

# **DNV-OS-A201: "Winterization for Cold Climate Operations (Tentative)"**

**Gaute Fossheim, Selbusjøen 2014-05-20**

- New Offshore Standard, October 2013
  - Ch.1, Sec.1:
    - *1.1.1 This standard provides general principles for preparation of mobile units and offshore installations for intended operations in cold-climate conditions.*
    - *1.1.2 The standard has been developed for general world-wide application. Governmental legislation in excess of the provisions of this standard may apply depending on type, location and intended service of the unit or installation.*

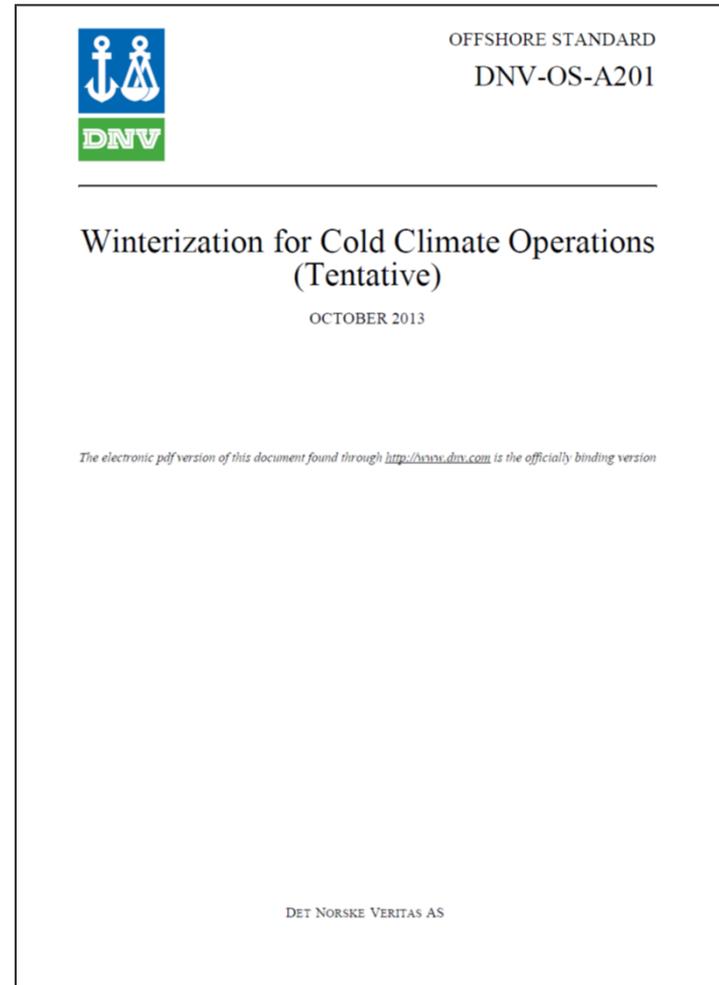
## Winterization: DNV-OS-A201

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- DNV *Tentative* OS-A201 publication end October 2013
  - Ref. DNV OSS-101, Ch. 1, Sec. 1, 2.2.73:
  - *"Tentative rules and standards: Apply to new fields to which DNV reserves the right to make adjustments during a period in order to obtain the purpose intended."*

# Winterization: DNV-OS-A201, Content:

- Ch. 1: Introduction
- Ch. 2: Technical provisions
  - Sec. 1: General requirements
    - Winterization philosophy & design basis document
    - Anti-icing, anti-freezing and de-icing measures
  - Sec. 2: Specific requirements
    - To all vessel types
    - To specific hull types
    - To specific service types
- Ch. 3: Certification & classification



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- Same general intent & style as the *Tentative Ship's Winterization Rules* issued July 2013 (Ships Rules Pt.5, Ch.1, Sec.6):
  - Ship Rules context:
    - regular cargo vessel in transit
    - no deck activity at sea (fishing, seismic, OSV activities not addressed)
  - Offshore context:
    - continuous offshore industrial operations on exposed decks
    - design temperature definitions (extreme low/lowest MDAT)
    - offshore regulatory regime
    - it is an important issue for the offshore industry (hazards, downtime, crew wellbeing)

