Cold, Wind, Water & Work Keeping Crews Safe in Extreme Winter Conditions

EASTERN CHAPTER - WEDA FALL 2025 CONFERENCE

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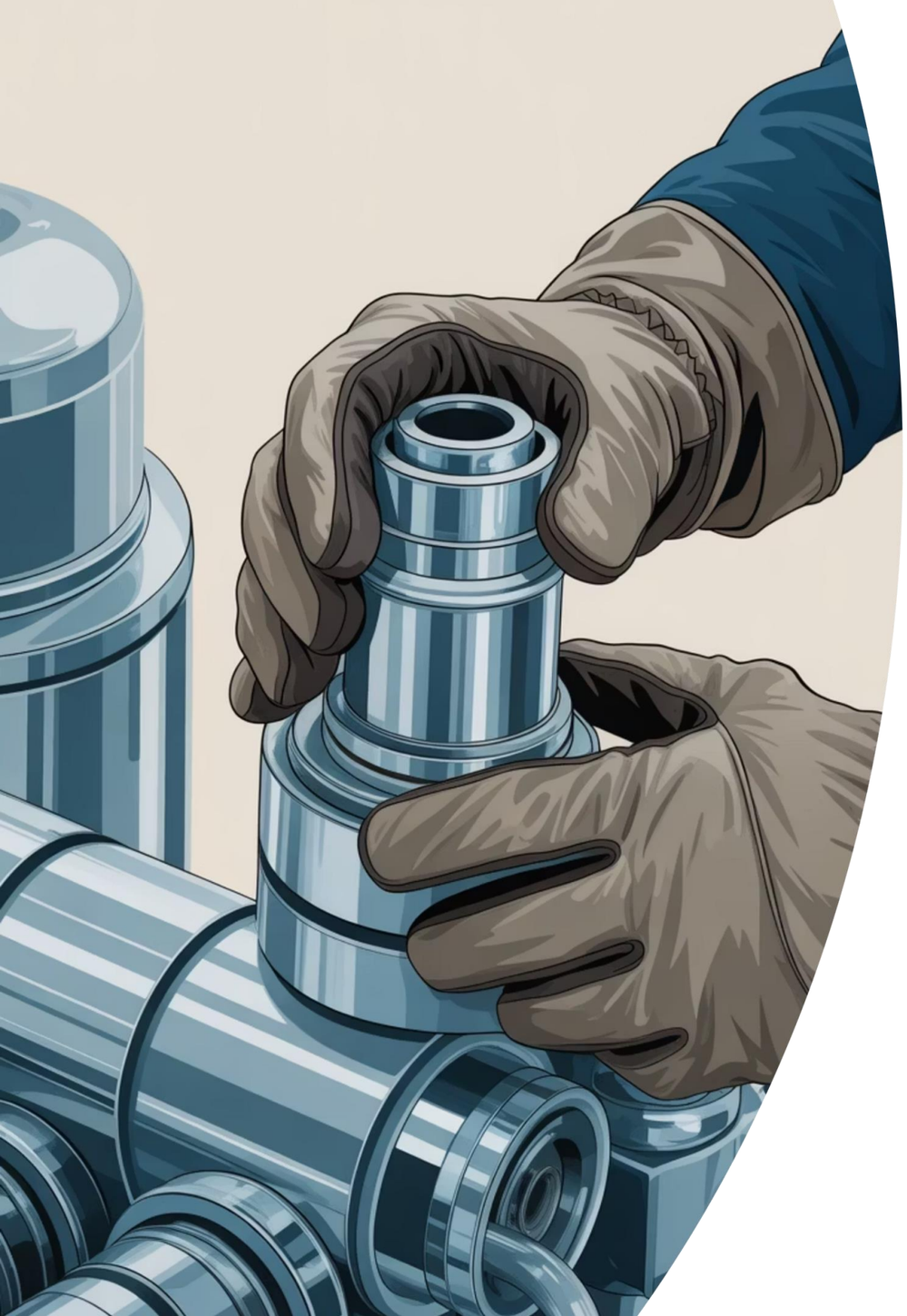


Why This Matters

Impaired Performance

Cold stress rapidly degrades fine motor skills, dexterity, and cognitive function—affecting judgment and reaction time when they matter most.

