APPENDIX M

Change in Surface Water Impacts from Aircraft Deicing and Fueling

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Change in Surface Water Impacts from Aircraft Deicing and Fueling

Prepared by:

Liesch Associates, Inc.

October 17, 2011

Minneapolis-St. Paul International Airport
2020 Improvements
Environmental Assessment/
Environmental Assessment Worksheet

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INTRODUCTION

The following technical memorandum has been developed in support of the Minneapolis-St. Paul International Airport 2020 Improvements Environmental Assessment (EA) being drafted by the Metropolitan Airports Commission (MAC). This memo relates to the evaluation of potential impacts to surface water discharges originating from aircraft deicing activities and potential fuel spills at the Minneapolis-St. Paul International Airport (MSP). The aircraft deicing related impacts are evaluated under Section 1. Potential fuel spill impacts are addressed under Section 2.

The conclusion from this evaluation is that both the Airlines Remain Alternative and the Airlines Relocate Alternative will *reduce* the overall impacts due to aircraft deicing compared to the No Action Alternative and there will be no change in potential impacts from fuel spills between the three alternatives.

These conclusions are based on historic glycol recovery information from the MAC's Glycol Recovery Program and anticipated MSP terminal usage scenarios developed for each of the three alternatives.

1 Aircraft Deicing Impacts

1.1 Background

The primary component of aircraft deicing fluid (ADF) is propylene glycol, which acts as a freeze-point depressant and will help to remove snow/ice build-up on aircraft surfaces and can help to prevent accumulation of snow/ice on ice-free surfaces. MSP Tenant airlines are responsible for determining when and how much ADF is applied to a given aircraft. The tenants apply (or contract with a deicing service provider to apply) ADF at various deicing locations around MSP. During application of ADF, some portion of the fluid will drip off the aircraft onto pavement beneath the aircraft. The Airport operates a Glycol Recovery Program that collects spent ADF from various deicing locations around MSP and transports the spent fluid to the Glycol Management Facility where the glycol-impacted stormwater is either sent to treatment at a publicly owned treatment works or is recycled on-site for ultimate re-sale as propylene glycol.

A fraction of the spent deicing fluid that is not able to be collected by the recovery program has the potential to impact stormwater flows and ultimately discharge to surface waters. Glycol will exert an oxygen demand within the surface water body, which has the potential to reduce

dissolved oxygen levels and stress aerobic organisms. The surface water body with the potential to be impacted by projects associated with this EA is the Minnesota River. The primary focus of the Glycol Recovery Program is to minimize the amount of glycol that discharges from MSP into the Minnesota River. The Airport maintains a National Pollutant Discharge Elimination System/State Disposal System Permit that authorizes the discharge of water from MSP. The permit includes a five-day carbonaceous biochemical oxygen demand ($CBOD_5$) annual load limit that is one of the main aspects of the Airport's NPDES/SDS Permit compliance efforts. $CBOD_5$ is a measure of the effects that glycol and any other organic loads within the discharge can have on the water body.

Any evaluation of potential impacts from ADF application must underscore the variability in ADF requirements from one deicing season to the next. ADF application is weather dependent, and therefore can vary substantially despite no difference in application technology or glycol recovery systems. In addition, the impact of the ADF application on stormwater discharges can also vary significantly as different types of storm events can have wide ranging impacts on the success of the recovery systems in place. During the past five years, the glycol recovery infrastructure at MSP has not undergone any significant changes, and the number of operations has been relatively constant. Nevertheless, the total application volumes have varied considerably as different weather conditions dictated varying ADF usage rates. **Table M.1.1** demonstrates the variable nature of glycol application over the past five years despite relatively constant operations.

Table M.1.1

MSP Annual Glycol Application Volumes

Year	Total Departure Operations	Total Glycol Applied (gal)
2006	238,588	573,151
2007	226,725	1,161,571
2008	225,209	1,429,666
2009	216,513	1,186,437
2010	218,320	1,373,038

Source: Liesch Associates, Inc.

