

# Identifying “Favorable” Thresholds for New Deicers or Mixtures of Deicers Piloting Framework:

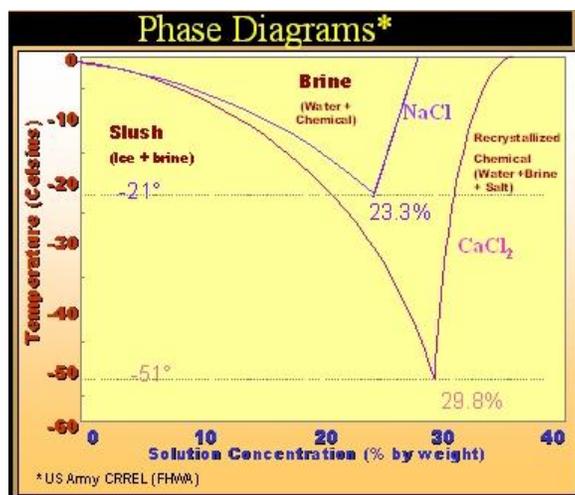
## Background:

At the third Non-Traditional BMPs workgroup, workgroup members recommended that the framework for piloting new deicers or mixtures of deicers identify threshold values for what should be considered “favorable.” This document follows up on that action item.

The purpose of this process is to suggest the timing and type of tests to evaluate the potential environmental impact (BOD and toxicity) of a new deicer or a mixture of deicers. Ideas for what is considered “favorable” in non-environmental tests are not discussed since the resources that discuss those tests adequately address that discussion. Additionally, the organization considering the use of the new deicer/mixture can make their own judgment on what is considered “favorable” taking into consideration the cost of the material and its intended use (e.g., certain surfaces like bridges).

## Below are considerations for the tests to evaluate environmental impacts:

- Concentrations of the deicer to test/consider:
  - Phase diagrams showing the deicer proportion in the solution (%) against the temperature can be used to determine the eutectic temperature and the eutectic composition (%). This eutectic composition (as a percent of the solution) can be used to calculate a conservative maximum concentration expected to be in stormwater. While this is an assumption, it provides a consistent method from which to derive an “expected stormwater concentration.”
  - For example, in the phase diagram below has both NaCl and CaCl<sub>2</sub> displayed. The eutectic temperature for NaCl is -21°C and the eutectic composition is 23.3% (the percent by weight that brines are mixed to). Similarly, for CaCl<sub>2</sub>, the eutectic temperature is -51°C, and the eutectic composition is 29.8%.



- BOD<sub>5</sub>
  - Water samples should be from local area streams, following best practices for sample preservation. All samples must be processed within 48 hours of collection.
  - In the very least, the concentration of the deicer that is expected to be in stormwater should be the concentration for which the BOD is evaluated. However, if resources permit, a range of concentrations that reflect what may be seen in stormwater should also be examined.

- BOD tests are typically run at 20°C. Because this does not reflect environmental conditions in melt water, it is recommended that BOD tests be run at 20°C to establish comparable BODs using standard methods, and at 2°C to establish melt water BODs. Given that microbial activity is extremely limited at 2°C, it is important that water samples be from local area streams as specified above. Additionally, if resources permit, BOD tests should be run at a range of temperatures between 20°C and 2°C to evaluate the variations in BOD with variations in temperature.
- A “favorable” BOD for a deicer should be based on best professional judgement. Since BOD tests create a condition not reflective of the environment (i.e., no reaeration, no mixing, etc.), the BOD should be viewed as an indicator for the magnitude of maximum potential impact.
  - Where possible, the rate of DO depression is important to consider when evaluating the “favorableness” of a deicer. In the environment (i.e., not in an enclosed BOD treatment) a deicer at concentrations expected in stormwater should not be capable of depressing oxygen concentrations below 4 mg/L for most waters of the state (see [9VAC25-260-50](#) for details; 5 mg/L and 6 mg/L in stockable and natural trout waters, respectively).
  - Attempts were made to summarize existing BODs for various deicers, but methods for deriving them, concentrations of the deicers tested, and other factors were either not available or varied considerably.
- Additional Notes:
  - It may be worthwhile to culture local area stream flora for consistent and representative BOD tests.
  - It should be recommended that all test results should be shared among the stakeholder community so that results can be compared and where appropriate, tests are not over-replicated.
- Acute and Chronic toxicity tests
  - Fathead minnows are a single, vertebrate organism. Toxicity impacts on invertebrates can occur at lower concentrations. Therefore, the initially proposed toxicity tests have been expanded.
  - It is recommended that new deicers or mixtures of deicers test for toxic effects following the [Clear Roads Project 11-02](#) methods for Determining the Toxicity of Deicing Materials.
    - In this project Acute and Chronic toxicity tests are run on three organisms that include an alga (*Selenastrum capricornutum*), an invertebrate (*Ceriodaphnia dubia*), and a fish (fathead minnow, *Pimephales promelas*) in order to represent the range of biota type that are expected to be found in a waterbody. Since different organisms have different toxic impacts, a range of organisms that span these taxonomic differences help to paint a more representative picture of toxic impacts to aquatic life.
    - Instead of providing LC50 thresholds to determine if the deicer is “favorable” with regards to toxicity, the results of the bioassays should be ranked similarly to the process described in the Clear Roads project, and BPJ should be exercised on whether or not the product’s results are considered “favorable.”
      - It is also worth considering whether or not the LC50s, both chronic and acute, would be concentrations of the deicer expected in stormwater. If the LC50 of either (for all three test organisms) is below that concentration, then the deicer is not “favorable.”