Cold Weather Preparedness Workshop

Wednesday, October 12, 2022 | 8:30 a.m. to 12:00 p.m. Central

Via WebEx

MIDWEST RELIABILITY ORGANIZATION

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Saint Paul, MN 55102

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www.MRO.net

LOGISTICS

WebEx Login:
Event address for attendees:
https://midwestreliability.webex.com/midwestreliability/j.php?RGID=rcfc993ed69cce18d36216231f72fa472

Event number (access code): 2552 383 3529

Audio Conference information: +1-415-655-0002 US Toll Global call-in numbers

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Audio
Participants will be muted upon entry and will not be able to unmute themselves to speak.

Questions
If you have questions for a speaker, please utilize WebEx's chat feature. Please submit all questions to "MRO Host". If we are unable to get all questions asked/answered during the conference, a response will be provided after the workshop either directly to the requestor or through another form of outreach.

Presentations
All presentations from today's workshop are available in this packet. The individual presentations and recordings from today's workshop will be made available in the near future.

Feedback
Your feedback is very important to us. Please utilize the survey link to provide your feedback.

AGENDA

Wednesday, October 12, 2022 | 8:30 a.m. to 12:00 p.m. Central

8:30 a.m. – 8:35 a.m.	**Introduction and Logistics** *C.J. Brown, Director, System Operations, Southwest Power Pool*
8:35 a.m. – 9:15 a.m.	**April 2022 Storm Restoration MDU** *Jacob Zettel, Region Electric Superintendent, Montana-Dakota Utilities Co.*
9:15 a.m. – 10:55 a.m.	**Manitoba Hydro Cold Weather Preparations** *Thomas Whynot, Operations Coordinator, Manitoba Hydro*
10:55 a.m. – 11:05 a.m.	**Break**
11:05 a.m. – 11:45 a.m.	**Project 2021-07 Extreme Cold Weather Operations, Preparedness and Coordination** *Matthew Harward, Manager, Reliability Standards, Southwest Power Pool*
11:45 a.m. – 12:00 p.m.	**Wrap up/Questions/Feedback/Adjourn** *Bryn Wilson, Senior Manager, Grid Operations, Oklahoma Gas & Electric*

SPEAKER BIOGRAPHIES

C.J. Brown

Director, System Operations, Southwest Power Pool

C.J. Brown received his bachelor of science in applied mathematics / economics from the University of Central Arkansas in 2000 and was NERC Reliability Coordinator certified in 2007. He has been with Southwest Power Pool (SPP) since 2006 and is currently the director of system operations at SPP. His responsibilities include oversight of the SPP real time operations for tariff administration, markets, balancing authority and reliability coordination functions in the Eastern and Western interconnections. He has over 20 years of experience in the electric utility industry with roles in generation, power marketing, market monitoring, and system operations.

In addition, C.J. is a member of the MRO RAC.

Jacob Zettel

Region Electric Superintendent, Montana-Dakota Utilities Co.

Mr. Zettel has worked at Montana-Dakota Utilities for 19 years, with 15 years as the Region Electric Superintendent. He provides leadership to the electric department responsible for the construction and maintenance of the electric system in parts of Western North Dakota, Eastern Montana, and Northwest South Dakota. Jacob received his electrical engineering degree from North Dakota State University and is a registered professional engineer in North Dakota.

Matthew Harward

Manager, Reliability Standards, Southwest Power Pool

Matthew Harward has worked in the public utility industry for over 16 years, starting his career in Southwest Power Pool's ("SPP") legal department as a staff attorney, and he currently works as Manager of SPP's Reliability Standards department, which facilitates SPP's coordinated efforts to track development and implementation of the North American Electric Reliability Corporation's ("NERC") Reliability Standards and other documents, and supports SPP's compliance outreach. During his career, his experience includes regulatory and administrative law matters before the Federal Energy Regulatory Commission, open access transmission tariffs and service agreements, wholesale rate recovery for transmission facilities, electricity markets, RTO seams issues, and system planning and operations. Matthew is a member of the drafting team for the current Project 2021-07 Extreme Cold Weather Grid Operations, Preparedness, and Coordination.

Tom Whynot

Operations Coordinator, Manitoba Hydro

Tom Whynot is an Operations Coordinator for Manitoba Hydro's System Control Department. He has been in System Operations for 11 years, and a field technician for 6 years prior with Manitoba Hydro and other contractors. He has participated in cold weather operations at the field and administrative level. Tom is pleased to share some of Manitoba Hydro's cold weather practices.

Bryn Wilson

Senior Manager, Grid Operations, Oklahoma Gas & Electric

Bryn Wilson is the Senior Manager of Grid Operations for Oklahoma Gas and Electric (OG&E). He has over 30 years of experience in the electric power industry, including 13 years in generation and 15 years in transmission operations. Bryn's prior experience includes an 11-year tenure with Texas Utilities/TXU and a 6-year tenure with General Electric. He received his bachelor's degree in Electrical Engineering from the University of Oklahoma. Bryn's current responsibilities at OG&E include managing the Transmission and Distribution Operations control centers and the Operations Support Engineering groups. He currently serves on the Southwest Power Pool (SPP) Operations Reliability Working Group (ORWG), the SPP Improved Resource Availability Task Force (IRATF), and the MRO Reliability Advisory Council (RAC). He also served as Vice Chair of the SPP Balancing Authority Operating Committee. Bryn is a registered Professional Engineer in the state of Texas.

MRO DISCLAIMER

Midwest Reliability Organization (MRO) is committed to providing outreach, training, and non-binding guidance to industry stakeholders on important industry topics. Subject Matter Experts (SMEs) from MRO's organizational groups and the industry may develop materials, including presentations, provided as a part of the event. The views expressed in the event materials are those of the SMEs and do not necessarily express the opinions and views of MRO.

PRESENTATIONS

All presentations for today's workshop are included in order of presentation.

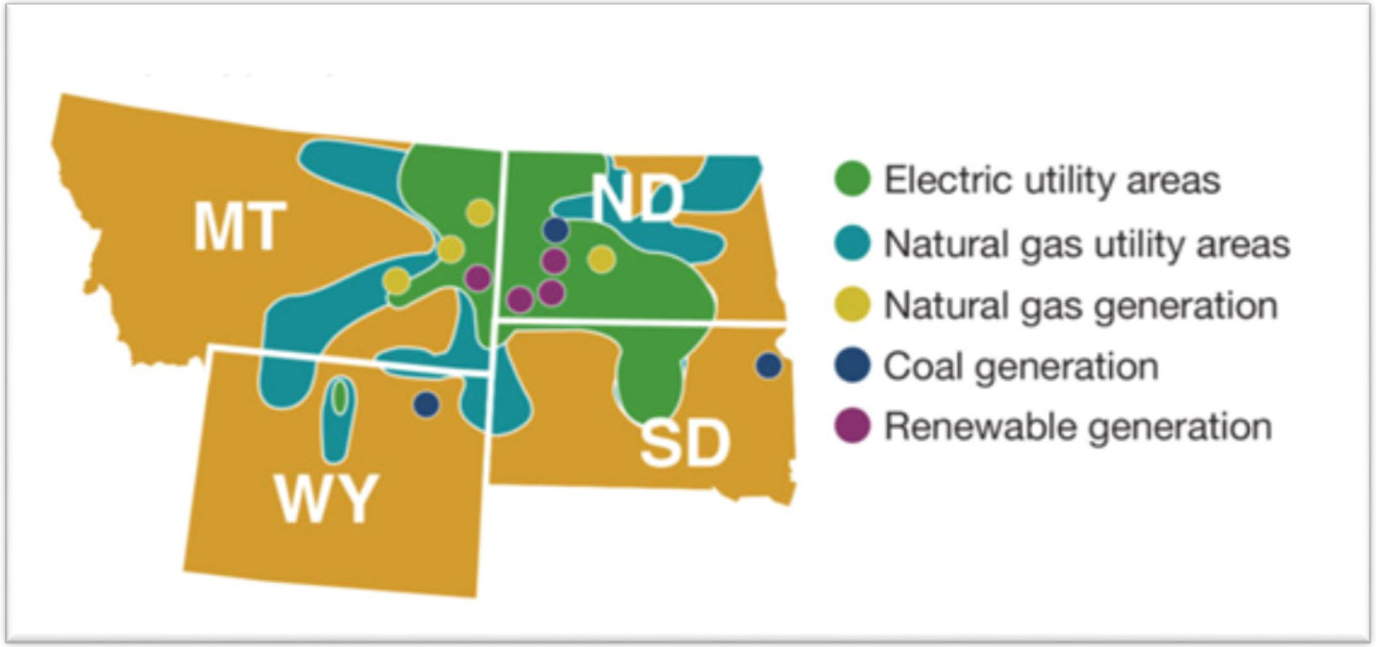
April 2022 North Dakota Storm Restoration

Jacob Zettel

Region Electric Superintendent

MONTANA-DAKOTA UTILITIES CO.

MONTANA-DAKOTA UTILITIES CO.



- Founded in 1924
- 168,000 Sq Mile Service Territory
- ND, MT, SD, WY
- 425,000 customers in 271 communities
- 144,000 Electric Customers
- 283,500 Gas Customers

April Storm Forecast – Ice, Wind, Snow

Freezing Rain / Snow / 40mph+ Winds

Starting late Fri (April 22nd) – through Sunday

Friday - Imminent Threat Preparation

- Notify personnel, stock trucks
- Fuel up, ready tire chains
- Start & load tracked Bombardiers
- Ice breaking stick tools
- Weekend locations / Availability

Saturday Afternoon – Outages Start

Blizzard Conditions

Low Visibility / Snow Accumulations

Fortunate to get all personnel home and accounted for on Saturday night

MONTANA-DAKOTA UTILITIES CO.