The Glycol Recovery Program was initiated in 1993 as a means of complying with the $CBOD_5$ annual load limit and has been evolving ever since to go above and beyond permit compliance and reduce overall MSP impacts on the environment. The recovery program relies on dedicated deicing pads, storm sewer plug and pump systems (PnP), and glycol recovery vehicles (sweepers) to collect spent ADF. Each of these systems has unique characteristics that determine its collection efficiency as well as its feasibility for any individual tenant's use. As the MAC evaluates the comparative impacts of the three different alternatives being evaluated in this EA, the terminal use and potential construction of new terminal areas can impact the

anticipated performance of the Glycol Recovery Program. The following evaluation quantifies the difference in ADF impacts between the three alternatives under consideration. The alternatives are:

- No Action Alternative: Airport infrastructure remains unchanged from today.
- Alternative 1 – Airlines Remain: Airlines currently located at Terminal 1-Lindbergh would remain at Terminal 1-Lindbergh (including those tenants not associated with Delta Air Lines (Delta) or Delta's regional partners).
- Alternative 2 – Airlines Relocate: Airlines besides Delta and Delta's regional partners are relocated to a substantially expanded Terminal 2-Humphrey.

It should be noted that with any of the three alternatives evaluated in this EA, the total number of departure operations does not change, only the location from where those operations originate.

1.2 Methodology and Results

The comparative evaluation in potential impacts to surface water discharges from ADF application was performed by using historic collection efficiency data from the Glycol Recovery Program and modeling those collection efficiencies against the anticipated changes in deicing activity location for each alternative. The glycol recovery data was categorized based on deicing locations and spent ADF collection areas. A total of nine areas were used, which included five areas around Terminal 1-Lindbergh associated with plug and pump systems, the Terminal 2-Humphrey ramp, the Terminal 2-Humphrey remote deicing area, the dedicated deicing pads, and the "cover and sweep" glycol recovery vehicle areas. The areas are identified in **Table M.1.2**.

Historic collection efficiency data from the past three seasons was compiled and an average collection efficiency assigned for each of the nine locations. It was assumed that the collection efficiencies of these areas will remain constant in 2020. For purposes of evaluating the Airlines Remain Alternative and the Airlines Relocate Alternative against the No Action Alternative, two "new" areas were also identified - the new pavements associated with the G Concourse and Terminal 2-Humphrey expansions. Collection efficiencies were assigned to these new areas based on best professional judgment and the expectation that efficient at-gate PnP collection systems will be a part of the pavement design and therefore result in higher than average PnP collection efficiencies.

Table M.1.2

Performance of Glycol Recovery Program
(Three-Year Average: 2008-09 through 2010-11 Season)

Deicing/Collection Area	Glycol Applied (gal)	Glycol Collected (gal)	% Collected
C Concourse PnP	31,512	2,428	7.4%
D Pod & North E Concourse PnP	95,463	12,521	12.9%
Throat Area PnP	51,537	19,098	38.7%
South F Concourse PnP	46,901	9,320	17.5%
G Concourse PnP	51,045	9,192	26.1%
G Concourse PnP *New Gates*			*40.0%*[1]
Deicing Pads	1,044,088	575,695	54.7%
Terminal 2-Humphrey PnP	35,534	635	2.1%
Terminal 2-Humphrey PnP *New Gates*			*40.0%*[1]
T2 Remote PnP	5,338	3,642	63.4%
Cover and Sweep	89,924	13,258	15.1%

Notes:

(1) Assumes new pavement areas designed for glycol collection. Actual results may vary based upon type of aircraft, deicing frequency and method of application.

Source: Liesch Associates, Inc.

As can be seen in the table above, the location at which deicing activity occurs can impact the success of the collection program. There are many factors that can affect the collection efficiency of a collection area, some of which are related to the collection area itself, others that may be a byproduct of the ADF application methods used by the tenant. Due to the difficult and subjective nature of quantifying differences between deicing tenants, it has been assumed that collection efficiencies will remain constant based on location. Liesch believes this is an appropriate assumption given the locations that are subject to the greatest potential changes between the three alternatives.

The 2020 gate schedules modeled by HNTB Corporation for this EA were then utilized to determine departure gates for the three alternatives. The gate schedule information was provided for a “typical” day given the conditions of each of the alternatives. Each departure gate was then assigned a deicing location based on a three-year history of deicing preferences used by the various tenants. Essentially, for all non-Delta (and regional partners) tenants, it was assumed that at-gate deicing would remain the primary location for deicing (with the exception of a small fraction of Terminal 2-Humphrey remote location deicing used by Terminal 2-Humphrey tenants). Delta and their regional partners would continue to conduct the vast majority of their deicing at the dedicated deicing pads and remain the only tenants utilizing the deicing pads.

Deicing area allocation was based on the following assumptions:

- All regional aircraft originating from the A Concourse, B Concourse, and Gates C16 through Gates C27 would deice at the 30R Deicing Pad.
- Delta and their regional partners would continue to deice approximately 86% of all aircraft that are deiced at one of the five deicing pads.
- Delta aircraft were assigned proportionally from their respective departure gates to the dedicated pads based on the information above.
- Terminal 2-Humphrey remote deicing would be used by Terminal 2-Humphrey deicing tenants with the same proportion of activity as is currently occurring.
- Each daily departure was considered a potential deicing operation.
- The total number of daily departures did not change between the three alternatives.