Marine Multipliers

Marine work creates a perfect storm of exposure factors: cutting wind, cold water spray, heat-stealing metal surfaces, and constant vessel motion.

The Real Danger

Wind chill and wetness—not air temperature alone—determine true cold stress risk. Plan and prepare accordingly.

Injury & Fatality Picture

The National Landscape

According to Bureau of Labor Statistics data, temperature extremes cause dozens of workplace fatalities each year across the United States. Construction consistently ranks among the most affected sectors.

Cold related Days Away From Work (DAFW) cases persist every winter, though many incidents go unreported. This means the true toll is likely much higher than official statistics suggest.

Marine & Dredging: Accelerated Risk

For maritime and dredging operations, cold water immersion and continuous environmental exposure dramatically accelerate the onset and severity of cold stress injuries.

Marine Factor: Cold Water Changes Everything

Swimming Failure

Muscle coordination and strength decline rapidly in cold water, making self-rescue nearly impossible within minutes.

Hypothermia Onset

Core body temperature drops quickly in water below 59°F (15°C). Survival time shrinks from hours to minutes as water temperature decreases.

Cold Shock Response

Occurs within the first 1-3 minutes of cold water immersion, causing a gasping reflex and hyperventilation that can lead to drowning before hypothermia even begins. This is often the most immediate threat to survival.

Prevention strategies and rapid retrieval plans aren't optional—they're critical to survival in cold water environments.

Wind Chill 101: The 'Real Feel'

The National Weather Service Wind Chill Temperature (WCT) index calculates how cold air feels on exposed skin when factoring in wind speed. It's valid for temperatures at or below 50°F with wind speeds of 3 mph or greater.

The Formula

$$WCT(°F) = 35.74 + 0.6215T - 35.75\ V^{0.16} + 0.4275\ T\ V^{0.16}$$

Where T = air temperature (°F) and V = wind speed (mph)

Real-World Example

Air temperature: 0°FWind speed: 15 mph**Wind Chill: ≈ −19°F**

At this wind chill, exposed skin can develop frostbite in approximately 30 minutes.

Critical caveat: Wind chill assumes dry skin. Wet clothing or water immersion increases heat loss far beyond what the wind chill index predicts.

New England's Changing Winter

Heavier Precipitation Events

Climate data shows an increase in the frequency and intensity of heavy precipitation events—storms are delivering more moisture in shorter timeframes.

More Winter Rain

A growing percentage of winter precipitation now falls as rain rather than snow, creating dangerous ice accumulation and freeze-thaw cycles.

Operational Hazards

These changing patterns impact site access, reduce visibility during critical operations, and cause hazardous icing on decks, walkways, and rigging equipment.

How the Risk Shows Up On Our Jobs

Loss of Dexterity

Cold fingers can't tie proper knots or secure rigging correctly. Dropped tools and materials become common—and dangerous.

Equipment Failures

Hydraulic hoses stiffen and crack. Diesel fuel gels. Seals become brittle. Equipment that worked yesterday won't today.

Iced Surfaces

Walking and working surfaces become skating rinks. Slips and falls on decks, gangways, and ladders multiply exponentially.

Visibility Problems

Blowing snow and frozen spray reduce visibility for navigation, crane operations, and coordinating lifts—increasing collision and crushing risks.

Cold-Stress Conditions & Symptoms

Hypothermia

Progressive stages: Begins with uncontrollable shivering as the body tries to generate heat. Advances to confusion, slurred speech, and impaired coordination. Without intervention, leads to loss of consciousness and cardiac arrest.

Core temperature drops below 95°F (35°C)

Frostbite

Warning signs: Affected areas become numb and lose sensation. Skin appears pale, grayish, or waxy white. Tissue feels unusually firm or hard to the touch. Most common on fingers, toes, nose, and ears.