April 2022 Storm

Sunday Morning Status Update

- 21 Transmission Lines Out of Service
- 18,000 meters out
- Start ground and aerial patrols
  - Storm Over, Clear weather, melting
- Isolate damage sections
- Started Group Daily Briefing Meetings
  - Incident Command

Patrols determine damage magnitude

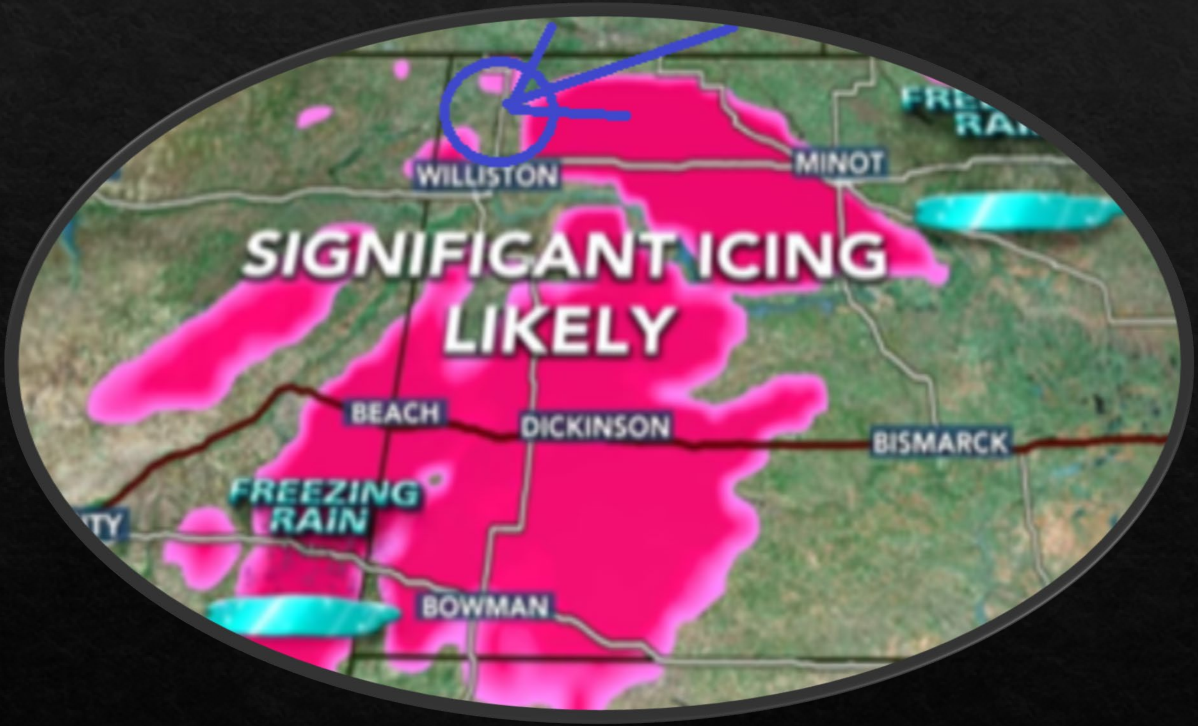
Approximately 370 miles of transmission to patrol

- 115/41.6kV Dickinson – Green River Dbl Circuit
- 115kV Plentywood – Grenora 115kV
- 115 kV Tioga to Stanley 115kV
- 69kV Hettinger to Cedar Butte
- 60kv Glendive – Herigstad
- 60kV Sidney Loop
- 60kV Medora – Beaver Hill
- 60kV Kincaid – Noonan
- 60kV Tioga – Ray

- **60kV Kenmare - Lignite**
- **60kV Williston Loop – all 4 PCBs**
- **60kV Zahl – Crosby**
- **60kV Williston – Zahl**
- **60kV Grenora – Zahl**
- 41.6kV Halliday – Dunn Center
- 41.6kV Thunderhawk to Keldron
- 41.6kV Hettinger to Lemmon

Additional 60+ miles of rural distribution feeders to patrol

Patrols Indicate Heaviest Damage in NW



<u>Approximate Damage Totals</u>

- 150 broken poles
  - Transmission / rural distribution
- 350 Transmission Arms / Timbers

- Heaviest damage in rural, exposed areas (no wind blocks)
- Lines running east/west with heavy damage due to the crosswind out of the North

22 structures down 115/41.6

Guard structure to lift conductor over road.
Downed Line isolated, grounded, left out of Service

Damage on 60kV Lines

Damage

115kV

60kV
Crossarm

Distribution

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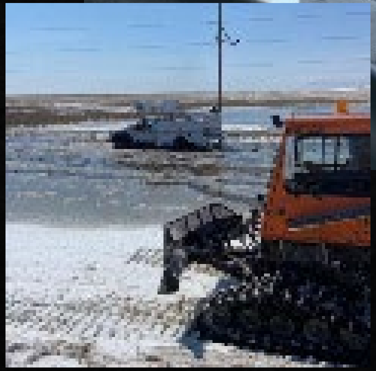
UTILITIES CO.

Quick Need Assessment

- Manpower
- Equipment
- Materials
- Lodging and Meals

Wet, Sloppy, Muddy Conditions

Extra Equipment needed for mobility



- 5 dozers (various size)
- 3 all – terrain tracked digger derricks
  - contractors / mutual aid
- 2 DB-37 tracked backyard digger derricks
- 3 tracked Bombardiers
- Some farm equipment assistance

Manpower

- Request all available MDU crews
  - Bismarck ND
  - Dickinson ND
  - Mobridge SD
  - Sheridan WY
  - Glendive MT
  - Miles City MT
  - Wolf Point MT
- Send Coordinators with Crew

Reach out to contractors under contract with MDU

- 3 contractors mobilized (50)

Mutual Aid Crew (Ottertail)

- Tracked Digger Derrick

Temp Line Tech Students

Unique Opportunity

- School Credit
- Boot and Raingear Reimbursement
- Issued PPE
- Paid hourly

- Frame Distribution Arms
- Debris Clean Up – With Gas Crew Leads

Daily Outage Coordination Updates

Daily meeting with all key groups represented to provide information and assistance

Key Departments and Stakeholders

- Management
- Communications, Customer Service Team, Regulatory Liaison
- Safety
- Purchasing
- Fleet
- Environmental
- Transmission Substation Engineering and Dispatch

Unique Challenges

- Distance of crews from city and shop
  - Pick up food with materials in morning
    - Sandwiches, drinks, hot food available
  - Arrangements for portable bathrooms
  - Material Transport
- Traffic Control
  - Narrow highways
- Sunblock needed (in April)
    - Sunburn was unexpected effect of sun on fresh snow

Materials / Supply Chain Concerns

MDU crews bring material from home warehouse

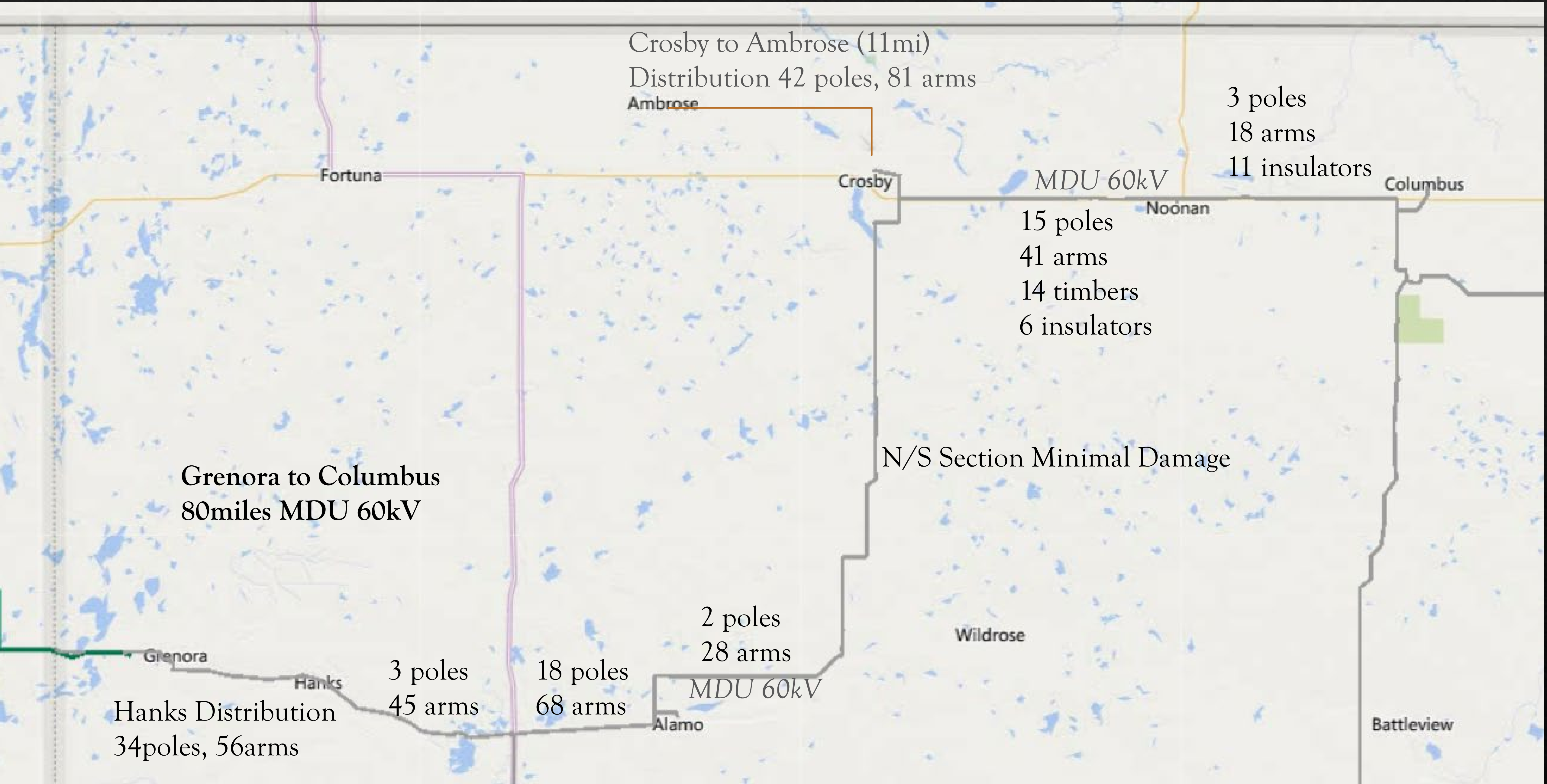
- 60kV post insulators
- Timbers, braces, poles
- Hardware