The results from the deicing area allocation can be seen in **Table M.1.3**.

Table M.1.3

Percent of Potential Daily Deicing Operations at Each Collection Area

Deicing/Collection Area	No Action Alternative	Alternative 1 - Airlines Remain	Alternative 2 - Airlines Relocate
C Concourse PnP	2.3%	1.7%	1.6%
D Pod & North E Concourse PnP	9.7%	8.1%	1.6%
Throat Area PnP	5.1%	5.8%	2.2%
South F Concourse PnP	1.5%	1.5%	1.5%
G Concourse PnP	2.6%	2.6%	2.0%
G Concourse PnP *New Gates*	0.0%	1.1%	0.0%
Deicing Pads	57.4%	57.4%	57.4%
Terminal 2-Humphrey PnP	7.2%	4.6%	8.1%
Terminal 2-Humphrey PnP *New Gates*	0.0%	3.1%	11.3%
T2 Remote PnP	0.4%	0.3%	0.5%
Cover and Sweep	13.8%	13.8%	13.8%

Source: Liesch Associates, Inc.

The analysis conducted to arrive at the values included in Table M.1.3 above relate to the deicing area were a certain fraction of deicing operations is anticipated to occur under each alternative. However, collection efficiencies are related to and impacted by the volume of ADF applied at each location. Certain deicing locations have a history of application tendencies

based on the typical use in that area (i.e. deicing pads typically have higher average use per aircraft than at-gate deicing where frost busting applications happen frequently).

To account for this, the historic percent of total deicing fluid applied at each deicing location was determined based on the average of the past three seasons. These percentages were then applied to the No Action Alternative, as it is assumed that current deicing characteristics would exist unchanged for the No Action Alternative. The percent of total fluid application for the Airlines Remain Alternative and the Airlines Relocate Alternative were then determined based on the relative changes in deicing operation locations predicted in Table M.1.3. The results of this analysis are included in **Table M.1.4**.

Table M.1.4

Percent of ADF Application Volume at Each Collection Area

Deicing/Collection Area	No Action Alternative	Alternative 1 - Airlines Remain	Alternative 2 - Airlines Relocate
C Concourse PnP	2.2%	1.7%	1.5%
D Pod & North E Concourse PnP	6.6%	5.5%	1.1%
Throat Area PnP	3.6%	4.1%	1.5%
South F Concourse PnP	3.2%	3.2%	3.3%
G Concourse PnP	3.5%	3.5%	2.7%
G Concourse PnP *New Gates*	0.0%	0.5%	0.0%
Deicing Pads	71.9%	71.9%	71.9%
Terminal 2-Humphrey PnP	2.4%	1.6%	2.8%
Terminal 2-Humphrey PnP *New Gates*	0.0%	1.5%	8.5%
T2 Remote PnP	0.4%	0.2%	0.4%
Cover and Sweep	6.2%	6.2%	6.2%

Source: Liesch Associates, Inc.

Given the percent of ADF applied at each deicing location (Table M.1.4) and the collection efficiency for each deicing location (Table M.1.2), a total collection for each deicing area could be determined for the three alternatives that would quantify the changes in total collection efficiency for the Airport based on the alternate departure/deicing locations. The results of the analysis indicate that the two action alternatives will increase deicing collection efficiencies airport- wide and would therefore reduce the overall impact of aircraft deicing operations on stormwater discharges compared to the No Action Alternative. The results are shown in **Table M.1.5**.

The Airlines Relocate Alternative has the greatest increase in collection efficiency, with results indicating a 1.7% increase in overall collection of applied ADF compared with the No Action Alternative. This is due largely to the migration of deicing activities from the E Concourse PnP to

the new Terminal 2-Humphrey PnP systems that are assumed to have superior collection efficiencies. In addition, some deicing activity at Terminal 1-Lindbergh will migrate to the new Concourse G PnP areas associated with the new International Gate areas.

The Airlines Remain Alternative has a marginal increase in collection efficiencies, with results indicating a 0.7% increase in overall collection of applied ADF compared with the No Action Alternative. This is due to the migration of deicing activities from older PnP sites to the newer PnP pavements associated with the expanded G Concourse. In addition, the Airlines Remain Alternative includes three new Terminal 2-Humphrey gates that are assumed to include superior PnP systems that would provide greater collection than the current Terminal 2-Humphrey PnP system.

