U.S. Department of Transportation

Federal Aviation Administration

Advisory Circular

Subject: CHANGE 2 TO AIRPORT WINTER SAFETY AND OPERATIONS	**Date:** 10/2/90 **Initiated by:** AAS–100	**AC No:** 150/5200–30 **Change:** 2

1. **PURPOSE.** This change allows the use of glycol–based fluids on aircraft operational areas.

Affected pages carry the change number and effective date on the top. Asterisks (*) located on the left margin (change begins) and right margin (change ends) identify revised, added or deleted portions.

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a. **Deicing Chemicals.** Deicing chemicals should be applied on ice 1/16 inch (1.5 mm) or less in thickness. Thicker layers of ice require an extended period of time to obtain ice-free pavement. However, solar radiation from even a cloudy sky enhances melting action to such an extent that elimination of ice thicknesses greater than 1/16 inch (1.5 mm) are possible.

b. **Anti-Icing Chemicals.** The recommended chemical form for anti-icing is liquid (including solid chemicals in solution). A dry solid chemical applied to a cold dry surface may not adhere and may be blown off or scattered by either surface winds or aircraft movements. Wetting a dry anti-icing chemical, either during distribution or before or after loading into the application vehicle, improves the ability to achieve uniform distribution and improved adhesion.

34. **CHEMICALS.** Any water-soluble substance will lower the freezing point of water and thus, promote the melting of ice. Theoretically, the lower the molecular weight and the more individual particles (ions) the substance disassociates into, the more effective the product is as an ice control chemical, assuming its solubility still remains high at the freezing temperature. For the purpose of shared information, airport operators should advise the airlines before using any chemicals on the airside.

a. **Approved Airside Chemicals.** Airside chemicals approved for nonaircraft applications are airside urea, glycol-base fluids, calcium magnesium acetate (CMA), and magnesium calcium acetate (MCA). The FAA either establishes approval specifications or, upon recognition, references the specifications of professional groups such as, the Society of Automotive Engineers (SAE) through Aerospace Material Specifications (AMS) and the United States military (MIL-SPEC). Airport operators should obtain vendor certification that airside chemicals meet the applicable specification. Approved airside chemical specifications are as follows:

(1) **Urea (also called carbamide).** The applicable specifications are SAE AMS 1730A, Urea Compound - Shotted, SAE AMS 1731A, Urea Compound - Powder, and MIL SPEC DOD-U-10866D, Urea-Technical. Urea produced for agricultural use is not acceptable. Production of this nontoxic solid white chemical, chemical formula $(NH_2)_2CO$, is in either powder or "shotted" ("prilled") form. The latter form's shape is small spheres of about 1/16 inch (1.5 mm) diameter. Both forms are primarily for deicing where powdered urea is frequently mixed with sand. Hot mixtures of powder or "shotted" urea and sand serve two purposes: (1) immediate increase in braking action and; (2) retention of chemical over the pavement area until it initially dissolves some of the ice and then melts the remainder. The urea deicing function is practical only at temperatures above approximately 15° F (-10° C) because of the decreasing melting rates below this temperature value. The decreasing melting rate is a result of urea's eutectic temperature, defined in paragraph 4(d), which is approximately 11.3° F (-11.5° C). However, the presence of solar radiation assists urea in the melting action. Pavement surface temperature and ice thickness determine the urea application rate.

Application Rate of Urea (lb/ft^2)

Ice Thickness (inch)	Temp (°F)		
	30°	25°	20°
less than 1/32	.016	.023	.06
1/32 - 1/8	.03	.06	.125
1/8 - 1/4	.125	.175	.275

(2) **Glycol-base Fluids.** The applicable specifications are SAE AMS 1426B, Fluid, Deicing/Anti-icing - Runways and Taxiways, and MIL-D-83411A, Deicer/Anti-icer Fluid (for Runways and Taxiways). Composition of proprietary solutions meeting these specifications varies with the manufacturer, though the glycol-base content is approximately 50 percent. Application rates range from 1-2 gal/1000 ft^2 for deicing and from 0.2-0.5 gal/1000 ft^2 for anti-icing. While the above specifications only require a eutectic temperature of -10°F (-23°C) or less, proprietary products are available with eutectic temperatures as low as -75°F (-59°C). Ethylene glycol has a eutectic temperature of approximately -58°F (-50°C) for an aqueous solution of 58-78 weight percent of ethylene glycol and