- Saved some hardware salvaged from wreckage (in case needed)
- Changed some framing to HLP due to post insulator shortages

Leverage Alliance Agreement with Supplier (Border States)

- Place orders for estimated quantities
- BSE find alternates if required
- BSE arrange transport logistics
  - 3rd party dedicated transport

Getting to Crosby

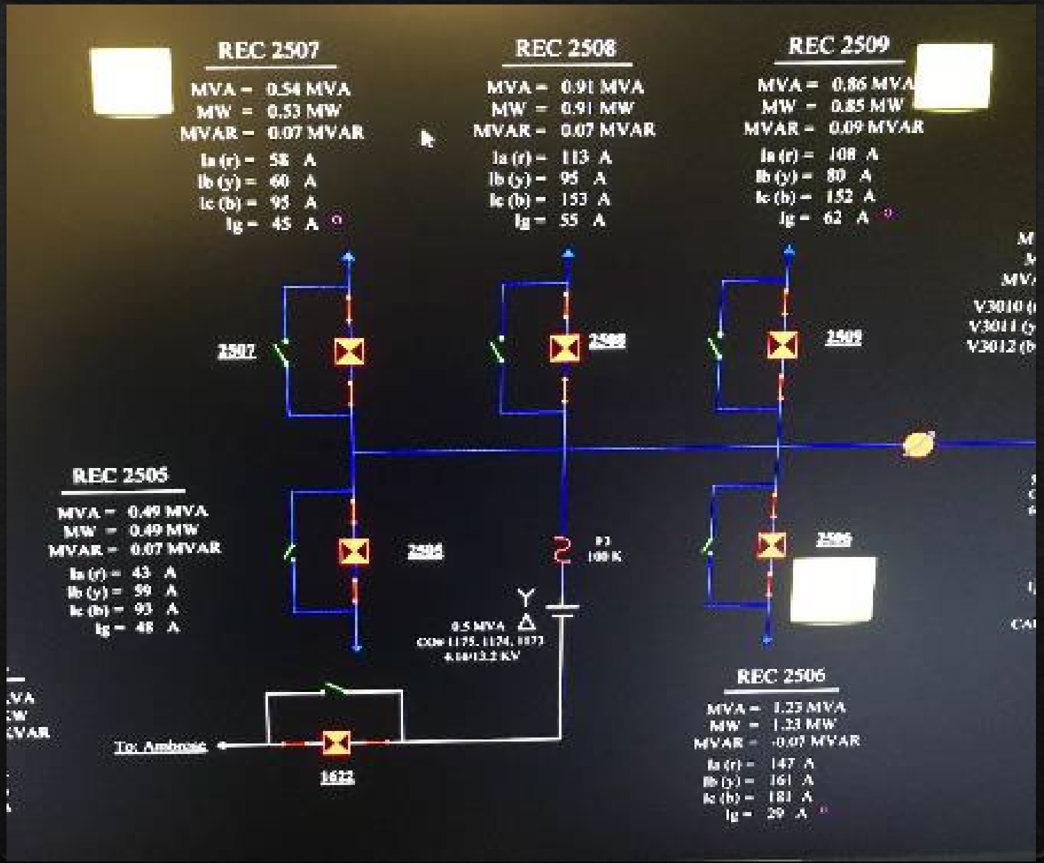


Restoration Timeline

- Sunday, April 24th 6am – 18,000 out, good conditions, prioritize Williston Loop
- Williston Restored at 3pm, by 8pm 1,691 customers remain out (18 towns)
- Monday – 6 towns restored, 1229 out
- Tuesday – 4 towns restored, 961 out
- Wednesday – 1 town (Crosby) restored, 205 out
- Thursday – 1 town restored, 185 out
- Friday – 3 towns restored (transmission service complete), 49 out
- Saturday – 3 towns restored (distribution feeders), 0 out

Restoring Electric Heat – Crosby, ND

- Approximately 750 Meters (pop 1245)
- Out of service 4 days
- Area Temps - Lows 20-30s - Highs 40-50s
- No gas service – high electric heat density
- Single Substation (5MVA)
- Started restoration with 3 circuits (140%), staged the remainder on during next 3 hours.
- Approximately 3-4 times avg load 1-2 hours



Overall Takeaways

Things that went well

- Aerial Patrol to determine damage scale
  - All other items follow
- Daily Update Coordination Meeting
  - Provided updated information to customers
  - All groups involved
- Mutual Aid
  - Unknown when agreement utilized prior

Items to Improve

- Carry more traffic control barriers
  - Traffic control on rural highways
- OMS would be helpful
  - Improvement over current outage display map
  - Keep outage record

Questions?

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MRO Cold Weather Workshop
October 12, 2022

Manitoba Hydro, Cold Weather Preparations

"At least it's a dry cold"

Tom Whynot
Operations Coordinator System Control

Acknowledgements

Allan Silk
Jeff Bloodworth
Kevin Gawne
Shawna Zeilstra
Jarrod Malenchak
Devon Danielson

Manitoba Hydro

Manitoba Hydro Cold Weather Preparations

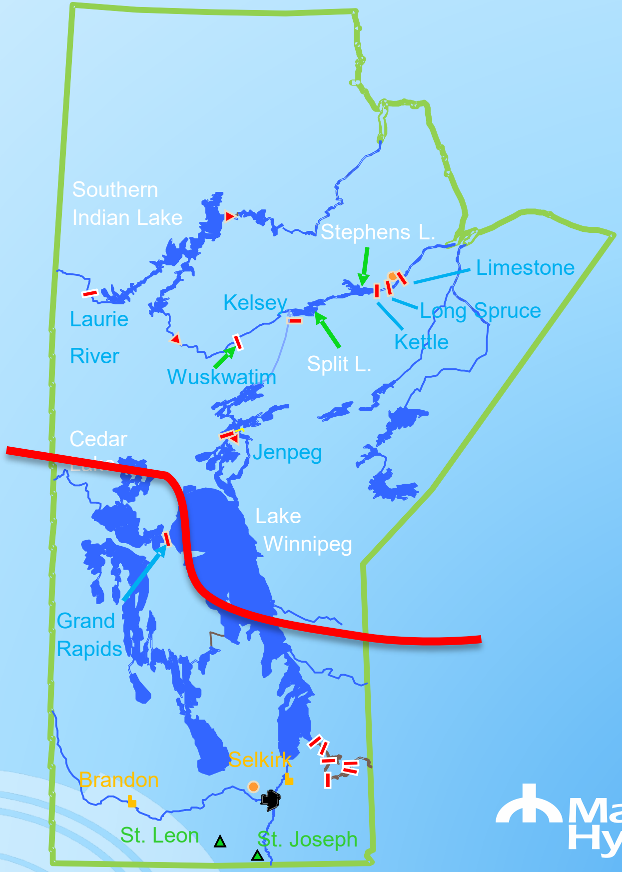
- Manitoba Hydro and its climate
- Frazil Ice
- Icing Lines
- Planning and Operation in Cold Weather

Manitoba Hydro

- Provincially owned energy utility
  - > 95% hydro
  - 16 hydro stations
  - 1 thermal station
  - 6,600 MW capacity
  - Avg. hydro generation 32TWh/yr
  - Manitoba load 26TWh/yr

Manitoba Climate

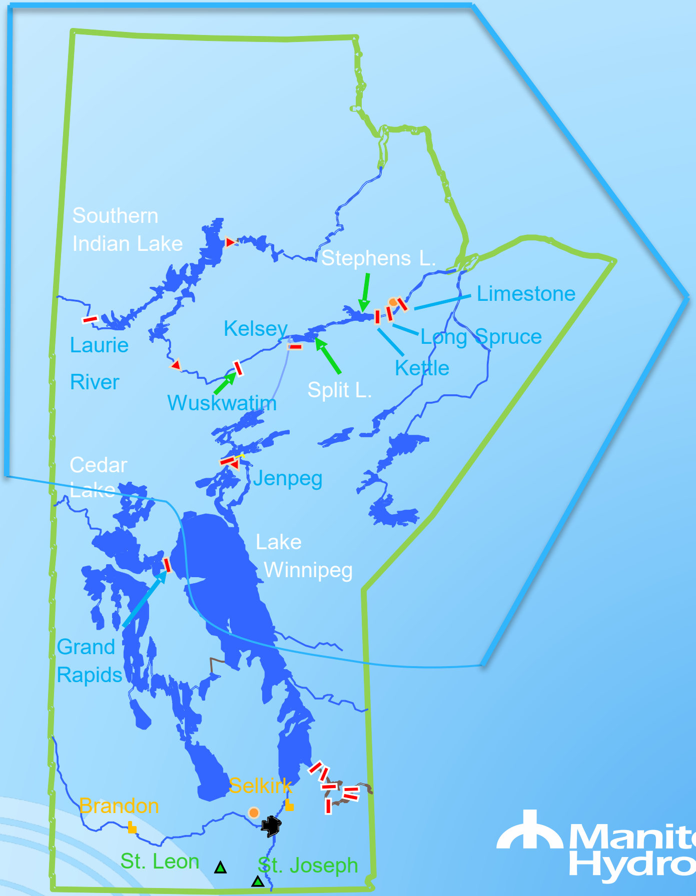
- A cold climate with long winters. The North is classified as Sub-artic, while the South is classified as Warm-humid continental.