- No deterioration in overall Safety Level due to “Cold-Climate Conditions”
  - Ch. 1, Sec. 1, Definitions: “Cold-Climate Conditions: A generic term indicating the potential presence of combinations of low air temperatures, low sea water temperatures, wind, snow, ice, freezing fog, etc”.
  - Ch. 1, Sec. 1, Definitions: “Winterization: Measures taken to prepare the vessel for operations in cold climates. Winterization is primarily focused on the adverse effects and control of freezing, icing, wind chill and material properties in cold temperature.”.

- Ch. 2, Sec. 1: The Owner's Winterization Operations Philosophy/Design Basis Document
  - "shall be available on the start of the design process. This document represents the owner's operating philosophy adopted for the vessel to address the often conflicting aspects between winterization issues and the normal vessel design/operational criteria."

## Winterization issues

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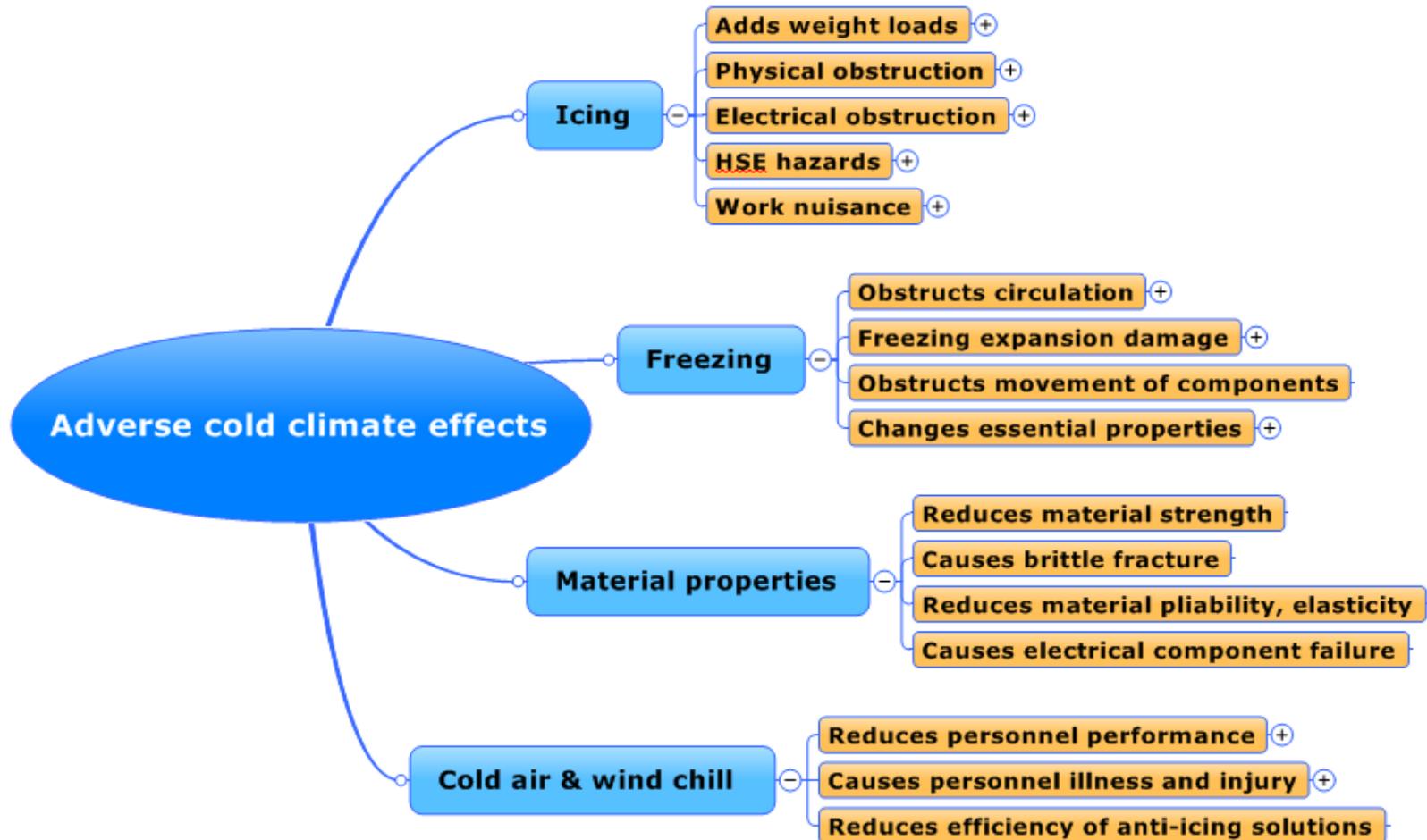
**Icing**

**Freezing**

**Material  
DAT**

**Wind  
Chill, etc**

# Cold Climate Effects

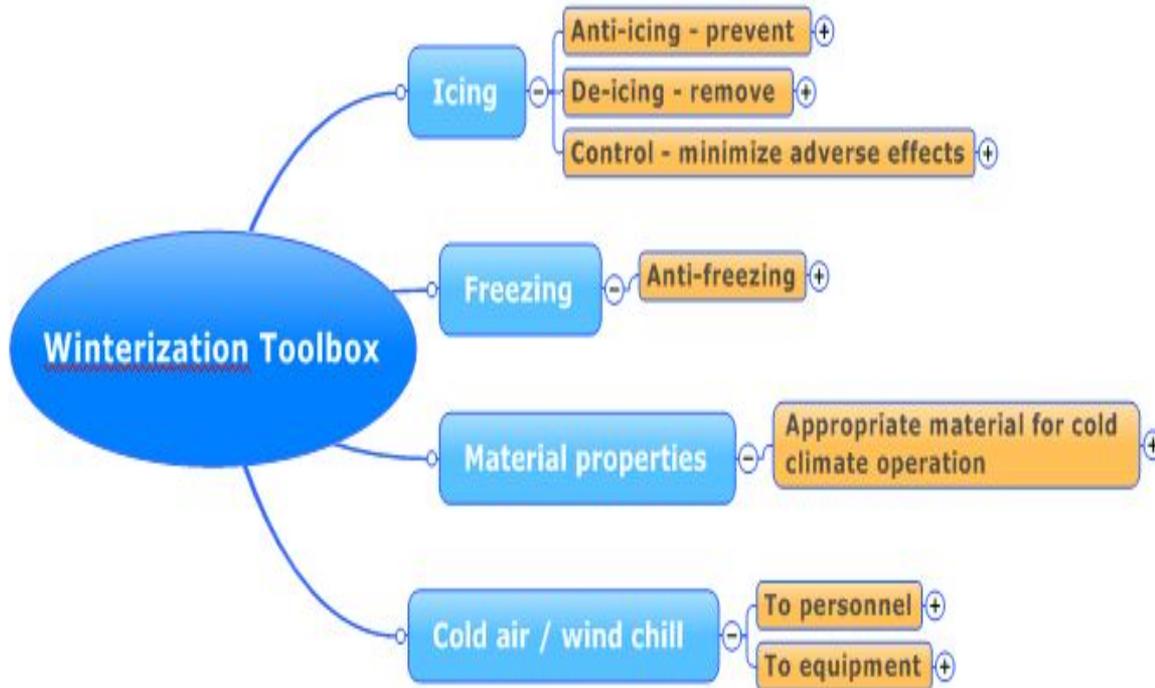


## Winterization: Challenges

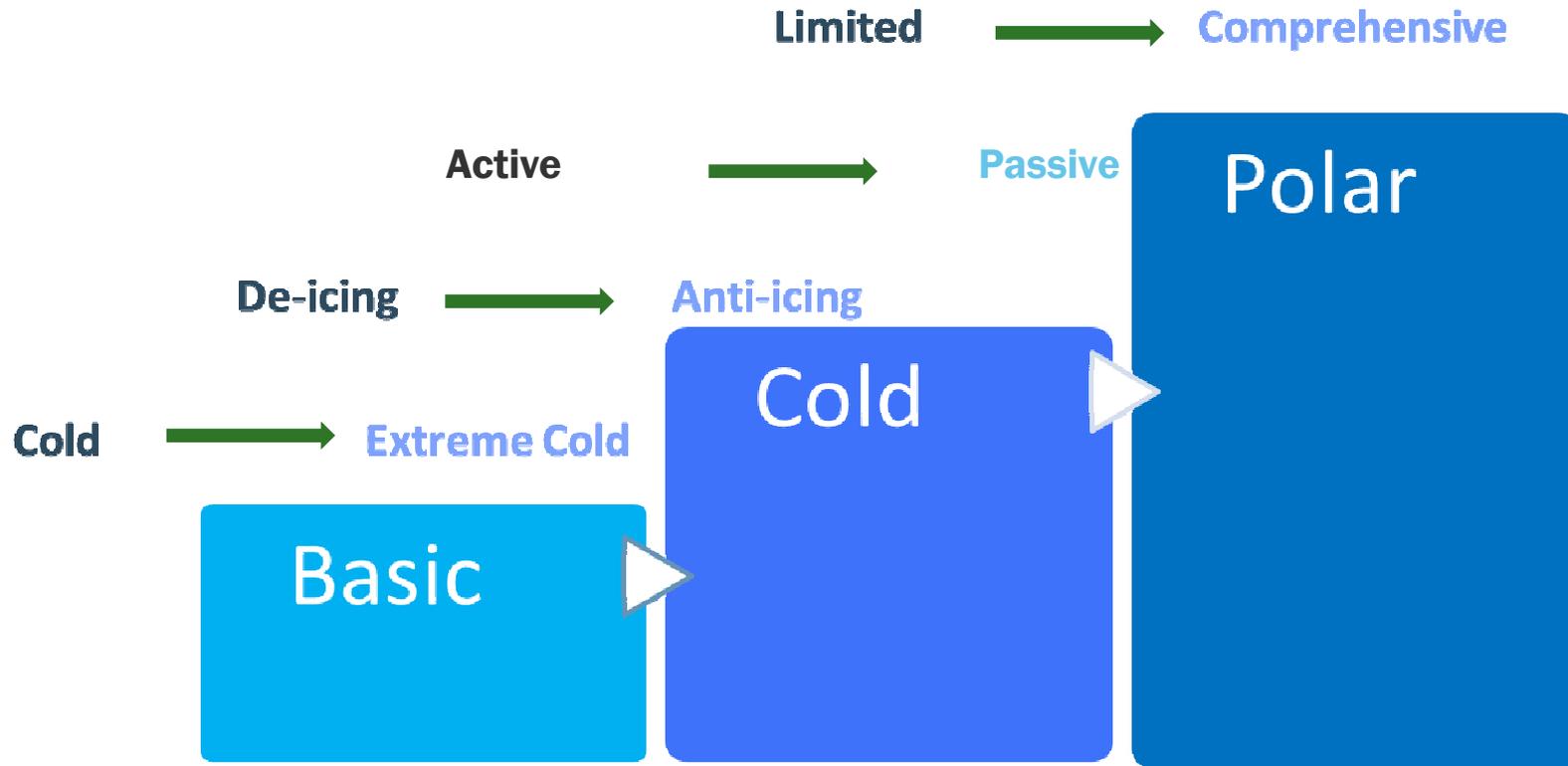
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- Winterization for crew well-being
  - Physical effects such as fatigue, frostbite, hypothermia
- Winterization for safety
  - Safety-critical equipment and systems
- Winterization for operability
  - Systems to maintain the functionality of desired operations

# Winterization Toolbox



# Notation philosophy



## Winterization: DNV-OS-A201 Winterization Level

<i>Winterization Level</i>	<i>“Indicative” Winterization Temperature (<math>t_w</math>)</i>	<i>Sea water temperature</i>	<i>Typical Application</i>
<b>Basic (<math>t_w</math>)</b>	-15°C	+4°C without ice class -2°C with ice class	Operation occasionally in cold-climate conditions for short periods
<b>Cold (<math>t_w</math>)</b>	-30°C	+2°C without ice class -2°C with ice class	Operation in cold-climate conditions regularly or for an extended period of time.
<b>Polar (<math>t_w</math>)</b>	-45°C	-2°C	Operation in extreme cold-climate conditions of the polar regions year-round, typically in ice-infested waters.

- Winterization Level Basic/Cold/Polar proposed by Owner:
  - Voluntary Class Notation (obligations & expectations both ways)

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- $t_w \Rightarrow$  “extreme low” air temperature for intended operating location:
- $t_w$  proposed by Owner: subject to DNV agreement pre-class contract:
  - consistency with hull structure design temperature  $T_d$
  - consistency between  $t_w$  and Winterization Level Basic/Cold/Polar
  - availability/consistency of owners winterization philosophy/design basis document

### **Winterized Basic ( $t_w$ ) =>**

- Ship-Shaped Vessel  
*extreme low temp  $t_w$  -15°C?, typical hull  $T_d$  -10°C.*
- Semi-Sub Drilling Unit (seasonal use):  
*extreme low temp  $t_w$  -20°C?, typical hull  $T_d$  -20°C.*

### ■ **Winterized Cold ( $t_w$ ) =>**

- Semi-Sub Drilling Unit (all year round operation, southern Barents Sea):  
*extreme low temp  $t_w$  -30°C?, typical hull  $T_d$  -20°C.*

### ■ **Winterized Polar ( $t_w$ ) =>**

- Specialist Ice Class Drill Ship (all year round operation, Northern Barents Sea):  
*purpose built for extreme cold-climate & regular operations in ice*  
*extreme low temp  $t_w$  -45°C?, typical hull  $T_d$  -30°C, ice strengthened hull.*

- Achieving the relevant “functional requirement” is the objective
  - Functional Requirements => Performance Requirements => Prescriptive Requirements
- 4.2.8 *Functional requirement*: Requirements that provide the fundamental rationale behind a particular rule and which needs to be satisfied.
- 4.2.11 *Performance requirement*: Requirements that explain in greater detail the type of performance a winterization measure must achieve in order to partly fulfill the intent of the functional requirement.
- 4.2.12 *Prescriptive requirement*: Requirements that present in greater detail the type of generally acceptable solutions for a winterization measure to partly fulfill the intent of the functional requirement/performance requirement.

## ■ Types of Functional Requirements:

### – “*Function as Normal*”:

- activities important for safety, e.g. LSA, structure, stability, ballast, power, propulsion, position keeping, ESD, F&G, etc.

### – “*Restrictions*” on operational limits:

- industrial activities, e.g. crane operations, drilling activities, cargo handling, etc

### – “*Do No Harm*”:

- minimise potential disruption, e.g. basic habitability, anti-freezing protection for other piping systems, etc

### – “*Special Studies*”:

- wind chill, dropped object hazards, emergency contingency planning, JTA of critical de-icing, etc

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## Lifeboat Arrangement: "Function as Normal"

### Functional Requirements:

*"The crew shall be able to launch/lower/release and operate the lifeboats safely and without delay in cold-climate conditions".*

Ref. 2).

### Performance requirements:

- Lifeboats shall not be damaged in stowage by ambient air temperatures down to  $t_w$ , if stowed in an unheated space.

### Performance Requirements:

*"Lifeboats shall not be damaged in stowage by ambient air temperature down to  $t_w$  if stowed in an unheated space".*

- Lifeboats and their securing and launching systems shall be fitted with anti-icing protection.
- Lifeboat davits & launching systems shall be made from materials suitable for operation at  $t_w$ .
- Lifeboat windows for coxswain shall be fitted with anti-icing and internal de-misting arrangements such that lifeboat can be launched safely and without delay.
- Lifeboat engines shall be fitted with a heater and be arranged to ensure they will start readily with an external ambient air temperature down to  $t_w$ .

### Prescriptive Requirements:

*"Lifeboat engine fuel oil shall be suitable for operation down to  $t_w$ ".*

- Fuel oil and medication stored in the lifeboat shall be protected from freezing down to  $t_w$ .

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## Functional Requirement: "Restrictions"

<p>Cargo Offloading System (Ch. 2, Sec. 5, 1.1.1, Table 5-1, Ref. 7).</p>	X	X	X	<p>Functional requirements:</p> <ul style="list-style-type: none"> <li>• Cargo Offloading system shall be suitable for the cold-climate conditions</li> <li>• FLNG loading arms shall be suitable for the cold-climate conditions</li> <li>• Fenders arrangements provided for side-by-side tanker transfer shall be suitable for the cold-climate conditions.</li> </ul> <p>Performance requirements:</p> <ul style="list-style-type: none"> <li>• The cargo offloading system and fendering system shall remain functional based on an external ambient temperature of <math>t_w</math> (or a less severe temperature if specified in the Owners Winterization Operations Philosophy/Design Basis Document and included in the vessel's Winterization Operations Manual).</li> <li>• The fendering system materials and components not continuously immersed in sea water shall be capable of being routinely subjected to a temperature <math>t_w</math> without deterioration.</li> <li>• The FLNG flexible loading arms shall be provided with anti-icing protection to extent necessary to ensure that the flexible joints and telescopic joints in the system function without restraint.</li> </ul>
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### Functional Requirements:

*"Cargo Offloading system shall be suitable for the cold-climate conditions".*

### Performance Requirements:

"The cargo offloading system and fendering system shall remain functional based on an external ambient temperature of  $t_w$  (or a **less severe temperature if specified** in the Owners Winterization Operations Philosophy/Design Basis Document and included in the vessel's Winterization Operations Manual)".

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## Functional Requirement: "Do No Harm"

### Functional Requirements:

"Piping systems and equipment, *irrespective of system function*, shall not be damaged by internal freezing of liquids".

### Performance Requirements:

"Piping & equipment on *open decks and in non-heated spaces\** that carry liquids susceptible to freezing at  $t_w$ , including drainage systems, shall be provided with anti-freezing protection".

*\*Ch. 2, Sec. 1, 2.1.1 GN: "Unheated Spaces referred to in this Chapter are considered to be any space where the internal temperature is not maintained above +1°C with an external ambient air temperature of  $t_w$ ."*

*Ch. 2, Sec. 1, 2.1.2: "The heating capacity for anti-freezing arrangements shall be sufficient to prevent exposed systems and equipment from freezing under an external ambient air temperature of  $t_w$ . Anti-freezing arrangements using heating should be able to maintain the subject liquid to at least +3°C above its nominal freezing temperature".*

*Ch. 2, Sec. 1, 2.1.3: "Anti-freezing arrangements using anti-freeze additives should be based on providing protection down to a temperature of 5°C colder than  $t_w$ ."*

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## Functional Requirement: "Special Studies"

### Functional Requirements:

*"Contingency planning shall take account of the **consequential effects** of a failure of a cold-climate mitigation measure on the normal contingency plans".*

Prescriptive Requirement - *"Contingency plans addressing **mains power outage scenario** shall address the escalating consequential effects of loss of active\* anti-icing and active\* anti-freeze measures and/or loss of space heating and active de-icing measures over time".*

- Direct consequence: loss of **active\*** anti-icing and **active\*** anti-freezing systems, etc.
- In-direct consequence: potential for progressive loss of some ability to manage/recover from the scenario which caused the power outage

\* Ch. 1, Sec. 1, Definitions, 4.2.1: *"Active measures: Winterization measures that **rely primarily on energy** to address the adverse effects of icing, freezing or wind chill; e.g. heat, physical force and circulation of liquids"*

Ch. 1, Sec. 1, Definitions, 4.2.10: *"Passive measures: Winterization measures that **do not rely primarily on energy** to address the adverse effects of icing, freezing or wind chill; e.g., shielding, enclosures, insulation and building-in areas or equipment".*

**Thank you for your attention!**

**Questions?**

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