EASA Safety Information Bulletin

SIB No.: **2010–26R1**
Issued: **23 February 2011**

Subject: **Potential Performance Degradation of Anti-icing Fluids – Reduced Holdover Times**

Ref. Publication: Letter of the SAE G-12 Aircraft De/Anti-icing Fluids Committee "Residues Working Group" hereby attached.

Description: Recent research tests presented at SAE G-12 Committee 2010 annual conference, showed that when mixing thickened aircraft anti-icing fluid (ADF) with minimal amounts of runway de-icing fluids (RDF) (formate or acetate based), anti-icing protection provided by the ADF could be diminished due to a separation of the thickening agents in this fluid, consequently reducing holdover time.

The tests' scenario happens when fluids from the runway are splashed onto the wing by the nose gear wheels or from the engine thrust reversers at landing and then ADF is applied in a one-step process as protection for the next flight.

Additional tests also showed that when using a two-step de-icing/anti-icing process, the application of the first step with water or type I ADF solution, cleans off the RDF wing contamination so that the anti-ice protection provided with the second step is not affected by the RDF.

The RDF contamination scenario described is based on preliminary research findings, and it is not reported to have been observed in actual operations so far. Further research is considered necessary in order to quantify the effect of the fluid performance degradation in a normal operations scenario. These reasons have led the Agency to recommend a more flexible approach through this revision compared with the original issue of this SIB.

The Agency recommends that operators make their personnel aware of this effect, as pertinent to their duties, and provide procedures or guidelines appropriate to their individual network structure and operational conditions.

When possible, operators should consider that de-icing/anti-icing applications are performed in a two-step process, using water or a Type I fluid/water mixture as a first step, and as described in Association of European Airlines (AEA)

"*Recommendations for De-Icing / Anti-Icing of Aircraft on the Ground*", and AEA "*Training Recommendations and Background Information for De-Icing /Anti-Icing of Aircraft on the Ground*" , (both retrievable at the following link: http://www.aea.be/press/publications/index.html) which also reduces the formation of gel residues (see also EASA SIN 2008-29).

Applicability: All aeroplanes operating in winter conditions.

Contact: For further information contact the Airworthiness Directives, Safety Management & Research Section, Certification Directorate, EASA; E-mail: ADs@easa.europa.eu.

To: **Airports, Deicing Service Providers, De/Anti-icing Fluid Suppliers, Aircraft Operators and Aviation Regulatory Authorities**

From: **SAE G-12 Aircraft De/Anti-icing Fluids Committee "Residues Working Group"**

Subject: **Safety Concerns due to Runway Deicing Fluid Overspray affecting Airplane Deicing/Anti-icing Fluid Holdover Times**

SUMMARY
This letter is sent to advise all interested parties about the unsafe condition that may occur when thickened airplane anti-icing fluid is applied to a wing that has been contaminated with small amounts of runway deicing fluid. Recent testing has shown that a thin layer of runway deicing fluid on a wing surface can have dramatic effects on the performance of a thickened airplane anti-icing fluid.

The SAE G-12 Residues Working group strongly recommends that all users of airplane deicing/anti-icing fluids consider the use of the two-step deicing/anti-icing process. Research and testing has shown that use of the two-step deicing/anti-icing process will help ensure safe operation of airplanes during the winter season. Using the two-step process will reduce the formation of gel residues in critical areas, and will reduce the chances of wing contamination from runway deicers causing failure of airplane anti-icing fluid holdover times.

DISCUSSION
For several years operators of aircraft during winter months have had to deal with the consequences of gel residues that form after the use of thickened deicing/anti-icing fluids. Dried residues from these fluids can rehydrate and form into a gel-like substance that can freeze during flight and cause aircraft safety problems, such as restrictions to the flight control systems.

In November 2005 a "Residues Working Group" was formed as part of the SAE G-12 Aircraft Ground Deicing Committee. The charter of this group was to lead an effort of research and testing to better understand residues and how to mitigate the safety problem they impose on the aircraft operators.

One way that aircraft de/anti-icing fluid (ADF) residues can form quickly is when they are mixed with runway deicing fluids (RDF). Research has shown that when these fluids combine, the salts of the runway fluids will cause the separation of the polymer thickening agents of the airplane fluids. This may lead to a more rapid formation of the gel residue than occurs when they dry out in aerodynamic quiet areas. Combining these fluids on the wing can lead to an unpredictable reduction in the anti-icing fluid holdover time (HOT), which can lead to serious safety consequences for the airplane.

The scenario for combining airplane de/anti-icing fluids and runway deicing fluids happens when fluids from the runway are splashed onto the wing by the nose gear wheels or from the engine thrust reversers. Runway fluids are known as "hydroscopic fluids", which means they don't dry out very fast, and can leave a thin wet layer on the wing that can be difficult to see.

Recent testing was conducted on behalf of the FAA and Transport Canada to examine the performance of a Type IV propylene glycol based anti-icing fluid applied over a thin layer of runway deicing fluid. The scenario was to replicate what happens when wings get contaminated with runway overspray, and then have anti-icing fluid applied in a one-step application. Wind tunnel tests were run in a light freezing rain condition with the anti-icing fluid applied over various concentrations of the runway deicing fluid. Half of the wing section was covered with a thin layer of the runway fluid and then compared against a clean baseline on the other half of the wing. In all tests, the film thickness of the Type IV airplane anti-icing fluid was significantly reduced when applied over the runway fluid, compared to the non-contaminated section. This led to early failure of the Type IV fluid on the contaminated wing section, where the failed fluid did not properly shear off the wing during rotation, and ice precipitation was adhering to the wing surface.

In another test, a potassium formate based runway deicer was sprayed onto test plates and dried, then rehydrated with water to simulate in-service conditions. The test plates were then cleaned by pouring heated Type I fluid over one and heated water over the other. The results showed that the water removed 100% of the runway deicer, while the Type I fluid removed approximately 90% of the runway deicer.

The aforementioned test examples illustrate the concern that arises when runway fluid contaminates a wing prior to application of the airplane anti-icing fluid. The testing also shows how using a two-step deicing/anti-icing process on the airplane may be even more important for airplane safety than previously thought. In a typical two-step process, a heated Type I deicing fluid, or a heated mixture of Type I and water, is used to clean off any wing contamination prior to the application of the thickened Type II, III or IV anti-icing fluid.

In conclusion, the SAE G-12 Residues Working group strongly recommends that all users of airplane deicing/anti-icing fluids consider the above information while planning for the next winter operating season. Airplane safety is the most important factor when making decisions during winter operations, and having predictable and reliable holdover times for airplane anti-icing fluids is crucial to meeting that need. Research and testing has shown that use of the two-step deicing/anti-icing process will help ensure safe operation of airplanes during the winter season. Using the two-step process will reduce the formation of gel residues in critical areas, and will reduce the chances of wing contamination from runway deicers causing failure of airplane anti-icing fluid holdover times.

Signed on behalf of the SAE G12 Residue Workgroup

Kirsten Dyer (Chair)