Manitoba Climate

Northern Manitoba

- Sub-arctic zone.
- Long and extremely cold winters
- Winter overnight lows of -40°F



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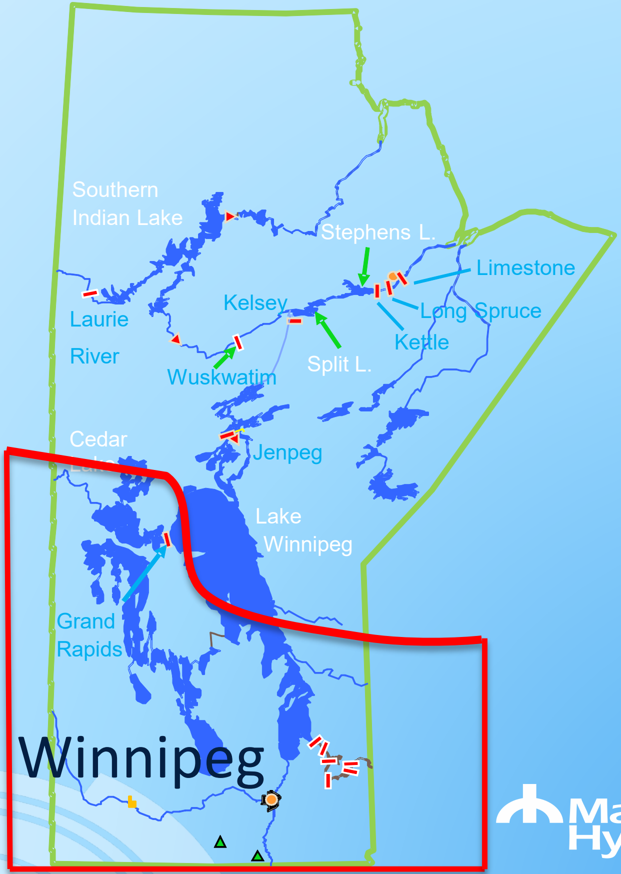
Manitoba Climate

Southern Manitoba

- Prairie: generally flat landscape.
- Predominantly strong NW winds.
- Snow is on the ground 132 days avg a year.



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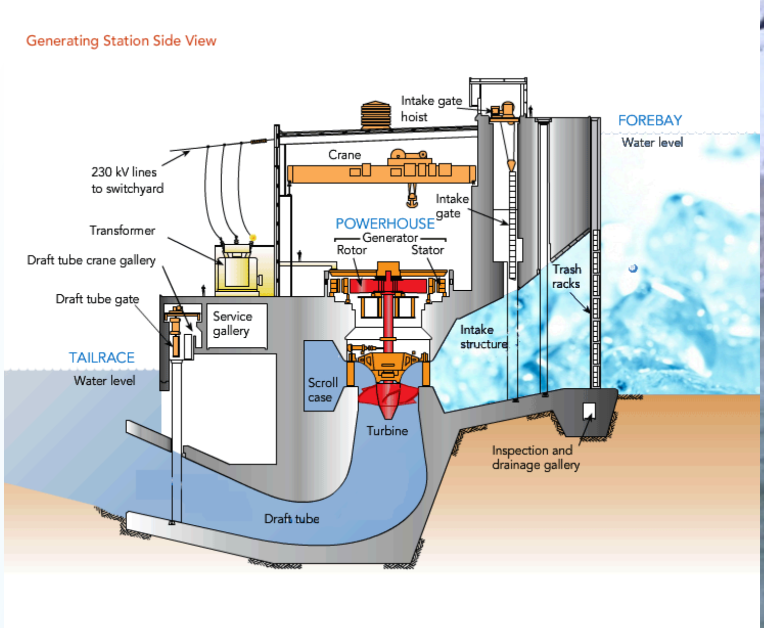
Frazil Ice

Frazil Ice forces Generation out of service.



Normal Ice Formation: Lake, Border Ice

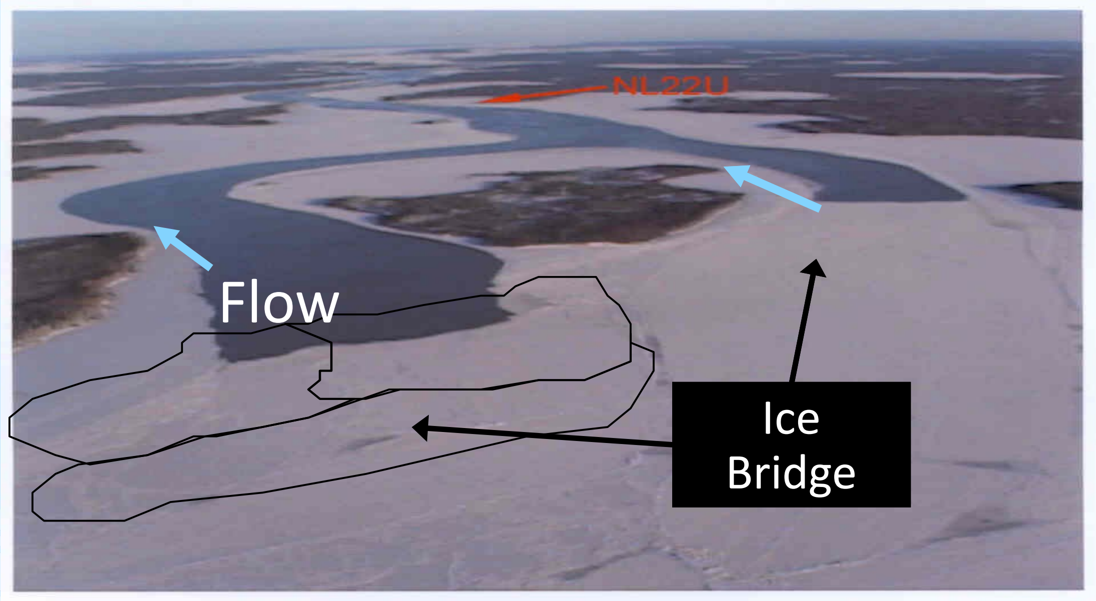
- Late fall (early Nov in Northern Manitoba / late Nov in Southern MB)
- Water temperature cools to 0°C (32°F)
- Lake ice forms
- Border ice along the edge of the river and in relatively quiet back bays where water velocities are less than ~0.4 m/s (1.3 ft/s)

Ice Formation Progression

- Once a bridge is established, an ice cover can advance upstream
- Juxtaposition (lower velocities, smaller river slope)
- Mechanical thickening and shoving (higher velocities, larger river

Normal Ice Formation Bridging/Insulating Ice Cover

- Pans can become interlocked with border ice later in the freeze-up period
- Bridge forms, impeding the flow of ice pans
- Insulates the river section from further ice production



Frazil Ice Primer: Frazil Ice

- Frazil ice forms during the winter in open water, where the water is in a turbulent state. The Turbulence permits the water to become supercooled, as a heat exchange takes place between the air and water.

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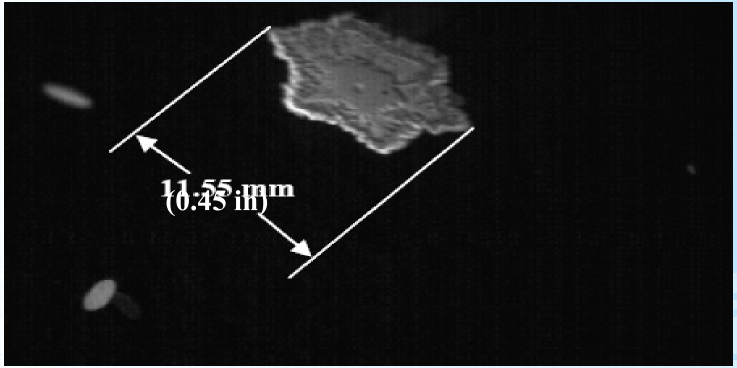
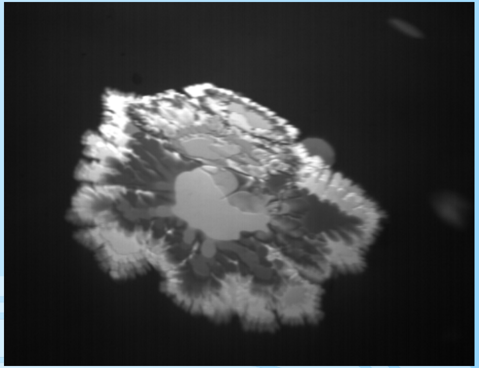
Frazil Ice Recipe:

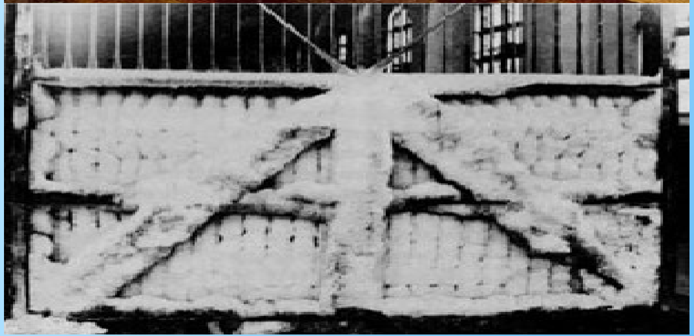
- Turbulent open water areas (> ~0.6 m/s, 2 ft/s)
- Clear, cold nights with wind
- Supercooled water <0°C (<32°F)
- Crystals suspended in the flow, collects as sticky "flocs"
- Adheres to materials, grows quickly