a freezing point of approximately 8.6°F (-13°C) for the pure fluid. Propylene glycol has a eutectic temperature of approximately -75°F (-59°C) for an aqueous solution of 60 weight percent of propylene glycol. Propylene glycol in its pure form does not have a freezing point per se, but sets to glass below -60°F (-51°C). The following are two varieties of glycol-based fluids with their corresponding chemical formula: ethylene glycol $(CH_2)(OH)(CH_2)(OH)$ and propylene glycol $(CH_2)(OH)(CH)(OH)(CH_3)$.

(3) **Calcium Magnesium Acetate (CMA) and Magnesium Calcium Acetate (MCA).** Appendix 4 contains the applicable "interim specification" for these products. Currently, the SAE is in the process of writing a generic solid specification which may replace the specification in appendix 4. Both products function only as pavement surface deicers/anti-icier. Proprietary products are available having eutectic temperatures lower than that specified for ethylene glycol. Product application rates are provided by manufacturers.

b. **Landside Chemicals.** The most effective landside chemicals used for deicing/anti-icing based on both cost and freezing point depression are from the chloride family, e.g., sodium chloride (rock salt), calcium chloride, and lithium chloride. Prohibited on the airside are products that contain salts, particularly salts of the chloride family, or any other product known to be corrosive to aircraft. After landside application, precautions should be taken that vehicles do not transport any nonapproved airside products onto the airside.

35. **ENVIRONMENTAL ASPECTS OF DEICING CHEMICALS.** All freezing point depressants may cause scaling of portland cement concrete (PCC) by physical action related to the chemical concentration gradient in the pavement. Deleterious effects on PCC can be reduced by ensuring sufficient cover over reinforcing steel (minimum of 2 inches (5 cm)), using air-entraining additives, and avoiding applications of chemicals for a year after placement. Concrete meeting the compressive strength outlined in ASTM C 672, Scale Resistance of Concrete Surfaces Exposed to Deicing Chemicals, or concrete receiving a prior application of commercial concrete sealer such as boiled linseed oil will perform very well when subjected to chemical deicers. No surface degradation of asphalt concrete has been observed due to deicing chemicals. Both deicing chemicals commonly used on airfields, urea and ethylene glycol, rapidly biodegrade in the environment although biological oxygen demand is high. Low temperatures and dilution from heavy runoff during periods of use tend to minimize this. Urea decomposes to ammonia which is quickly dissipated.

36. **RUNWAY FRICTION IMPROVEMENT.** Since snow and ice degrade the coefficient of friction between rubber tires and pavement and could pose an unsafe condition for aircraft, it is important to clear to bare pavement whenever possible. There are situations where complete removal is difficult or impossible to achieve within a required span of time; at temperatures approaching the eutectic temperature of a deicing chemical, for instance, it may require an hour or more for the chemical to go into solution and melt the ice. There are two techniques for modifying the frictional coefficient of a pavement covered with ice or compacted snow, one by building in a texture on the surface and the other by surface treatment of the ice or snow. It should be emphasized, however, that an abrasive is not a deicing chemical and will not remove ice or compacted snow--in fact, heavy applications of abrasives can insulate the ice and prolong its presence.

a. **Pavement Surface Modification.** These two modifications by themselves will not increase the coefficient of friction of ice formed on the surface but both will enhance the response of chemical treatment.

(1) **Pavement Grooving.** Grooves cut into the pavement will trap deicing chemical, reduce loss, and prolong its action. Grooves also assist in draining melt water and avoiding its refreezing. There is empirical evidence that grooves and porous friction courses modify the thermal characteristics of a pavement surface, probably by reducing the radiant heat loss, and delay the formation of ice. There do not appear to be any negative effects from grooved pavements.

(2) **Porous Friction Course (PFC).** PFC has generally the same benefits as grooving. Open graded asphalt concrete is less effective in improving coefficient of friction under icing conditions because the open spaces will fill with compacted snow, and to a lesser extent with ice in the case of freezing rain. Most maintenance personnel have found that chemical treatment rates must be increased on this type of pavement compared to dense graded asphalt concrete because of drainage of the chemical. The drainage characteristics also change as abrasives accumulate in the voids and plug them.