Table M.1.5

Change in Total ADF Collection from the No Action Alternative

Deicing/Collection Area	No Action Alternative % of Total Collected Gallons	Alternative 1 - Airlines Remain Change from No Action Alt.	Alternative 2 - Airlines Relocate Change from No Action Alt.
C Concourse PnP	0.2%	-0.04%	-0.05%
D Pod & North E Concourse PnP	0.8%	-0.14%	-0.71%
Throat Area PnP	1.4%	0.20%	-0.79%
South F Concourse PnP	0.6%	0.00%	0.01%
G Concourse PnP	0.9%	-0.01%	-0.22%
G Concourse PnP *New Gates*	0.0%	0.21%	0.00%
Deicing Pads	39.4%	0.00%	0.00%
Terminal 2-Humphrey PnP	0.1%	-0.02%	0.01%
Terminal 2-Humphrey PnP *New Gates*	0.0%	0.58%	3.39%
T2 Remote PnP	0.2%	-0.08%	0.03%
Cover and Sweep	0.9%	0.00%	0.00%

Source: Liesch Associates, Inc.

1.3 Conclusion

The previous analysis indicates that in either of the 2020 action alternatives, changes in ADF application location will have a *beneficial* effect on surface water discharges as compared to the No Action Alternative. The analysis indicates that the construction of new deicing surfaces, assumed to be engineered with glycol containment as part of the design criteria, will provide superior spent ADF collection abilities than existing PnP systems.

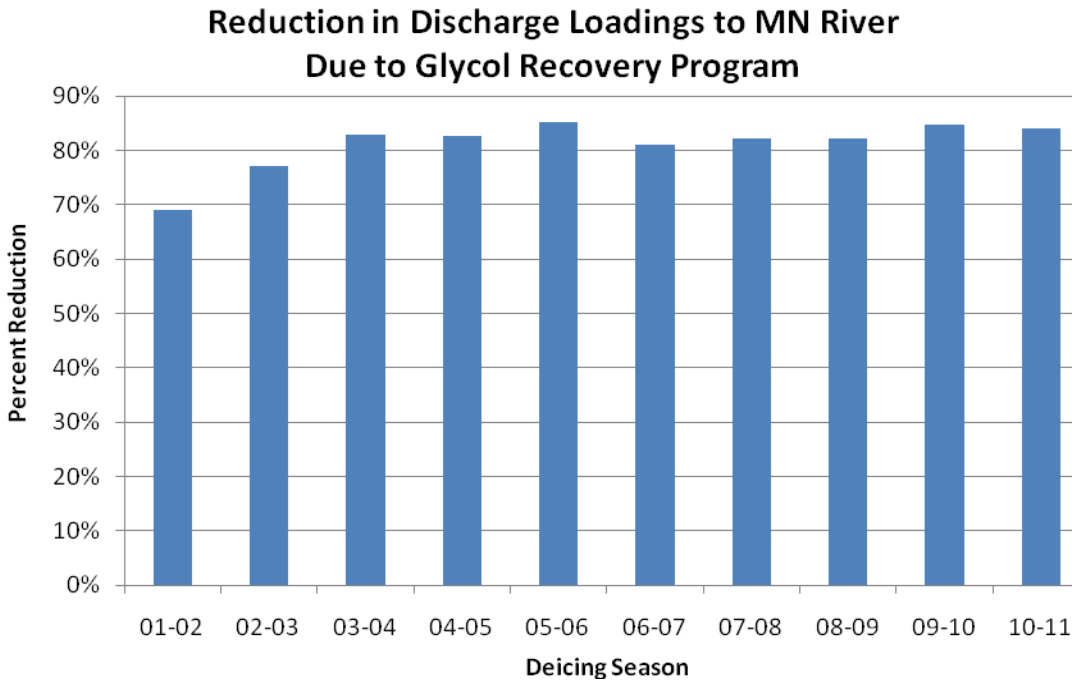
Further supporting the quantitative conclusions above is that both the Airlines Remain Alternative and the Airlines Relocate Alternative include the development of a new 30L Deicing

Pad. This deicing pad may increase containment efficiencies compared to the existing 30L Deicing Pad. The current pad is not equipped with the same collection design standards that have been employed at the other pads (grooved pavement, interior/exterior collection zones, contained snow melters, in-pad temporary storage, etc.). This new pad may also encourage wide-body deicing pad operations as the pad will be relatively close to the new international departure gates. These factors were not included in the previous analysis due to the inability to confidently quantify the potential benefits, however it is Liesch's professional opinion that these enhancements to the Glycol Recovery Program will result in increased collection performance.