Tissue freezes and ice crystals form in cells

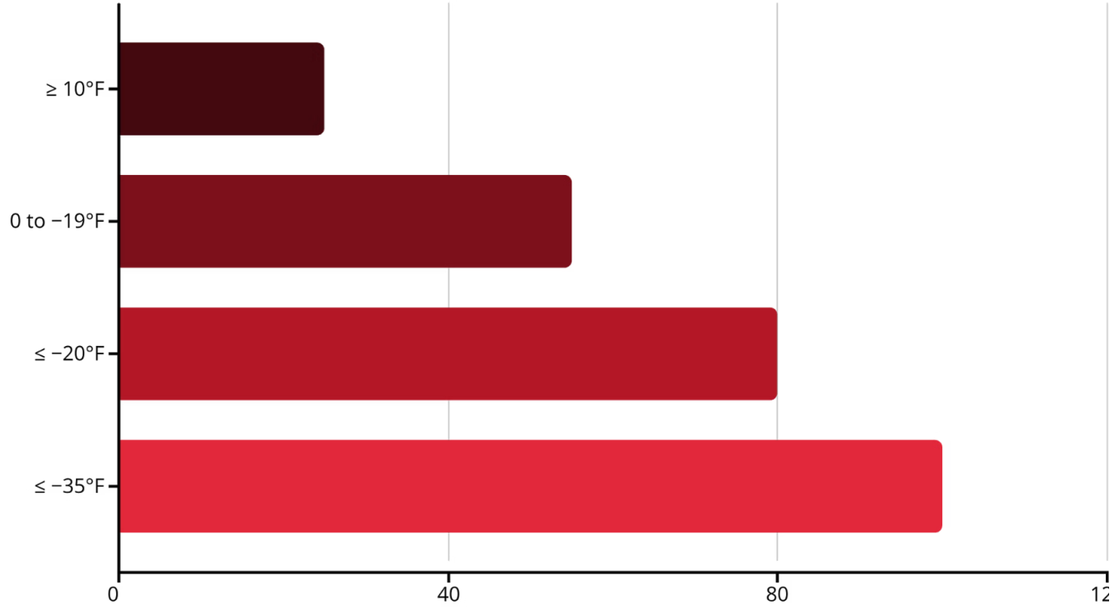
Trench Foot (Immersion Foot)

Surprising risk: Develops from prolonged exposure to wet, cool conditions—even in temperatures up to 60°F. Doesn't require freezing temperatures, just continuous moisture and inadequate circulation.

Hours or days of wet feet can cause permanent damage

Decision Bands by Wind Chill

These example thresholds provide a framework for your site-specific plan. Customize based on your operations, task intensity, and crew experience.



≥ 10°F: Normal Operations

Standard work with properly layered PPE and routine cold-stress checks throughout the shift.

0 to −19°F: Shortened Cycles

Reduce exposure time. Provide warm, dry shelter access every 60–90 minutes. Actively monitor extremities and face for early warning signs.

≤ −20°F: Very Short Cycles

Minimal exposure with frequent rotation to heated areas. Hot beverages available continuously. Seriously consider postponing non-essential tasks.

≤ −35°F: Suspend Work

Halt all operations except emergency response activities. Risk to personnel is too great for routine work.

Engineering Controls on Barges & Sites

Physical Infrastructure

- **Heated shelters:** Permanent or temporary structures on deck with space heaters. Maintain proper clearances and monitor for carbon monoxide.
- **Radiant spot-heaters:** Position near repetitive workstations to keep hands and core warm during extended tasks.
- **Windbreaks:** Strategic barriers around high-traffic or stationary work areas to reduce wind chill exposure.
- **Drying stations:** Dedicated racks and heated areas for rotating through dry gloves, socks, and liners.

Surface Management

Implement systematic de-icing procedures: mechanical scraping and chipping, approved chemical treatments, and traction aids. Mark and maintain defined walking routes.

Winterized Systems

Convert to cold-weather diesel, hydraulic fluids, and lubricants. Use heated hoses for fluid transfer. Insulate vulnerable lines and equipment.

