

APPENDIX D

POTW DISCHARGE APPLICABILITY AND FEE INDEX MEMO

Appendix D is supplemental to *ACRP Research Report 257: Guide for Treatment of Airport Stormwater Containing Deicers: Update* (ACRP Project 02-96, “Update ACRP Report 99: Guidance for Treatment of Airport Stormwater Containing Dicers”). The full report can be found by searching on *ACRP Research Report 257* on the National Academies Press website (nap.nationalacademies.org).

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TECHNICAL MEMORANDUM

TO: Joe Navarrete, ACRP
FROM: Gresham Smith w/LinerCo.
DATE: October 14, 2022
**SUBJECT: TASK 6 DELIVERABLE
POTW DISCHARGE APPLICABILITY AND FEE INDEX MEMO**
Gresham Smith Project No. 45435.00

OBJECTIVE

The objective of this memo is to summarize considerations related to discharge fees for airports with current or potential future discharges of spent stormwater containing deicers to publicly owned treatment works (POTWs).

The memo presents the following:

- Results from a survey of the cost structure for airports discharging to POTWs, inclusive of surcharge rates for flow (volume) and Biochemical Oxygen Demand (BOD)
- A surcharge fee "index" based on the average cost to discharge a captured gallon of aircraft deicing fluid. The intent of the index is to provide a common baseline for the evaluation of competing spent deicer management alternatives
- Considerations related to discharge fees to assist airport decision-making on the use of "POTW Discharge" as a treatment technology within an airports' deicer management program.

The memo will be included as an appendix to the updated *ACRP Report 99* guidebook. The updated guide will separately include a section describing non-fee based considerations for use of the POTW Discharge treatment technology.

BACKGROUND

Many airports discharge stormwater containing deicers to POTWs as "industrial users" through a sanitary sewer discharge permit issued by the authority operating the POTW treatment facility. The industrial user discharge permit normally requires that dischargers, especially those classified as "Significant Industrial Users", pay a fee based on surcharge rates for the flow volume and mass of BOD discharged to the facility. The formulas for calculating rates usually require input of daily flow rate (mgd) and BOD concentrations above a specific threshold concentration. Typically, POTWs apply a common fee formula and surcharge rate structure to all industrial users, including airport dischargers.

Surcharges for other parameters (e.g., suspended solids) may also be required, but those are usually much less impactful for airports on the total fee paid to the POTW than surcharges associated with the high stormwater volumes and high BOD concentrations from the propylene glycol (PG) found in aircraft deicing fluid.

Industrial user permits also include a range of fixed charges that may account for permit issuance, compliance monitoring, administration, maintenance fees and other miscellaneous items. The rates evaluated in this memo are for mass and flow surcharges only; fixed charges intended to cover items such as laboratory analysis are not addressed in this memo and must be factored for a detailed analysis at an individual facility.

SURCHARGE RATE SUMMARY

Both POTW discharge fee calculation formulas and surcharge rates are known to vary considerably across the United States (U.S.) in terms of structure and range of cost per parameter. To support this research project, U.S. airports with known POTW discharges were contacted to provide information on the current surcharge rates. Thirteen airports responded to requests for information with the surveyed airports ranging from small to large hub facilities. **Table 1** provides a summary of the rates from the survey. A dash (“-”) indicates no value for a threshold or surcharge rate.

Table 1: Surcharge Rate Summary

Airport	Threshold BOD Concentration	Parameter Unit	BOD Surcharge (\$/#BOD)	Flow Surcharge (\$/CF) ¹
1	0	mg-BOD/L	\$0.181	\$0.0021
2	300	mg-BOD/L	\$0.280	-
3	275	mg-CBOD/L	\$0.337	-
4	250	mg-BOD/L	\$0.186	\$0.0111
5	varies	mg-BOD/L	\$0.288	\$0.0075
6	500	mg-COD/L	\$0.231	\$0.0165
7	275	mg-CBOD/L	\$0.502	-
8	220	mg-BOD/L	\$0.279	\$0.0150
9	240	mg-BOD/L	\$0.435	\$0.0524
10	300	mg-BOD/L	\$0.430	\$0.0535
11	240	mg-BOD/L	\$0.419	\$0.0657
12	250	mg-CBOD/L	\$0.450	\$0.0792
13	250	mg-BOD/L	\$1.266	\$0.0703

¹ CF = Cubic Foot

Of particular note in the **Table 1** data is the wide range of both BOD and flow surcharge flow rates among POTWs. The highest BOD surcharge rate is seven times more than the lowest rate, although the highest BOD surcharge rate (\$1.266/lb) was notably outside the range of other values. The highest flow-based rate is 10 times more than the lowest rate, with three POTWs not applying a flow surcharge rate. Based on the 13 surveyed airports, the average surcharge rate for BOD is \$0.407/#BOD and \$0.034/CF for flow.