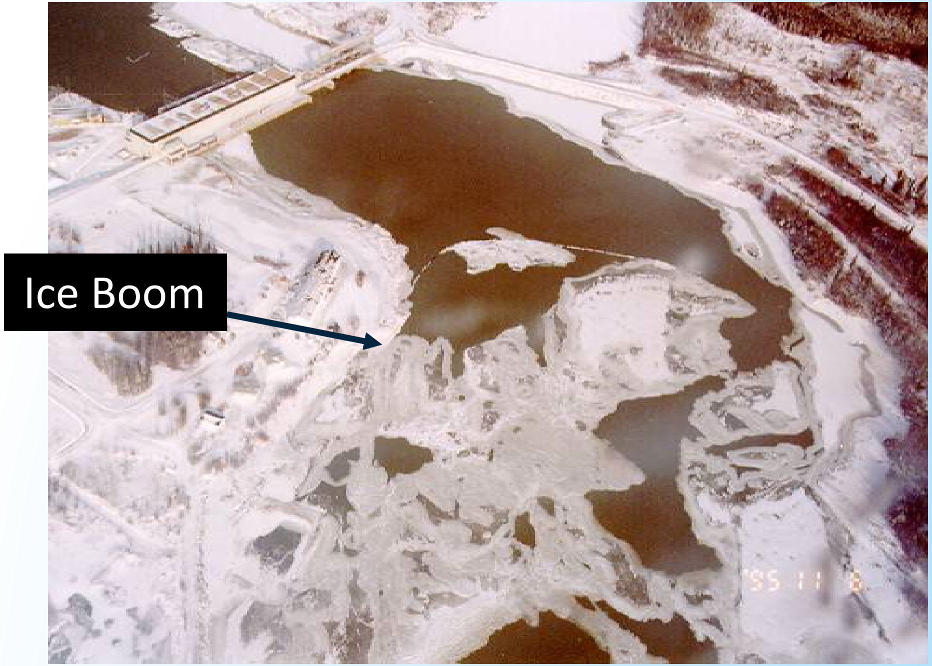


Frazil Ice on Intake Trash Racks

- Vertical mixing of sufficient force will drive the sub millimeter ice crystals below the surface where than can accumulate and build up ice on Generator track racks at the intakes and plugs them quickly.



Solutions: Ice Boom & River Management



Potential Impacts/Risks

- Reduced flow control
  - Surging of reservoir levels
  - Stakeholder/property impacts
- Sudden loss of Generation
  - Cost of reduced generation
  - Station supply for station operation and heating
  - Risk window begins when temps reach -32F, lasting until ice cover is achieved, avg is 2 weeks.

Mitigating Actions

- Coordination meetings between the control center, generating stations, and hydraulic experts will take place daily until ice cover is sufficient.
- Notices to waterway stakeholders
- Communications with upstream water control board
- Back-feeding of supply to station services
- Pre-emptive reservoir drawdown
- Overnight staffing

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Summary

- Coordinate, Communicate, consult the experts
- Monitoring, scheduled reporting
- Proactive measures (vs. reactive)
- Flow management plan established in advance
- Event forecasting/early warning

Icing of Overhead Lines

- Ice Accumulation Conditions
- Ice Melting Process
- Ice Detection
- Challenges

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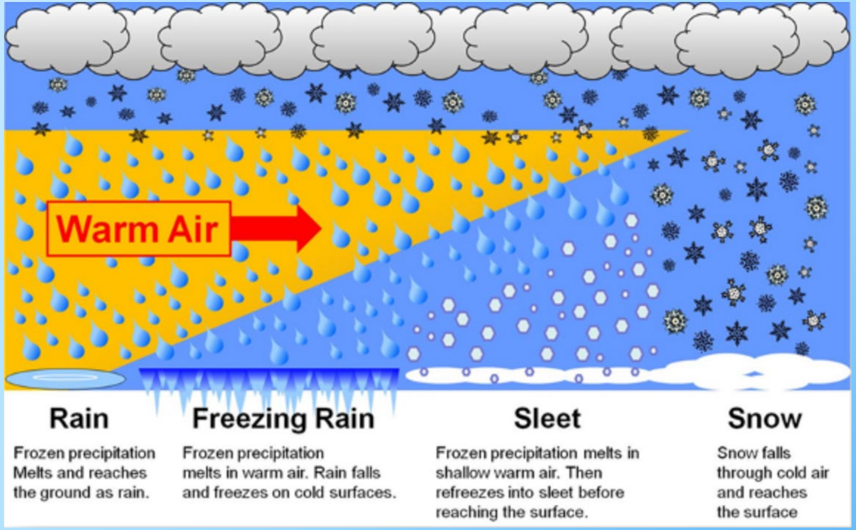
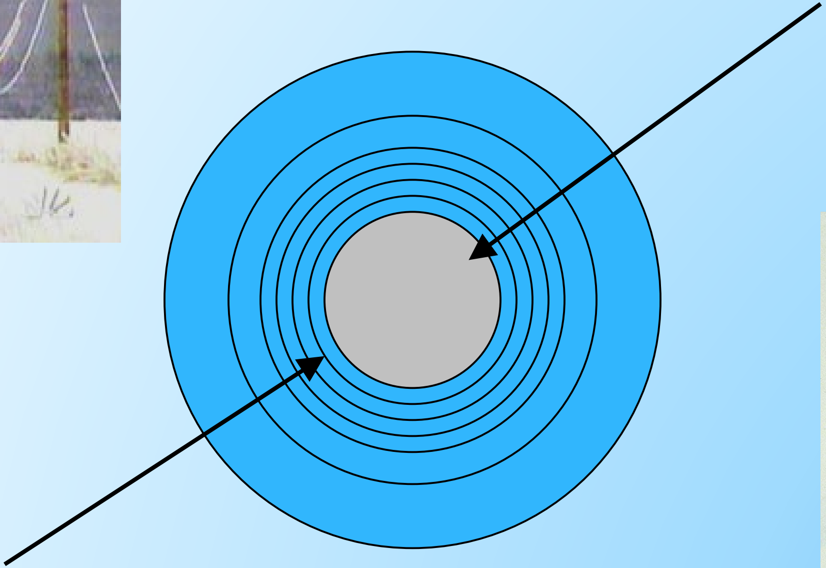
Ice Accumulation Conditions

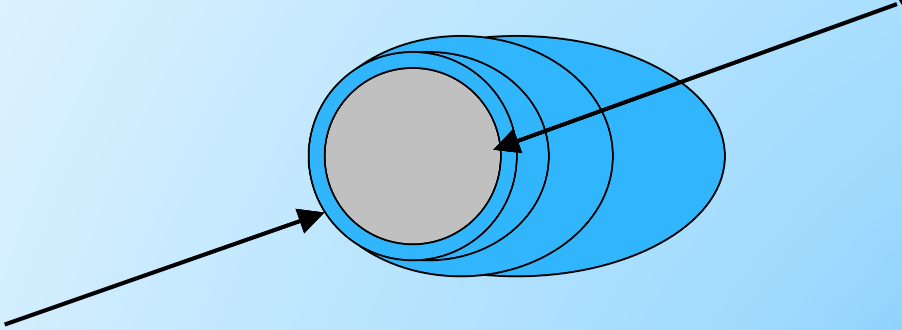
- Usually occurs in the Spring and Fall
- Temperatures are freezing, or near freezing
- As precipitation contacts the lines, it freezes and accumulates
- Wind will compound the problems



Ice Accumulation

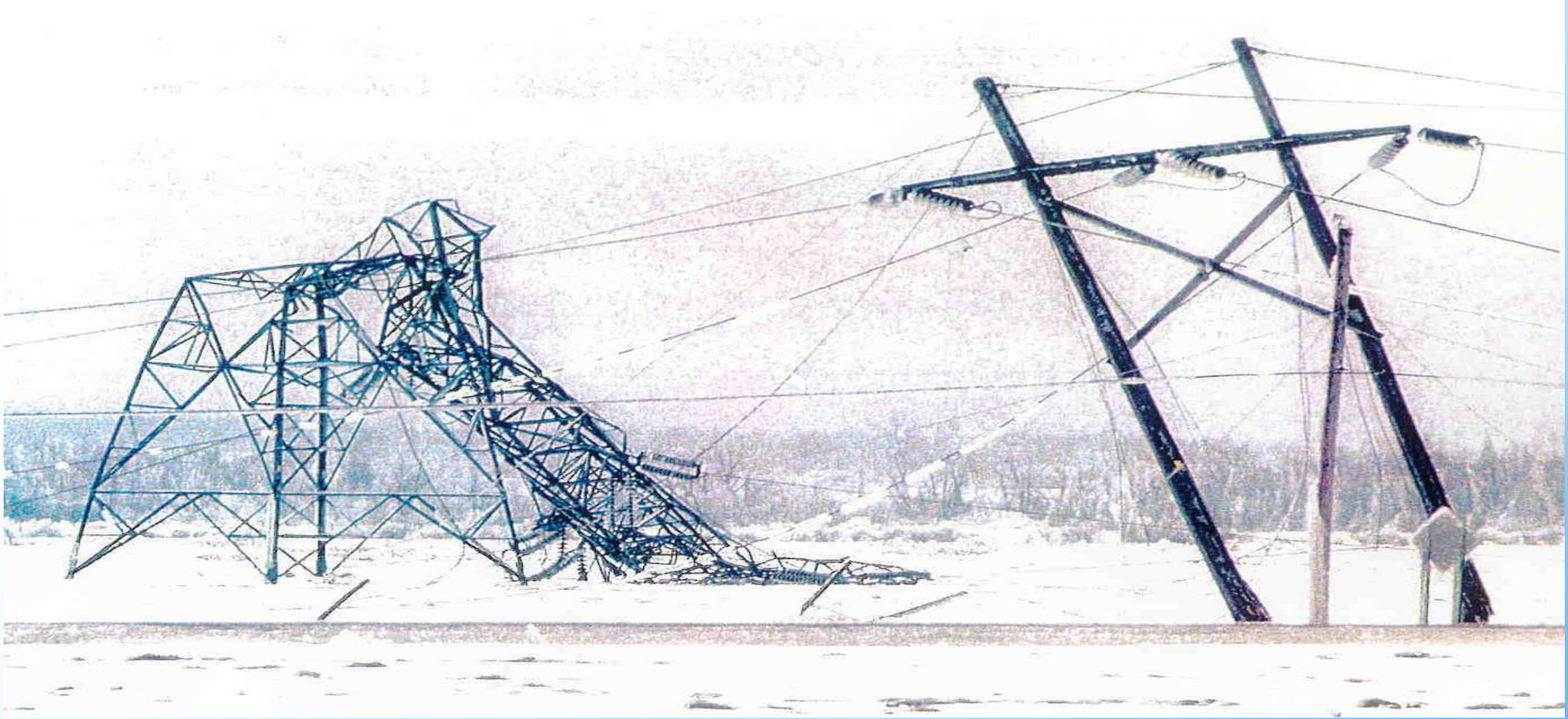


Ice Accumulation With Wind



Ice build-up develops airfoil shape

- Galloping and conductor blowout damage



What Is Ice Melting

- Ice melting is performed by creating a "controlled" short circuit to heat up the lines and melt the ice.
- Application of a source/voltage (at a predetermined level) to a line with an applied three phase short (also calculated), causing the conductors to heat, melting the ice off the line.
- We can vary the melting current by changing the location of the "short" or by varying the voltage we apply to the line to be melted.