It should be noted that the increase in collection from either the Airlines Remain Alternative or the Airlines Relocate Alternative will be modest given the dominance of Delta (and its regional partners) from a total operations perspective. The 2010 Improvements proposed will not have a major impact on Delta Airlines and their regional partners' overall deicing operations, which make up approximately 85.5% of all deicing fluid applied. It is anticipated that Delta and their regional partners will continue to apply the vast majority of their applied deicing fluid at the dedicated deicing pads, approximately 84% of their total volumes. This inherently minimizes the overall impact to Glycol Recovery Program performance due to changes in other tenants deicing locations.

In addition, the Glycol Recovery Program has a history of being consistently successful despite varying weather conditions, deicing conditions, fleet mix, and minor changes to deicing operations. Given that the primary goal of the program is to reduce organic loadings from the stormwater discharges originating from MSP deicing operations, the program has consistently performed at a high level. **Figure M.1-1** below demonstrates the past ten-years of Glycol Recovery Performance through various infrastructure changes and weather conditions. The changes proposed within the 2020 Improvements EA will provide a net benefit to the program through enhanced collection, but it is not anticipated to have a major impact on the overall success of the Glycol Recovery Program.

Figure M.1-1



The Glycol Recovery Program is constantly pursuing ways to improve overall collection performance, and the changes associated with either the Airlines Remain Alternative or the Airlines Relocate Alternative would achieve this goal. However, the ability for MSP to comply with NPDES/SDS Permit conditions will be greatly dependent on weather conditions in each given deicing season and the deicing practices of MSP tenants. In addition, the potential impact of future changes in tenant deicing either by migrating more activity to dedicated deicing pads or utilizing new application technology that reduces the overall volume applied has the greatest potential to significantly reduce glycol discharges to the Minnesota River.

2 Potential Fuel Spill Impacts

2.1 Background

Spill prevention, response, and clean-up are an integral part of airport operations at MSP for both the MAC and the tenant airlines. The MAC conducts fueling operations related to their field maintenance and fleet vehicles. Tenant airlines are responsible for aircraft fueling and the management of the Jet Fuel storage and delivery system. The largest potential for a major spill release is associated with the Jet Fuel hydrant system and associated tanks. Following a 2004 fuel hydrant release at the Lindbergh Terminal (renamed Terminal 1-Lindbergh), the MAC and MSP tenants worked cooperatively to develop the Integrated Spill Response Plan. This plan detailed the responsibilities and expectations of those entities operating at MSP that may encounter fuel spills. The plan included streamlined reporting and notification procedures and has been successfully implemented.

In addition to the immediate response, notification, and onsite clean-up that is related with the spill plan, the Airport has invested substantial resources in upgrading and maintaining spill control mechanisms within the Airport's stormwater ponds and discharge locations to minimize the potential for unwanted releases of petroleum impacts into the Minnesota River. These include:

- Oil absorbent and barrier booms maintained within pond forebays, around pond discharge structures, and within the Highway 5 Outfall channel.
- Stormwater pond forebays equipped with underflow discharge pipes.
- Stormwater discharge structures equipped with underflow discharge baffles.
- Remotely actuated gates on all three stormwater pond discharges to stop discharges in an emergency.
- Daily monitoring and recording of visual observations.

These fuel spill discharge prevention devices have been a documented success at capturing unwanted petroleum impacts from discharging into the Minnesota River.

2.2 Analysis and Conclusions

The 2020 improvements being proposed in the Airlines Remain Alternative and the Airlines Relocate Alternative do not include any major modifications to the stormwater conveyance systems near the end of pipe where the petroleum impact discharge prevention mechanisms are located. In addition, it is assumed that spill response, notification, and clean-up will continue to be part of MSP operations regardless of the alternative selected. It is assumed the total number of operations does not change based on the alternative selected, therefore the total number of fueling operations and total volume of fuel is not expected to change.

It is expected that the location of fueling activities will be different based on the alternative selected, in particular if the Airlines Relocate Alternative is selected and Terminal 2-Humphrey is significantly expanded. However, it is not expected this will impact petroleum surface water discharges as these fueling activities would move from the MSP Pond #2 drainage area to the MSP Pond #1 drainage area. The stormwater ponds serving these areas are equipped with essentially identical spill release prevention measures and therefore it is not expected there would be a material change in potential impacts from any of the three alternatives.

Based on this information there is no need to conduct a quantitative analysis of potential petroleum impacts on discharge water quality.