Administrative Controls & Work Practices

Work/Rest Cycling

Structure shifts with exposure time keyed directly to wind chill readings and physical task intensity. Higher exertion requires more frequent warm-up breaks.

Buddy System

Pair crew members to watch each other for early cold-stress symptoms and questionable decisions. Cold impairs self-awareness—buddies catch what you miss.

Daily Tailboards

Brief wind chill forecast, expected spray and icing conditions, deck hazards, emergency rescue procedures, and shelter locations before every shift.

Hydration & Fueling

Provide warm beverages and frequent high-carbohydrate snacks. Cold stress increases caloric needs—underfed workers get cold faster and recover slower.

PPE Foundations: Layering & Ratings

Base Layer: Moisture Management

Synthetic or merino wool wicking materials that pull sweat away from skin. Never cotton—it traps moisture and accelerates heat loss.

Mid Layer: Insulation

Fleece, synthetic insulation, or down that traps warm air while allowing moisture to escape. Thickness depends on activity level and temperature.

Shell Layer: Wind & Water Protection

Wind-resistant and water-repellent outer layer that blocks environmental exposure while remaining breathable.

Task-Specific Outer Layer

High-visibility vest, PFD, or specialized protective outerwear appropriate for the specific job hazards.

Critical fit requirement: Layers must accommodate full range of motion while wearing gloves. Compressed insulation loses its thermal protection value.

Reference international standards like EN 342 (cold protective clothing) and ISO 11079 (IREQ method) to estimate insulation requirements for specific temperature and wind conditions.

Cutting-Edge Cold-Weather PPE

1

Aerogel-Enhanced Insulation

Revolutionary thin insulation materials for gloves, boot liners, and jacket panels. Provides exceptional thermal resistance without the bulk that restricts movement and dexterity.

2

Battery-Heated Apparel

Electric heating elements in jackets, gloves, and insoles powered by rechargeable lithium batteries. Verify safety listings and always carry warm non-powered backup options.

3

Smart Wearable Monitors

Devices that track skin temperature, activity levels, and physiological stress indicators. Provide early warning alerts before symptoms become obvious—but supplement, don't replace, direct supervision.

4

Low-Temp FR Outerwear

Flame-resistant clothing engineered to maintain flexibility and protection in sub-zero conditions. Paired with anti-fog, impact-rated eye protection and aggressive ice traction devices.

Hands: Where Work Fails First

The Critical Challenge

Hands lose heat faster than any other body part and require the most dexterity for complex tasks. When fingers go numb, precision work becomes impossible and dangerous.

Fine Work Strategy

Battery-heated gloves with touchscreen-compatible fingertips for rigging, equipment operation, and detailed tasks requiring tactile feedback.

Transit & Heavy Work

Aerogel liner gloves worn under insulated mittens or heavy outer shells during movement between stations or less precise work.

Rotation System

Keep multiple pairs cycling through a heated drying box. Swap wet gloves for dry ones every 30-60 minutes depending on conditions.

Pro tip: Test different glove options while performing actual work tasks during training. The perfect glove on paper may be unusable in real conditions.

Face & Airway Protection

Facial Coverage

Balaclavas and face covers protect exposed skin from frostbite, especially cheeks, nose, and ears. Choose moisture-wicking materials that won't ice up from breath condensation.

Vision Protection

Anti-fog coating or dual-pane eye protection is absolutely critical for crane operators, watchkeepers, and anyone performing precision visual tasks. Fogged lenses create immediate safety hazards.

Airway Considerations

In extreme cold (below -20°F), protect airways during heavy physical exertion. Breathing deeply through frozen air can cause bronchospasm and respiratory distress.

Immersion & Rescue Planning

Prevention First

Ensure PFDs are worn correctly and secured at all times on deck. Maintain anti-slip walking routes with frequent inspections. Install and use lifelines and safety harnesses for overboard-risk tasks.

Rapid Recovery

Position rescue ladders, throw rings, and retrieval poles at multiple deck locations. Practice deployment regularly so the entire crew can execute rescues in seconds, not minutes.

