

FACT SHEET

July 2002

Deicing/Anti-Icing

Deicing and anti-icing are the flight critical processes of removal (deicing) and prevention (anti-icing) of frost, ice, or snow accumulation on aircraft, airfields, and other base areas. Deicing and anti-icing are vital to flight safety because even small amounts of ice on airframes and airfoils can degrade aircraft lifting properties and control. The removal and prevention of frost, ice, or snow accumulation usually requires the application of chemical agents. In order to *remove* snow and ice, solid chemical agents should be pre-wetted, when possible, to form brine, which penetrates to the surface of the aircraft or airfield. Once at the surface, the brine solution moves outward melting and undercutting the snow and ice. To *prevent* snow and ice formation, accurate weather information is critical. Chemical agents must be placed on the aircraft or airfield prior to or at the beginning of the storm event, which will depress the freezing point of water, effectively stopping the bond formation between the snow or ice and the aircraft or airfield surface.

Chemical Agents

Each deicing and anti-icing chemical works in much the same way though their rate, performance, and environmental impact varies. It is important to note, these chemical agents are not intended to melt every trace of snow and ice.

- ▶ **Ethylene Glycol** is highly water-soluble, has a high biological oxygen demand (BOD), and is toxic to aquatic life and mammals. It is subject to various hazardous substance regulations under the Clean Air Act, the Comprehensive Environmental, Response, Compensation, and Liability Act, and the Emergency Planning and Community Right-to-Know Act.
- ▶ **Propylene Glycol** exerts an even greater BOD effect than ethylene glycol and remains in the environment longer; however, it is less toxic and is not subject to hazardous substance regulations.

- ▶ **Grade B Isopropyl Alcohol** has been in limited use for deicing and anti-icing due to its high volatility, and vapors could be carried inside the aircraft creating a fire hazard.
- ▶ **Urea**, used in pellet form, has a high BOD, and is of limited effect at temperatures below 25 degrees Fahrenheit (°F). Urea degrades to ammonia, which is toxic to aquatic organisms and may accelerate the growth of algal blooms.
- ▶ **Sodium Acetate** is a granulated product applied in the same manner as urea. Sodium acetate is effective at temperatures as low as 10°F, has a lower BOD and is less toxic than urea.
- ▶ **Potassium Acetate**, mixed in solution with water, is effective at temperatures as low as -20°F, but should be used with special attention, as it may act as an electric conductor. Potassium acetate may be used as a pre-wetting solution when applying granulated sodium formate.
- ▶ **Sodium Formate** has similar characteristics to sodium acetate. It is effective at temperatures as low as 5°F, has a low BOD, and has a neutral pH, which reduces corrosion problems.
- ▶ **Chloride Salts** (sodium chloride and calcium chloride) are corrosive, can cause groundwater contamination, and damage vegetation.

Air Force Protocol

Technical Order (T.O.) 42C-1-2 is the general authority on Air Force aircraft deicing and anti-icing activities; however, aircraft specific technical orders are the final authority for deicing and anti-icing procedures. Airfield deicing and anti-icing protocols are addressed in Air Force Instruction (AFI) 32-1002, *Snow and Ice Control*.

Aircraft Deicing/Anti-Icing

Currently, propylene glycols procured to Military Specification, MIL- A-8243, Type I are the only glycol based deicing and anti-icing chemical agents approved for purchase by Air Force activities. *Note: This specification is provided for*



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Air Force installations, which have yet to convert to SAE/AMS 1424 and 1428. Air Force aircraft deicing and anti-icing activities are prohibited from procuring ethylene glycol (MIL-A-8243, Type II) and may only use existing ethylene glycol supplies until depleted, if approved by the Aircraft Single Manager. However, ethylene glycol is still in use by some commercial airport facilities, and Air Force personnel conducting deicing and anti-icing activities at commercial facilities are required to advise their Major Command of the types of deicing chemicals utilized.

Airfield Deicing/Anti-Icing

Chemical agents for airfield deicing and anti-icing activities must be approved by the installations Environmental Protection Committee, and receive approval from the Aircraft Single Manager. The Air Force advocates the use of three environmentally acceptable chemical agents: potassium acetate (certified to AMS 1435), sodium acetate, and sodium formate (both certified to AMS 1431). Older methods, such as the use of urea, glycols, or isopropyl alcohol are no longer recommended.

Streets & Other Areas

Chloride salts, which are readily available and cost effective, may be used for deicing and anti-icing of base area sidewalks, streets, and parking lots; however, these chemical agents should not be used within 300 feet of airfields, as they are corrosive. An alternative to chemical agents is the use of abrasives, such as sand, to provide/improve traction, although over application may degrade air and water quality. Prior to the use of any chemical agent or abrasive coordinate with the installation's Environmental Flight Chief to ensure compliance with local standards.

Environmental Impacts

The chemical agents used in deicing and anti-icing processes impact natural resources by depleting the available oxygen in receiving waters. Under the Clean Water Act of 1972 discharging into any waters of the U.S. is prohibited unless authorized by a National Pollutant Discharge Elimination System (NPDES) permit. To ensure compliance with state and Federal storm water provisions many Air Force installations prevent drainage of residual deicers into storm systems during deicing and anti-icing activates enabling the chemical agent to be collected. The used product may be recycled, by procuring a service contract through which the used product can be collected, concentrated, and then marketed as a low quality deicing solution, or blended with virgin product for reuse. *Note: Recycled glycol agents are typically lower quality and cannot be re-used on aircraft.*

For Additional Information...

Contact PROACT at DSN 240-4214 or by e-mail at pro-act@brooks.af.mil. In addition, Air Force personnel may contact:

- ↳ Mr. Jay Shah, Environmental Division, U.S. Air Force (HQ USAF/ILEV), DSN 327-0120, (703) 607-0120, jayant.shah@pentagon.af.mil, or
- ↳ Mr. Dave Wagner, Air Force Civil Engineering Support Agency (HQ AFCESA/CEOM), DSN 523-6388, dave.wagner@tyndall.af.mil or visit the Snow and Ice Control website at <http://www.afcesa.af.mil/Directorate/CEO/Management/snowcontl.htm>.

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