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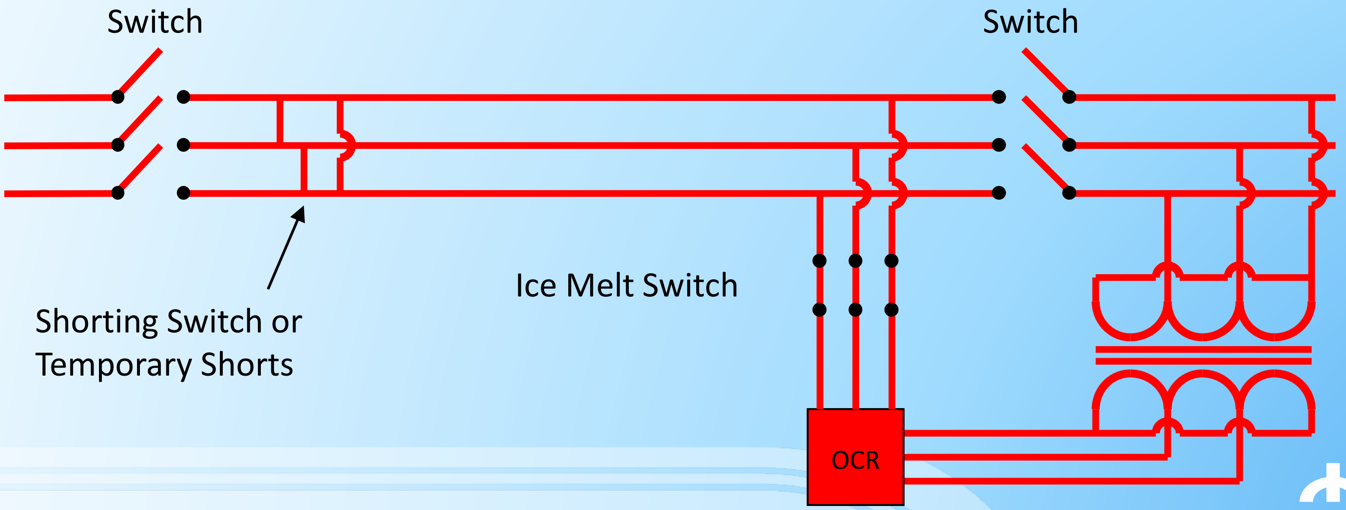
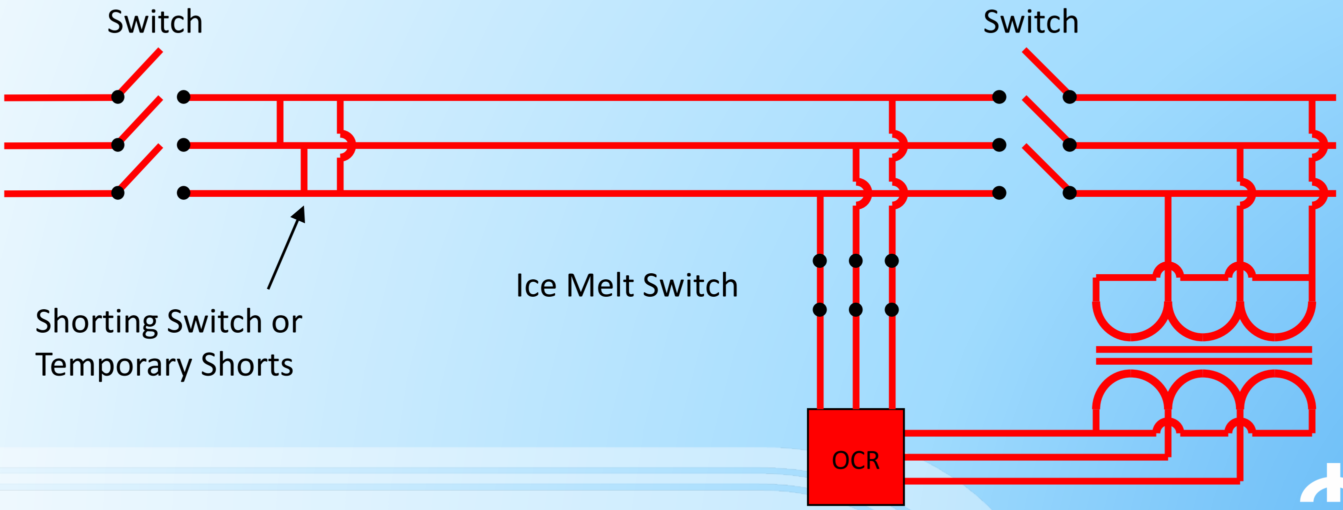
What Is Ice Melting cont'd

- Line acts like a heating element, raising temperature of conductor, causing ice to fall



What Is Ice Melting cont'd

- A successful ice melt produces enough current to melt the ice off the line without burning down the line or damaging any other equipment in the circuit.



Ice Melting Data

2007 - 2008	13 melts
2008 - 2009	74 melts
2009 – 2010	23 melts
2010 – 2011	10 melts
2011 – 2012	1 melt
2012 – 2013	162 melts
2013 – 2014	0 melts
2014 – 2015	208 melts
2015 - 2016	84 melts
2016 – 2017	53 melts
2017 - 2018	32 melts
2018 - 2019	72 melts
2019 – 2020	12 melts
2020 – 2021	10 melts
2021 – 2022	8 melts

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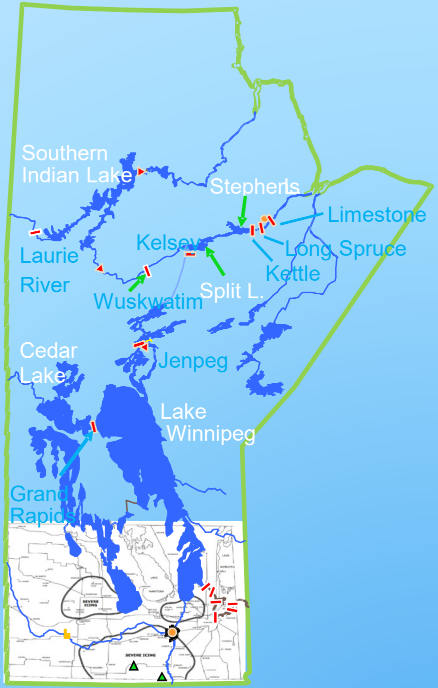
Ice Detection

- Weather Stations
- Camera networks
- Alert systems
- Pattern with historical data



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Challenges with Ice Melting

- First melt(s) may be delayed.
  - Time required to call-out personnel
- Restricted by temperature and wind.
- Restricted by source capacity and voltages.
- Can not melt sky wires and neutrals.
- Circuits must be de-energized for set up.
- Additional training of personnel prior to system events (Ice storms)

Prevention / Mitigation Strategies in Cold Weather

Planning and Operation in Cold Weather

- Planning of critical outages.
- Outage deferral.
- Common operating issues in extreme temperatures.
- System planning for the extreme cold.

Outage Planning

- Minimize the outage durations with equipment out of service when seasonal ambient temperatures are in the -13 °F range.
- If impending storm systems are forecasted, seeking to restore equipment to service as soon as possible for planned or unplanned outages. Defer work that is not necessary.

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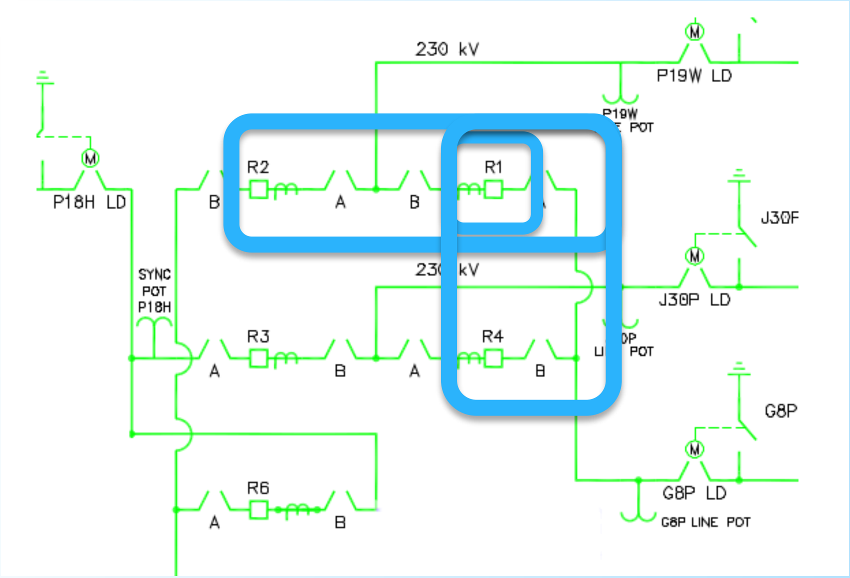
Outage Deferral

- Do not release equipment for discretionary work during periods when temperatures are -22 °F or colder.
- Do not perform unnecessary switching operations during periods when temperatures are -22 °F or colder.
- Restrict releases of equipment when it's -22 °F or colder to emergency work only.