Post-Retrieval Care

Stage rewarming kits with heat packs ready to apply to armpits, chest, and groin. Activate EMS immediately—even if the victim seems fine. Afterdrop hypothermia can be fatal hours after rescue.

Remember: Cold water immersion can be fatal in minutes. Every second of delay reduces survival probability. Train until rescue response becomes automatic muscle memory.

Build Your Site-Specific Winter Plan

Planning Essentials

Define Trigger Points

Establish specific wind chill thresholds for modified work/rest cycles, mandatory shelter access, and complete work stoppage. Document these in writing.

Inventory Infrastructure

Catalog all heaters, windbreaks, and drying stations. Assign responsibility for pre-season inspection, seasonal maintenance, and daily operational checks.

Task-Specific PPE

Create detailed gear lists for each job type using IREQ thermal insulation logic. Keep adequate backup inventory on site for equipment failures and wet gear rotation.

Emergency Equipment

Assemble rescue and rewarming kits with all necessary components. Ensure entire crew receives hands-on training and conducts seasonal drills.

Technology QA

Test all battery-heated PPE before the season. Maintain charged spare batteries. Always have non-powered backup gear in case of battery or electronic failure.

Climate-Ready Scheduling for New England

1 Build in Weather Float

Schedule extra buffer days for heavy precipitation events, icing delays, and coastal storm windows that will disrupt operations.

