with local conditions is highly encouraged to promote and achieve the highest levels of reliability for these high impact weather events.

Assumptions

A. Each BPS Generator Owner and Generator Operator is responsible and accountable for maintaining generating unit reliability. It is recognized that nuclear power plants already have more detailed winterization and summarization procedures with NRC regulation and INPO guidance than indicated in this document.

B. What constitutes severe or extreme weather is different in different locations. Each entity will need to make its own determination for what constitutes normal winter weather and what is extreme for each of its own locations, and thus what level of preparedness and response steps to include in its normal and extreme cold weather procedures.

C. After identifying issues related to derates, outages, or other operational issues, Generator Owners should communicate with their Balancing Authorities, Transmission Operators, and Reliability Coordinators (Reliability Entities) as soon as possible. Generator Operators should also use past experiences at the plant to identify the potential for freezing issues (including potential fuel concerns) and warn the Reliability Entities of that potential if measures to address the issue are not available. This level of communication allows the Balancing Authorities, Transmission Operators, and Reliability Coordinators to better assess the level of risk on the system.

Guideline Details

An effective winter weather readiness program that includes severe winter weather event preparedness should generally address the following components: Safety, Management Roles and Expectations, Processes and Procedures, Evaluation of Potential Problem Areas with Critical Components, Testing, Training, and Communications.

I. Safety

Safety remains the top priority during winter weather events. Job safety briefings should be conducted during preparation for and in response to these events. Robust safety programs to reduce risk to personnel include identifying hazards involving cold weather, such as personnel exposure risk, travel conditions, and slip/fall issues due to icing. A job safety analysis (JSA) should be completed to address the exposure risks, travel conditions, and slips/falls related to icing conditions. Winter weather alerts should be communicated to all impacted entities. A business continuity and emergency response plan should also be available and communicated in the event of a severe winter weather event.

II. Management Roles and Expectations

Management plays an important role in maintaining effective winter weather programs. The management roles and expectations below provide a high-level overview of the core management responsibilities related to winter weather preparation. Each entity should tailor these roles and expectations to fit within their own corporate structure.

1. Senior Management
   a) Set expectations for safety, reliability, and operational performance.
   b) Ensure that a winter weather preparation procedure exists for each operating location.
   c) Consider a fleet-wide annual winter preparation meeting, training exercise, or both to share best practices and lessons learned.
   d) Share insights across the fleet and through industry associations (formal groups or other informal networking forums).
2. Plant Management
   a) Ensure development of a cold/winter weather preparation program and consider appointing a designee responsible for keeping its processes and procedures updated with industry identified best practices and lessons learned.
   b) Ensure the site specific winter weather preparation procedure includes processes, staffing plans, and timelines that direct all key activities before, during, and after severe winter weather events.
   c) Ensure proper execution of the winter weather preparation procedure.
   d) Conduct a plant readiness review prior to an anticipated severe winter weather event.
   e) Encourage plant staff to look for areas at risk due to winter conditions and bring up opportunities to improve readiness and response.

f) Following each winter, conduct an evaluation of the effectiveness of the winter weather preparation procedure and incorporate lessons learned.

III. Processes and Procedures

Winter weather preparation procedures should be developed for seasonal winter preparedness. Components of effective winter weather preparation procedures are included in Appendix B.

After a severe winter weather event, entities should utilize a formal review process to determine what program elements went well and which need improvement. Identify and incorporate lessons learned within applicable procedures. Changes to the procedures and lessons learned must be communicated to the appropriate personnel. NERC encourages sharing appropriate lessons learned with other entities so that grid reliability and the industry may benefit as a whole. NERC lessons learned documents provide a process in which that sharing may be performed anonymously.

IV. Evaluation of Potential Problem Areas with Critical Components

Identify and prioritize critical components, systems, and other areas of vulnerability that may experience freezing problems or other cold weather operational issues. Schedule any routine cold weather readiness inspections, repairs, and winterization work to be completed prior to the local expected seasonal first freeze date. Depending on the plant, further checks and winterization activities might be needed prior to forecasted extreme winter events in addition to seasonally.