Operating Issues In Extreme Temperatures

- Breaker alarms from low SF6 Gas
- Switchgear becoming stuck in the open or closed position.
- Response from Field Staff delayed due to inclement weather.
- If a Generation or Transmission asset is unavailable, record it as forced. Your operating picture must be kept accurate.

Risk vs Reward.



- R1, Low SF6 alarm. Breaker could fail in a closed state if the pressure continues to drop.
- If you are late taking action, and R1 fails closed. Do you risk operating R2 and R4?

System Planning

- Build new equipment to the extreme temperatures that it is expected to experience. Where required, retrofit equipment to meet the challenges of extreme weather.
- While most transmission assets can remain intact, Generation assets must be switchable to match loading and schedules.
- Minimize vulnerable switchgear operation where possible.
- BPIII's switch gear was built to operate at -58 °F

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Recap

- Frazil Ice conditions for Generation Stations can be predicted and the risk level mitigated.
- Icing of Overhead lines can be prepared for with training and planned infrastructure in ice prone areas.
- Operation of equipment should be minimized in the extreme cold. Weigh the Risk versus the Reward.

MIDWEST RELIABILITY ORGANIZATION

MRO Cold Weather Workshop
October 12, 2022

Questions?

Tom Whynot
Operations Coordinator System Control

Manitoba Hydro

PROJECT 2021-07 EXTREME COLD WEATHER OPERATIONS, PREPAREDNESS, AND COORDINATION

PHASE 1

- Phase 1 includes the following Recommendations from the Joint Inquiry Report:
  - 1d – GO Corrective Action Plan
  - 1e – Revise GO training requirement to require annual training
  - 1f – GO operation to specific ambient temperature and weather conditions (retrofit and new build)
  - 1j – TO, TOP and DP separation of circuits used for manual load shed

- Due to NERC Board by September 30, 2022

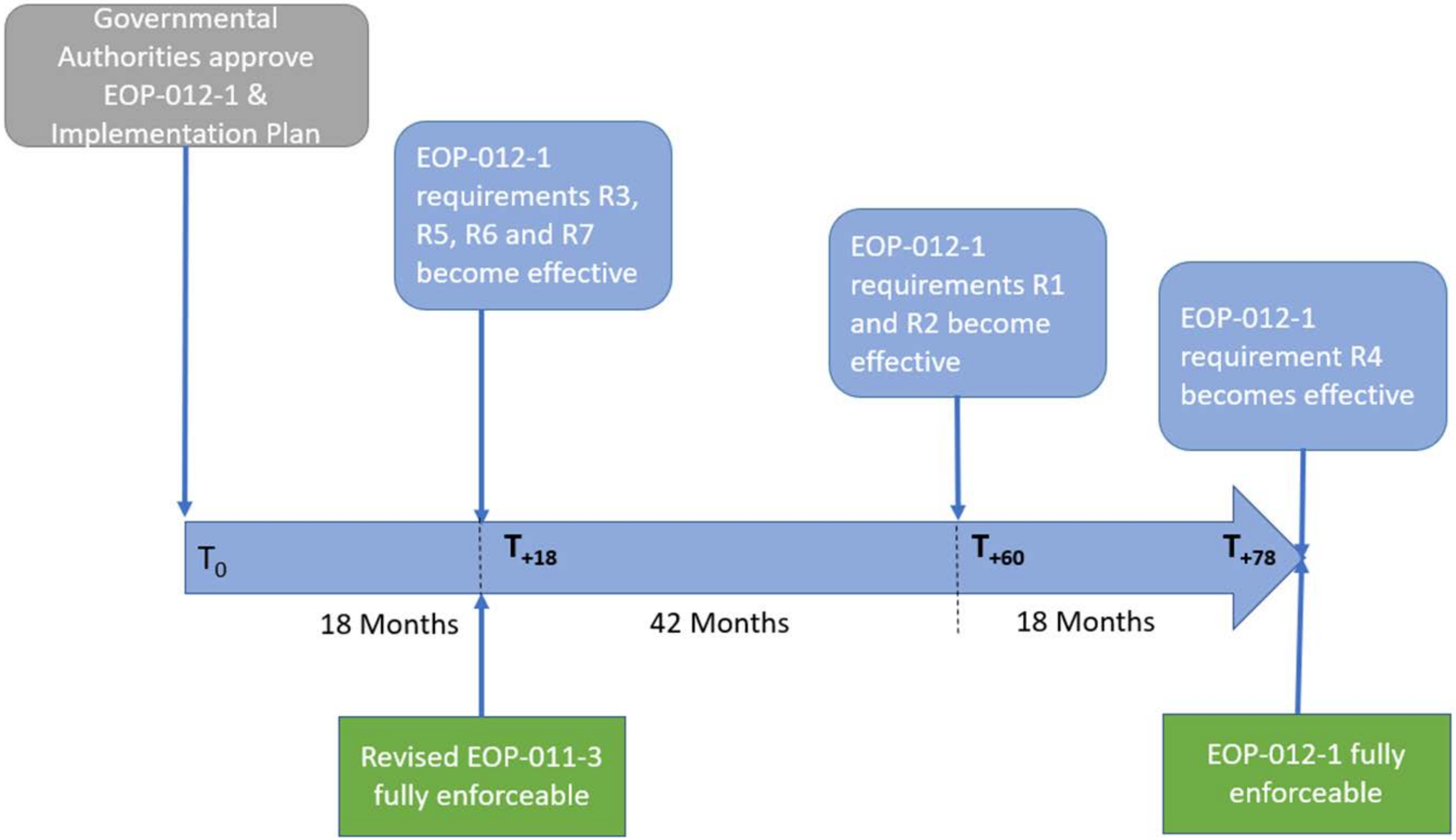
PHASE 2

- Phase 2 includes the following Recommendations from the Joint Inquiry Report:
  - 1a – GO identification of cold-weather-critical components and systems
    - Partly completed in Phase 1
  - 1b – GO identification and implementation of freeze protection measures on each of the elements identified per 1a
  - 1c – GO requirement to account for the effects of precipitation and wind
  - 1g – Revisions to provide greater specificity of the role each GO, GOP, and BA plays in determining generator capacity.
  - 1h – Language in BA operating plans that prohibits critical natural gas infrastructure loads from participating in demand response programs.
  - 1i – Specific requirements applicable to BAs, TOPs, PCs, and TPs around manual and automatic load shedding that protect critical natural gas infrastructure from load shedding.
- Due to NERC Board by September 30, 2023

MAPPING TO REQUIREMENTS

- Recommendations
  - 1d – GO Corrective Action Plan
    - See new EOP-012-1 Requirement 6 and 7
  - 1e – Revise GO training requirement to include annual periodicity completed
    - See new EOP-012-1 Requirement 5
  - 1f – GO operation to specific ambient temperature and weather conditions (retrofit and new build)
    - See new EOP-012-1 Requirements 1, 2 & 7
  - 1j – TO, TOP and DP separation of circuits used for manual load shed
    - See revised EOP-011-3 sections 1.2.5 and 2.2.8

IMPLEMENTATION PLAN



EOP-011-3

- EOP-011 Requirement R1 Part 1.2.5 has been expanded to address FERC Key Recommendation 1j:
  - *In minimizing the overlap of manual and automatic load shed, the load shed procedures of Transmission Operators, Transmission Owners (TOs) and Distribution Providers (DPs) should separate the circuits that will be used for manual load shed from circuits used for underfrequency load shed (UFLS)/undervoltage load shed (UVLS) or serving critical load. UFLS/UVLS circuits should only be used for manual load shed as a last resort and should start with the final stage (lowest frequency).*

- This Standard modification adds additional criteria TOPs should consider when developing their load shed procedures

EOP-011-3 R1

- EOP-011-2 Requirement R1 Part 1.2.5 required TOPs to:
  - Have an Operating Plan that included processes to prepare for and mitigate Emergencies including provisions for operator-controlled manual Load shedding that minimizes the overlap with automatic Load shedding and are capable of being implemented in a timeframe adequate for mitigating the Emergency
- EOP-011-3 proposed to expand upon these ‘provisions’
  - Provisions to minimize the overlap of circuits that are designated for manual Load shed and circuits that serve designated critical loads;
  - Provisions to minimize the overlap of circuits that are designated for manual Load shed and circuits that are utilized for underfrequency load shed (UFLS) or undervoltage load shed (UVLS); and
  - Provisions for limiting the utilization of UFLS or UVLS circuits for manual Load shed to situations where warranted by system conditions

EOP-011-3 R1

- The SDT elected to keep the phase “minimize the overlap” because it is not always practical or warranted to completely separate circuits used for each of these purposes
- This requirement can be accomplished in many different ways
  - Creating separate and distinct lists for each circuit type
  - Using prioritization and control-inhibit functions in an EMS
  - Varying the critical load priority
  - Each system is unique and will have various constraints that must be balanced

EOP-011-3 R2

- EOP-011-2 Requirement R2 Part 2.2.8 required BAs to:
  - Have an Operating Plan that included provisions for operator-controlled manual Load shedding w/ its BA area
- EOP-011-3 Requirement R2 Part 2.2.8 clarifies that the BA would create the specifications for the provisions and the TOP would implement them, since the BA would not have the capability to implement
  - Provisions for Transmission Operators to implement operator-controlled manual Load shed in accordance with Requirements R1 Part 1.2.5

NEW DEFINED TERMS

- Generator Cold Weather Critical Component
  - *Any generating unit component or associated fixed fuel supply component, that is under the Generator Owner's control and is susceptible to freezing issues, the occurrence of which would likely lead to a Generator Cold Weather Reliability Event.*
  - Partially addresses Phase 2 Recommendation (1a – GO identification of cold-weather-critical components and systems)
  - Ensures that there is clarity in the standards that freeze protection measures only apply to a subset of components that may be susceptible to freezing and are critical to the operation of generating units.
  - A fixed fuel supply component is intended to cover non-mobile equipment that supports the reliable delivery of fuel to the generating unit that is controlled by the Generator Owner. It would not include mobile equipment such as trains, bulldozers, or other equipment that are not fixed in one location.