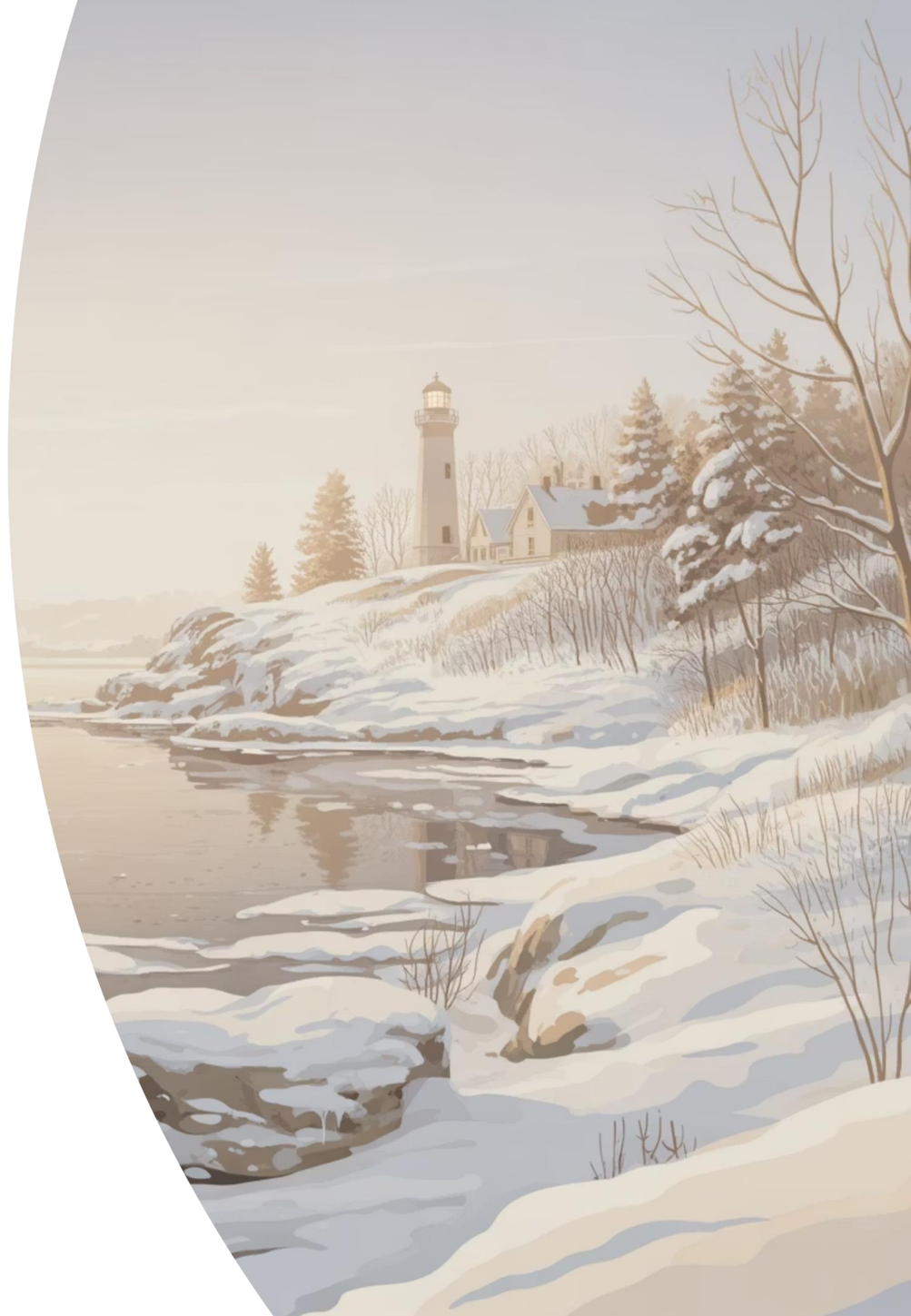
2 Shoulder Season Hazards

Anticipate dangerous rain-on-snow events and repeated freeze-thaw cycles during late fall and early spring transitions. These can be worse than mid-winter conditions.

3 Logistics Coordination

Work proactively with owners, harbor masters, and port authorities to arrange storm berthing, alternative access routes, and contingency logistics before events occur.

Climate projections indicate increasing weather variability. Build flexibility into project schedules and maintain open communication channels with all stakeholders about weather-driven delays.



Quick Training Moments for Crews

Reading the Wind Chill Chart

Post the National Weather Service wind chill chart in break areas and on deck. Train everyone to read current conditions and understand what the numbers mean for their safety and work practices.

Wet vs. Dry Equipment

Emphasize that wet gloves and socks are useless—or worse, dangerous. Show crew members where spare dry gear is stored and how to access heated drying stations throughout the shift.

Deck De-Icing Procedures

Walk through the daily ice removal plan. Mark and maintain defined walking routes. Demonstrate proper use of ice traction devices and when they're mandatory.

Short, frequent refreshers are more effective than annual marathon training sessions. Take five minutes each week during winter months to reinforce one key concept.

References & Further Reading

Regulatory & Safety Resources

- **OSHA Cold Stress Guide:** Comprehensive employer recommendations and worker protection standards
- **National Weather Service:** Official wind chill charts, frostbite time estimates, and winter weather forecasts
- **Bureau of Labor Statistics (BLS):** Injuries, Illnesses, and Fatalities database—temperature extremes category
- **U.S. Coast Guard:** Cold water immersion training materials and maritime safety guidance

Climate & Technical Standards

- **NOAA/NCA5:** Fifth National Climate Assessment and Regional Climate Assessments for the Northeast
- **EN 342:** European standard for cold protective clothing specifications
- **ISO 11079:** IREQ (Required Insulation) method for cold-environment clothing assessment

These resources provide the scientific foundation and regulatory framework for developing and maintaining effective cold-weather safety programs.

Appendix: Wind Chill Quick Reference

Print-Friendly Decision Guide

≥ 10°F	**Normal work** with layered PPE and routine checks
0 to −19°F	**Short cycles;** warm, dry shelter every 60–90 min; monitor digits/face
≤ −20°F	**Very short cycles;** hot beverages; consider postponement for nonessential tasks
≤ −35°F	**Suspend work** except emergency response

Wind Chill Temperature Formula (°F)

$$WCT = 35.74 + 0.6215T - 35.75\ V^{0.16} + 0.4275\ T\ V^{0.16}$$

Where T = air temperature (°F) and V = wind speed (mph)

Example Calculation

Air temperature: 0°F + Wind speed: 15 mph → **Wind Chill ≈ −19°F**

Customize these thresholds for your specific operations, crew experience, and task intensity. Post this reference where it's visible daily.

Thank you!

Questions?

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