Winterization efforts should include addressing critical instrumentation or equipment that has the potential to perform the following when frozen:

1. Initiate an automatic unit trip
2. Impact unit start-up
3. Initiate automatic unit runback schemes or cause partial outages
4. Cause damage to the unit
5. Adversely affect environmental controls that could cause full or partial outages
6. Adversely affect the delivery of fuel or water to the units
7. Cause operational problems such as slowed or impaired field devices
8. Create a weather-related safety hazard

Based on previous cold weather events, a list of typical problem areas is provided below. This is not meant to be an all-inclusive list. The list has been split into two sections to assist with the identification of issues seen at conventional generators and inverter-based resources. Individual entities should review their plant design and configuration, identify areas where critical components' potential exposure to the elements, ambient temperatures, or both might cause issues and tailor their plans to address them accordingly.

Conventional Generation

1. Critical Level Transmitters
   a) Drum level transmitters and sensing lines
   b) Condensate tank level transmitters and sensing lines
   c) De-aerator tank level transmitters and sensing lines
   d) Hotwell level transmitters and sensing lines
   e) Fuel oil tank level transmitters/indicators
2. Critical Pressure Transmitters
   a) Gas turbine combustor pressure transmitters and sensing lines
   b) Feed water pump pressure transmitters and sensing lines

c) Condensate pump pressure transmitters and sensing lines
d) Steam pressure transmitters and sensing lines

3. Critical Flow Transmitters
   a) Steam flow transmitters and sensing lines
   b) Feed water pump flow transmitters and sensing lines
   c) Natural gas or liquid fuel flow transmitters and sensing lines
4. Instrument Air System
   a) Verify that automatic blow downs, traps, dew point monitoring, and instrument air dryers are functioning correctly within acceptable parameters.
   b) Ensure that low point drain lines are periodically drained by operators to remove moisture during extreme cold weather.
5. Motor-operated valves, valve positioners, and solenoid valves
6. Drain lines, steam vents, and intake screens
7. Water pipes, water treatment, and fire suppression systems
   a) Low/no water flow piping systems
8. Fuel supply, materials, and ash handling
   a) Coal piles, other solid fuel storage, and handling equipment
   b) Transfer systems for backup fuel supply
   c) Gas supply regulators, other valves, and instrumentation (may require coordination with gas pipeline operator)
   d) Fuel oil heaters and flow control devices
   e) Ash disposal systems and associated equipment
   f) Lime storage and transfer equipment
9. Tank Heaters
   a) Conduct initial tests
   b) Check availability of spare heaters
   c) Record current tanks indicators for sodium-based injection (SBS) injection systems, flue gas desulfurization systems, dibasic acid additives, mercury control additives, etc.
10. Lube oil and greases for mechanical equipment necessary to support generation in locations that may be exposed to cold weather.
11. Ensure batteries and uninterruptible power supply systems critical to the functioning of the facility are housed in temperature-controlled locations and protected from weather.
12. Functional heat tracing, insulation, and temperature responsive ventilation (heaters, fans, dampers, and louvers) based on expected weather conditions.
13. Adjust operation of cooling tower fans, deicing rings, and riser drains to prevent icing.
14. Operation of necessary equipment to prevent accumulation of ice or snow on combustion turbine air inlet filter medium.
15. Steam soot-blowing systems (transmitters, regulators, drain valves, and traps).

Inverter-Based Resources

1. Functional wind turbine lube oil equipment within the nacelle, such as radiators, fans, heaters, and bypass valves.
2. Adequacy of tracking systems' lube oil for expected temperature during cold weather.
3. Accessibility of roads throughout the facility.
4. Anemometer functionality.
5. Ensure liquid-cooled inverters have freeze protection measures, such as anti-freeze or heaters, to address expected temperatures for that location.

6. Ensure winterization measures for battery systems are sufficient for expected cold weather conditions.
7. Ensure blade de-icing capabilities are known.
8. Consider snow removal and de-icing plans for facilities.

Potential vulnerabilities associated with emergency generators, including Blackstart Resources, should be evaluated when developing the site specific winter weather preparation procedure(s), as they may provide critical system(s) backup.

V. Testing of Emergency and Backup Systems

In addition to the typical problem areas identified above, emphasis should be placed on cold weather preparation and testing of infrequently used equipment and systems where applicable, such as start-up of emergency generators, operation on secondary fuels, fire pumps, and auxiliary boilers.

VI. Training

Coordinate annual winter training with plant specific awareness and maintenance training. This may include, but is not limited to, the following: response to freeze protection panel alarms, troubleshooting and repair of freeze protection circuitry, identification of plant areas most affected by winter conditions, review of special inspections or rounds implemented during severe weather, fuel switching procedures, knowledge of the ambient temperature for which the freeze protection system is designed, installation of winter-season wind breaks, preparation and staging of portable heaters, and lessons learned from previous experiences or the NERC Lessons Learned program. In addition, training should also include the following:

1. Entities should consider holding a winter readiness meeting on an annual basis to highlight preparations and expectations for severe cold weather.
2. Operations personnel should review cold weather scenarios affecting instrumentation readings, alarms, and other indications on plant control systems.
3. Entities should maintain the correct coding for NERC Generation Availability Data Systems on unit derates or trips as a result of severe winter weather events to promote lessons learned, knowledge retention, and consistency. Examples may include NERC GADS code 9036 "Storms (ice, snow, etc.)" or code 9040 "Other Catastrophe."

VII. Winter Event Communications

Clear and timely communication is essential to an effective program. Key communication points should include the following:

1. Before a severe winter weather event, plant management should communicate with their appropriate senior management and Reliability Entities that the site-specific winter weather preparation procedure, checklists, and readiness reviews have been completed.
2. Before and during a severe winter weather event, entities should communicate with all personnel about changing conditions and potential areas of concern to heighten awareness around safe and reliable operations.
3. Before and during a severe winter weather event, the affected entities will keep the BA up to date on changes to plant availability, capacity, low temperature cut-offs, or other operating limitations. Depending on regional structure and market design, notification to the Reliability Coordinator (RC) and Transmission Operator (TOP) may also be necessary.

4. After a generating plant trip, derate, or failure to start due to severe winter weather, plant management should conduct an analysis, develop lessons learned, and appropriate corrective actions, and incorporate good industry practices as appropriate:
    a) This process should include a feedback loop to enhance current winter weather readiness programs, processes, procedures, checklists and training (continuous improvement).
    b) Sharing of technical information and lessons learned through the NERC Event Analysis Program or some other method is encouraged.

Related Documents and Links

1. FERC-NERC-Regional Entity Staff Report: The February 2021 Cold Weather Outages in Texas and the South Central United States, dated November 2021, Federal Energy Regulatory Commission, North American Electric Reliability Corporation and Regional Entity Staff Report.
2. Report on Outages and Curtailments during the Southwest Cold Weather Event of February 1-5, 2011, dated August 2011, Federal Energy Regulatory Commission and North American Electric Reliability Corporation
3. 2019 FERC and NERC Staff Report: "The South Central United States Cold Weather Bulk Electric System Event of January 17, 2018"
4. Electric Reliability Organization Event Analysis Process, dated January 2020, ERO Event Analysis Process and associated Lessons Learned
5. Previous Cold Weather Reports and Training Materials

Appendix B – Attachment 1 – Elements of Cold Weather Preparation Procedure

This attachment provides some key points to address in each of the winter weather preparation procedure elements, including severe winter weather event preparedness. These are not all-inclusive lists. Individual entities should review their plant design and configuration, identify areas of potential exposure to the elements and ambient temperatures, and tailor their plans to address them accordingly:

1. **Work Management System**
   a) Review the work management system to ensure adequate annual preventative work orders exist for freeze protection and winter weather preparedness.
   b) Ensure all freeze protection and winter weather preparedness preventative work orders are completed prior to the onset of the winter season.
   c) Review work management system for open corrective maintenance items that could affect plant operation and reliability in winter weather and ensure that they are completed prior to the onset of the winter season.
   d) As appropriate to your climate, suspend freeze protection measures and remove freeze protection equipment after the last probable freeze of the winter. This may be a plant specific date established by senior management.
   e) Ensure all engineered modification and construction activities are performed such that the changes maintain winter readiness for the plant. (Newly built plants or engineered modifications can be more susceptible to winter weather.)

2. **Critical instrumentation and equipment protection**
   a) Ensure all critical site-specific problem areas (as noted above in section IV. Evaluation of Potential Problem Areas with Critical Components) have adequate protection to ensure operability during a severe winter weather event and emphasize the points in the plant where equipment freezing would cause a generating plant trip, derate, or failure to start.
   b) Develop a list of critical instruments and transmitters that require maintenance prior to winter and increase surveillance during severe winter weather events.

3. **Insulation, heat trace, and other protection options**
   a) Entities should ensure processes and procedures verify adequate protection and necessary functionality (by primary or alternate means) before and during winter weather and consider the effect of wind chill and precipitation when applying freeze protection. Considerations include, but are not limited to, insulation thickness, quality, and proper installation.
   b) Entities should verify the integrity of the insulation on critical equipment identified in the winter weather preparation procedure. Following any maintenance, insulation should be re-installed to original specifications.

4. **Heat trace capability and electrical continuity/ground faults**
   a) Entities should perform a complete evaluation of all heat trace lines and heat trace power supplies (including all breakers, fuses, and associated control systems) to ensure they maintain their accuracy. Label heat tracing and insulation in the field in reference to the

circuit feed panel to reduce troubleshooting and repair times. This inspection may include checking for loose connections, broken wires, corrosion, and other damage to the integrity of electrical insulation that could lead to heat trace malfunctioning. Measure heat trace amperage and voltage, if possible, to determine whether the circuits are producing the design output. If there are areas where heat tracing is not functional, an alternate means of protection should be identified in the winter weather preparation procedure.

b) Evaluation of heat trace and insulation on critical lines should be performed during new installation, during regular maintenance activities, or if damage or inappropriate installation is identified (i.e., wrapped around the valve and not just across the valve body):
    (1) For example, inspect heat tracing before it is covered by insulation to confirm that the extra cable length specified by the designer for the purpose of being concentrated at valves and supports has not been applied as a constant-pitch spiral over the length of the line
    (2) Re-install removed or disturbed heat tracing following any equipment maintenance to restore heat tracing integrity and equipment protection.
    (3) Update and maintain all heat tracing circuit drawings and labeling inside cabinets.
    (4) Require a report of calculations from the heat tracing contractor and ensure that their design basis is consistent with the insulation that will be applied with regards to exposure of valve bonnets, actuator, and pipe supports.

5. Wind breaks

a) Install permanent or temporary wind barriers as deemed appropriate to protect critical instrument cabinets, heat tracing and sensing lines.
    (1) Heaters and heat lamps
b) Ensure operation of all permanently mounted and portable heaters.
c) Evaluate plant electrical circuits to ensure they have enough capacity to handle the additional load. Circuits with ground fault interrupters (GFIs) should be continuously monitored to make sure they have not tripped due to condensation.
d) Steps should be taken to prevent unauthorized relocation of heating elements.
e) Ensure adequate fuel supply for heaters.

6. Covers, enclosures, and buildings

a) Enclose cold-weather sensitive critical transmitters in enclosures with local heating elements.
b) Install covers on valve actuators to prevent ice accumulation.
c) Inspect building penetrations, windows, doors, fan louvers, and other openings for potential exposure of critical equipment to the elements.

7. Supplemental equipment

a) Prior to the onset of the winter season, entities should inspect inventories of all commodities, equipment, and other supplies that would aid in severe winter weather event preparation or response and ensure that they are readily available to plant staff. Supplemental equipment might include the following:
    (1) Tarps
    (2) Portable heaters, heat lamps, or both
    (3) Scaffolding
    (4) Blankets

(5) Extension cords
(6) Kerosene/propane
(7) Temporary enclosures
(8) Temporary insulation
(9) Plastic rolls
(10) Portable generators
(11) Portable lighting
(12) Instrumentation tubing
(13) Heat guns or handheld welding torches
(14) Ice removal chemicals and equipment
(15) Snow removal equipment
(16) Cold weather personal protective equipment (PPE) available to personnel as appropriate.
(17) Properly winterized service vehicles
(18) Supplies for slip hazard reduction, such as sand, rock salt or calcium chloride

8. Operational supplies

a) Prior to the onset of a severe winter weather event, entities should conduct an inventory of critical supplies needed to keep the plant operational. Appropriate deliveries should be scheduled based on the severity of the event, lead times, etc. Operational supplies might include the following items:
    (1) Aluminum sulfate
    (2) Anhydrous ammonia
    (3) Aqueous ammonia
    (4) Carbon dioxide
    (5) Caustic soda
    (6) Chlorine
    (7) Diesel fuel
    (8) Ferric chloride
    (9) Gasoline (unleaded)
    (10) Hydrazine
    (11) Hydrogen
    (12) Sulfuric acid
    (13) Calibration gases
    (14) Lubricating oils (lighter grades or synthetic)
    (15) Welding supplies
    (16) Limestone

9. Staffing (as necessary)

a) Enhanced staffing during severe winter weather events.
b) Arrangements for lodging and meals.
c) Arrangements for transportation.
d) Arrangements for support and appropriate staffing from responsible entity for plant switchyard to ensure minimal line outages.
e) Arrangements for storage of in-house food inventories for extended work shifts.
f) Arrangements for on-site lodging during severe winter weather events.

10. Communications

a) Identify appropriate communication protocols to follow during a severe winter weather event.
b) Identify and verify operations of a back-up communication option in case the interpersonal communications capability is not available (i.e. satellite phone).
c) Include availability of interpersonal communication capability and available back-up communication options in job safety briefing for severe winter weather events.

11. Special operations instruction

a) Should be just prior to or during a severe winter weather event as appropriate.
b) Utilize the "buddy system" during severe winter weather events to promote personnel safety.
c) Utilize cold weather checklists to verify critical equipment is protected (e.g., pumps running, heaters operating, igniters tested, barriers in place, temperature gauges checked, etc.
d) Monitor room temperatures, as required, so that instrumentation and equipment in enclosed spaces (e.g. pump rooms) do not freeze.
e) Evaluate freeze protection needs for standby systems idled during current operations (out of service filters, heat exchangers, stagnant piping, etc.)
f) Prior to cold weather, test dual fuel capability where applicable. Identify alternate suppliers of fuel as necessary.
g) Ensure that alternate fuel suppliers are capable of delivering required quantities of fuel during adverse winter conditions.
h) Discuss with the Balancing Authority the possibility for the unit to be called upon (If likely, initiate pre-warming and/or early start-up, of scheduled units prior to a forecasted severe winter weather event.)
i) Run emergency generators immediately prior to severe winter weather events to help ensure availability.
j) Review fuel quality and quantity.
k) Place critical equipment in services, such as intake screen wash systems, cooling towers, auxiliary boilers, and fuel handling equipment, where freezing weather could adversely impact operations or forced outage recovery.

Independent Electricity System Operator
1600-120 Adelaide Street West
Toronto, Ontario M5H 1T1

Phone: 905.403.6900
Toll-free: 1.888.448.7777
E-mail: customer.relations@ieso.ca

ieso.ca

@IESO_Tweets
linkedin.com/company/IESO

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