NEW DEFINED TERMS

- Extreme Cold Weather Temperature
  - *The temperature equal to the lowest 0.2 percentile of the hourly temperatures measured in December, January, and February from 1/1/2000 through the date the temperature is calculated.*
  - Matches standard language with typical engineering practice to use a statistical approach to determine the design temperature when implementing generation facility freeze protection measures
  - Using the lowest 0.2 percentile of winter month temperatures since 1/1/2000 to identify a temperature yields a value which has been rarely surpassed but which allows some margin for a Generator Owner to have previously demonstrated successful operation

NEW DEFINED TERMS

- Generator Cold Weather Reliability Event

One of the following events for which the apparent cause(s) is due to freezing of equipment within the Generator Owner's control and the dry bulb temperature at the time of the event was at or above the Extreme Cold Weather Temperature:

(1) a forced derate of more than 10% of the total capacity of the unit and exceeding 20 MWs for longer than four hours in duration;

(2) a start-up failure where the unit fails to synchronize within a specified start-up time; or

(3) a Forced Outage.

GENERATOR COLD WEATHER RELIABILITY EVENT

- Limits event to those that are impactful to grid operation. Either a Forced Outage or a startup failure on a BES Generating Unit or a derate that is significant in scale and duration.

- Limits event to only those that are caused by freezing or equipment under the Generator Owner’s control

- Removes any disincentive for Generator Owner’s to attempt to operate well below the Extreme Cold Weather Temperature for a site by not requiring them to perform CAPs when they have issues at these temperatures

EOP-012-1

- Facilities Section
  - Which Generating Units does this apply to?
    - Generating units that are obligated to serve a Balancing Authority load pursuant to a tariff obligation, state requirement as defined by the relevant electric regulatory authority, or other contractual arrangement, rule, or regulation; or
    - Identified as a Blackstart Resource
  - Which units may operate but are not included in the standard?
    - Units that have a Extreme Cold Weather Temperature exceeding freezing temperatures
    - Units that typical do not continuously run for four hours below 32 degrees Fahrenheit (0 degrees Celsius)
    - Exclusion applies even if said Units above have been called upon to mitigate emergencies at or below 32 degrees Fahrenheit.

EOP-012-1 R1 AND R2

- EOP-012 Requirement R1 and R2 have been written to address FERC Key Recommendation 1f:
  - *To require Generator Owners to retrofit existing generating units, and when building new generating units, to design them, to operate to a specified ambient temperature and weather conditions (e.g., wind, freezing precipitation). The specified ambient temperature and weather conditions should be based on available extreme temperature and weather data for the generating unit's location.*

EOP-012-1 R1

- Applies to new units with COD after implementation date
- Capability to operate of not less than 12 continuous hours at the Extreme Cold Weather Temperature
  - GO documents Extreme Cold Weather Temperature
  - Generating units account for cooling effects of wind 20 mph on any exposed Cold Weather Critical Component
- Rule is specific to freeze protection measures
- GO may declare any technical or operational constraints that preclude the ability to implement appropriate freeze protection measures to hit target capability

EOP-012-1 R2

- Applies to existing units with COD prior to implementation date
- Capability to operate of 1 hour at the Extreme Cold Weather Temperature
- Rule is specific to freeze protection measures
- Generating units not capable of operating for 1 hour at Extreme Cold Weather Temperature shall:
  - GO to develop a Corrective Action Plan (CAP) for identified issues, or
  - GO may declare any technical, commercial, or operational constraints that preclude the ability to implement appropriate freeze protection measures to hit target capability

EOP-012-1 R3

- New for EOP-012-1 R3
  - Cold Weather Preparedness Plans to additionally include:
    - 3.1 Extreme Cold Weather Temperature for generating unit(s), including the calculation date and source of temperature data (new term- **see Slide 11)**
    - 3.2 Documentation identifying Generator Cold Weather Critical Components (new term – **see Slide 10)**
    - 3.3 Documentation of freeze protection measures implemented on Generator Cold Weather Critical Components, including measures that reduce the cooling effects of wind due to heat loss, and, where applicable, the effects of freezing precipitation (e.g., sleet, snow, ice, and freezing rain).

EOP-012-1 R3

- Language that was moved over from EOP-011-2 (Standards Effective April 1, 2023) remains largely unmodified.
  - Each Generator Owner to implement and maintain one or more cold weather preparedness plans for its generating unit(s) subject to the standard which include the following:
    - 3.4 Annual maintenance and inspection of such measures
    - 3.5.1 Generating unit limitations and expected performance in cold weather
      - Capability and availability
      - Fuel supply and inventory concerns
      - Fuel switching capabilities
      - Environmental constraints
    - 3.5.2 Each Generator Owner to develop accurate data to include:
      - The generating unit(s)' minimum design temperature (i.e., faceplate capability) during cold weather or
      - minimum historical operating temperature or
      - engineering analysis to determine current minimum cold weather performance temperature.

EOP-012-1-R4

- 5 year review of temp, plan, freeze protection measures
  - 4.1. Review the documented Extreme Cold Weather Temperature developed pursuant to Part 3.1, and update the cold weather preparedness plan as necessary;
  - 4.2. Review its documented cold weather minimum temperature contained within its cold weather preparedness plan(s) for its generating units, pursuant to Part 3.5.2; and
  - 4.3. Review whether its generating units have the freeze protection measures required to operate at the Extreme Cold Weather Temperature and, if not:
    - GO to develop a Corrective Action Plan (CAP) for identified issues, or
    - GO may declare any technical, commercial, or operational constraints that preclude the ability to implement appropriate freeze protection measures to hit target capability

EOP-012-1 R5

- EOP-012 Requirement R5 has been modified to address FERC Key Recommendation 1e:
  - *To revise EOP-011-2, R8, to require Generator Owners and Generator Operators to conduct annual unit-specific cold weather preparedness plan training.*

EOP-012-1 R6

- EOP-012 Requirement R6 has been written to address FERC Key Recommendation 1d:
  - *To require Generator Owners that experience outages, failures to start, or derates due to freezing to review the generating unit's outage, failure to start, or derate and develop and implement a corrective action plan (CAP) for the identified equipment, and evaluate whether the CAP applies to similar equipment for its other generating units. Based on the evaluation, the Generator Owner will either revise its cold weather preparedness plan to apply the CAP to the similar equipment, or explain in a declaration (a) why no revisions to the cold weather preparedness plan are appropriate, and (b) that no further corrective actions will be taken. The Standards Drafting Team should specify the specific timing for the CAP to be developed and implemented after the outage, derate or failure to start, but the CAP should be developed as quickly as possible, and be completed by no later than the beginning of the next winter season.*

EOP-012-1 R6

Corrective Action Plans shall be developed for:

- A derate of more than 10% of the total capacity of the unit, and exceeding 20 MWs, for longer than four hours in duration, or
- A start-up failure where the unit fails to synchronize within a specified start-up time, or
- A Forced Outage

When the following conditions are met:

- (i) the apparent cause(s) of the event is due to freezing of the Generator Owner's equipment within the Generator Owner's control, and
- (ii) the dry bulb temperature at the site at the time of the event are at or above the Extreme Cold Weather Temperature

EOP-012-1 R6

- The Report identifies that most of the outages and derates in the February 2021 event were due to freezing of instrumentation, transmitters, sensing lines, or wind turbine blades (p 166 in report). As such, the SDT followed the Report recommendation to require a CAP when the apparent cause of the event is freezing.
- The SDT defined a new term, **<u>Generator Cold Weather Reliability Event</u>**, to clearly define the circumstances for which a CAP is required.
- The defined term will make the standard easier to understand and implement by providing clear and reasonable factors to determine whether the impact of an event requires mitigation.

EOP-012-1 R6 CAP TIMELINE

- CAPs shall be developed
  - no later than 150 days subsequent to the event OR
  - by July 1 that follows the event, whichever is earlier

- This timeframe was chosen to allow Generator Owner's to review multiple events holistically following a winter season, and create one CAP for equipment with common failure causes

EOP-012-1 R7

- To better ensure CAPs are executed, this separate requirement was drafted to implement the CAP after being developed in Requirements R2, R4, and R6.
- If implementation is not possible due to any technical, commercial or operational constraints as defined by the GO, a declaration explaining these constraints is sufficient.
- CAPs need to be updated as necessary if actions or timetables change

BALLOT RESULTS

- First Ballot
  - EOP-11-3: passed with 70% industry support
  - EOP-12-1: failed with 20% industry support
- Second Ballot
  - EOP-12-1: passed with 69% industry support
- Final Ballot (closed September 30)
  - EOP-11-3: passed with 83% industry support
  - EOP-12-1: passed with 79% industry support

NEXT STEPS

- BOT approval in October 2022
- FERC filing by November 2022
- Drafting Team to begin work on Phase 2 in October 2022

CONTACT SLIDE

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CLOSING

Thank you all for attending this event!

Your feedback is very important to us. Please provide your feedback using the link: https://www.surveymonkey.com/r/WZ68ZYS or QR Code below: