APPENDIX A: DETAILS ON AIRCRAFT DEICING CHEMICAL USAGE

TABLE A-1. AIRCRAFT DEICING CHEMICAL USAGE

Airport	Number of DDFs at Each Airport	Pavement Type	Chemical(s) Used	Solution Strength***	Application Rate (annually)	Application Rate (per storm) *	Application Rate (per plane) **
Alpha	6 pads, each will hold 1 widebody or 2 narrowbody aircraft. 6 equal-size areas adjacent to pads can be used as holding areas, or can reverse direction of flow (equivalent of having 12 pads)	Mostly concrete (1 is asphalt)	Ethylene glycol	Mostly 50%, sometimes more diluted.	Average = 10,000,000 liters (2,641,728 gallons)	In a major storm, up to 1/2 million liters (132,086 gallons)	Last year: 14,000 aircraft, 12 million liters : 226 gallons/aircraft (diluted amount)
Delta	6 total (so far 4 new ones since 1999)	PCC (2 older ones Pac w/plugged drains - collect & truck to reclamation site, 4 new ones grooved PCC piped to collect runoff)	Propylene glycol (types I & IV)	55% glycol	Gallons of concentrate: in 2004/5, 85,000 gallons type IV (anti-ice), 800,000 - 1 million gallons Type I (de-ice)	If severe, maybe up to 175,000 gallons, or maybe 75,000 if it is mainly frost	Variable, due to size of aircraft and conditions: 150 - 2000 gallon range
Echo	4 total (1 brand new), plus concourse collection system Pier A, B, and C	3 pads (15L, 15R and Alternate A) are asphalt, 1 pad (28) and Piers A, B & C are concrete	Propylene glycol Types I & IV	Type I varies between 30 and 55% (depending on carrier and outside temperature). Type IV is undiluted.	Varies significantly. 6-season average = 161,065 gallons of undiluted glycol.	Varies significantly with length of storm, type of precipitation, timing (aircraft parked overnight vs. 30 minutes). Range: Min=1,109 gal undiluted (trace of snow, 28 deg F), Max=100,784 gal undiluted (1" snow, sporadic freezing drizzle over 2.5 days) Average = 20,651gal (pure glycol)	Varies significantly with storm and aircraft type
Foxtrot	4 pads, 22 spots	Concrete	Propylene glycol	50%	July 1, 2004 - June 30, 2005: Type I: Seven vendors reported a total of 1,542,187 gallons of mixed fluid. Type IV: Three vendors reported a total of 55,974 gal	There were 35 measurable snow events in the 2004/2005 season, so averages would be: Type I: 44,062gal Type IV: 1600gal. Note: The snowfall for the season reported was 63% of normal (39.3" vs 61.7"). The total deicer quantities would also be applied for icing/frost events, and so the "per storm" numbers will no tbe accurate.	Seven vendors reported the total number of aircraft deiced was 12,130. Therefore, the averages would be: Type I: 127gal Type IV: 4.6 gal
Golf	5 dedicated + 2 military (they do their own deicing)	Concrete (asphalt along shoulders, but not weight bearing)	Propylene glycol	Depending on temperature, from 35% to 55% glycol	Oct - Apr: 2004/5: 417,008 gal 2003/4: 821,828 gal 2002/3: 962,800 gal 2001/2: 322,730 g	Varies significantly	Added forced air 2 years ago, to reduce amount used (2004/5 was the first season it was used consistently). 2004/5: about 51 gal/aircraft. 2003/4: 101 gal. 2002/3: 91gal. 2001/2: 61 gal.

* Typically, the amount used in a storm will depend on the type of storm (ice, snow), severity of storm, sizes of planes, etc.
** Typically, the amount used per plane will depend on type/size of plane, whether it is covered with frost or thick ice, etc.
*** Type I glycols (used for deicing) are typically diluted to 40 - 60% solution (generally 50% - higher % in worse weather), & sprayed on at about 150-180 degrees F, to remove accumulated ice, frost & snow. Type IV glycols (used for anti-icing) are applied within about 10 minutes of departure - undiluted glycol with thickeners, so it stays on plane until take-off (shears off at that time).

TABLE A-1. AIRCRAFT DEICING CHEMICAL USAGE (CONTINUED)

Airport	What deicer is used on other pavement?	Application Rate	Other deicer on DDF	When deicing pavement near pads, do they contaminate the DDF?	Pavement degradation on pad	Due to deicer, or general wear and age	Other pavement degradation	Other Cooments
Alpha	KAc and Na formate		Pads pre-treated with Kay, treated with Na formate	The chemicals do get mixed (applied to pad)	Yes	Normal wear and tear	Normal wear and tear	He would think the concrete sealant may be more susceptible to degradation where glycol is used. They do a lot of replacement work on the sealant. **Waterloo University is doing a study on this - possibly interested in sharing information. Joe.forbes@gtaa.com
Delta	NaAc (solid) and Kay (liquid), primarily used on runways/taxiways, and will be applied if necessary on deicing pads (generally are not). Sand may be applied for traction. Aircraft deicing chemicals generally provide enough chemical to allow only mechanical removal when required. Road salt (NaCl) is used landside.		None	Only when runway chemicals are used on pads. Landside chemicals (NaCl) does not run onto pads or airfield.	Some	General wear and age.	Not that we are aware of.	
Echo	Potassium acetate (liquid) and sodium acetate (solid)	2004/5: KAc = 265,000Gal, NaAc = 122 tons, 2003/4: Kay = 200,000 gal, NaAc = 62 tons, 2002/3: Kay=88,000 gal, NaAc=44 tons	None	No. With the amount of chemical on the pads form the wing deicer, there is no need to use more	None. They use a very high granite content in the cement, with 15 year PM on the sealer	N/A	Just standard freeze/thaw cycles. Old underground conduit did have to be dug up and replaced - now using PVC	Airlines have reported trouble with carbon braking surfaces and hoses, but not from the wing deicers
Foxtrot	Potassium acetate		None	No, They do not run over the pads	No	If any, general wear and age	None	
Golf	Potassium acetate (liquid) and sodium formate (solid)	2004/5: Kay = 67,000 gal, Na Formate = 1 ton. 2003/4: Kay = 253,000 gal, Na Formate = 35 tons 2002/3: Kay = 204,000 gal, Na Formate = 20 tons	None	It is possible that some deicer gets tracked onto the pads by the aircraft. It is not applied, and the trucks drive around the pads.	None. They do annual joint and pavement inspections.	General wear and age.	No, none that is attributed to the deicers.	Have not used urea for 6 years. Pads were installed in 1992 - no quantifiable degradation from deicers. Some concrete has been replaced, but just due to wear and age.