While surcharge rates (\$ per pound or gallon) are an important criterion, the total fees for POTW discharges are a function of both the surcharge rates and the quantity discharged. To illustrate more clearly the relative impact of the varying flow and BOD surcharge rates across the surveyed airports, the rates in **Table 1** were applied to a common set of discharge conditions and graphed. **Figure 1** illustrates these calculated results of applying the surcharge rates to a hypothetical seasonal discharge of 200,000 gallons of neat propylene glycol at low (500 mg-PG/L) and high

(5,000 mg-PG/L) concentrations. The stormwater flow volumes in the calculations were determined by dividing the BOD load from the PG, by the PG concentration (500 mg/L = 383 MG; 5,000 mg/L = 38.1 MG). Both the BOD and volume (Vol) surcharge fees were calculated for each of the airports surveyed from these values. The costs in the **Figure 1** chart are stacked to provide an indication of the relative impact of flow vs. load surcharges. Note that each scenario, the airport's load surcharge rate does not change and the volume surcharge is inversely related to the concentration. The intent of the graph is to provide a relative comparison of total fees paid based on the varying surcharge rates.

For the high concentration (5,000 mg/L) scenario, the range of surcharge costs are between \$299,938 and \$1,122,719 with the outlier airport at \$2,381,233. The average cost is \$3.84/gallon of PG. For the lower concentration (500 mg/L) scenario, the range of surcharge costs was between \$395,576 and \$5,620,537. The average cost is \$9.49/gallon of PG. The difference in average cost per gallon of PG between low and high concentration scenarios reflects the impact that the volume surcharge has on discharge of low concentration SADF.

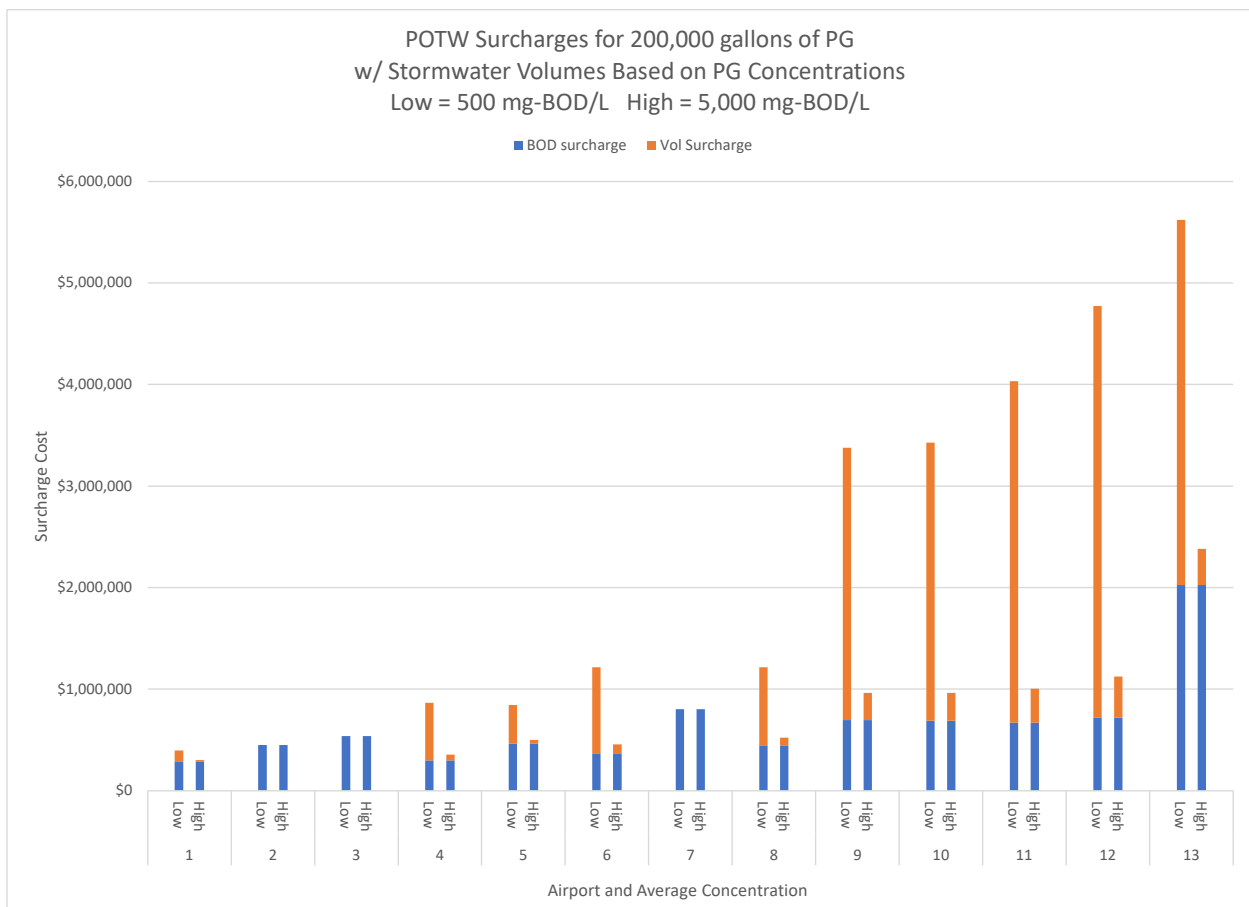


Figure 1: Chart of Hypothetical Surcharges for Various Airports

SURCHARGE INDEX

In the US, deicing fluid is primarily composed of PG, which has a density of ~64.3 lb/cf (Wikipedia). The BOD content of one pound of PG is ~0.93 lbs BOD/lb PG (Airport Cooperative Research Program, 2012). Accounting for density and BOD value, one gallon of PG is equivalent to approximately 8.0 lbs-BOD.

The average BOD surcharge rate for the 12 airports in **Table 1** is \$0.407 \$/lb-BOD with a maximum of \$1.266/lb-BOD and minimum of \$0.181 lb-BOD. Using the BOD value of PG, the related costs to dispose of gallon of PG to POTWs ranges from \$1.45 to \$10.13/gal-PG an average of \$3.26/ gal-PG.

Not all airports have a surcharge rate associated with the flow volume of SADF discharged. However, the average is \$0.030/cf discharged to POTWs for airports that also have a surcharge on volume discharged.

Using the data from **Table 1**, an average cost of disposal for captured PG to a POTW was developed based on the concentration of PG captured and discharged to the sewage plant. The PG concentration from captured SADF must be accounted for in calculating surcharges for the mass of BOD and flow in airport discharges. The concentration varies greatly depending on several factors including deicing practices, airport climate, and the weather. For example, airports in dry climates or airports that employ dedicated deicing pads will have higher concentrations while airports in wetter climates or that employ at-gate deicing will experience some dilution.

The plot represents the average cost of disposal for the airports surveyed based on only flow and BOD surcharge rates as it varies with PG concentration (excluding fixed (non-surcharge) fees).

The reduction in average cost of disposal to POTWs as PG concentrations decrease shown in **Figure 2** reflects the impact of the flow surcharge rate imposed on some airports because of the reduced flow volume; higher concentration typically leads to reduce disposal volume and a lower flow surcharge. The curve asymptotically approaches the average surcharge rate of \$3.26/gallon of PG captured as PG concentrations increase and the flow surcharge component approaches zero.

The curve illustrates the value in minimizing the volume of stormwater contaminated by SADF when discharging to POTWs. For airports that employ measures to minimize dilution below 2,000 mg-PG/L, average costs for POTW discharges are below \$5/gal of captured PG, whereas airports that manage more dilute SADF can see average costs in the range of \$5-10/gal of captured PG or higher.

The curve in **Figure 2** can also be used to support early-stage comparisons of the cost to dispose of SADF to a POTW vs. treating onsite. If the average PG concentrations are greater than 1,000 mg/L, the costs for discharge to a POTW are relatively low on a per gallon basis, resulting in the POTW discharge option often being more cost effective than onsite treatment. However, if a given airport has average PG (BOD) concentrations less than 1,000 mg/L, fees to the POTW can increase exponentially as average concentration decreases, resulting in a greater likelihood that onsite treatment may be a more economical option than discharge to a POTW.

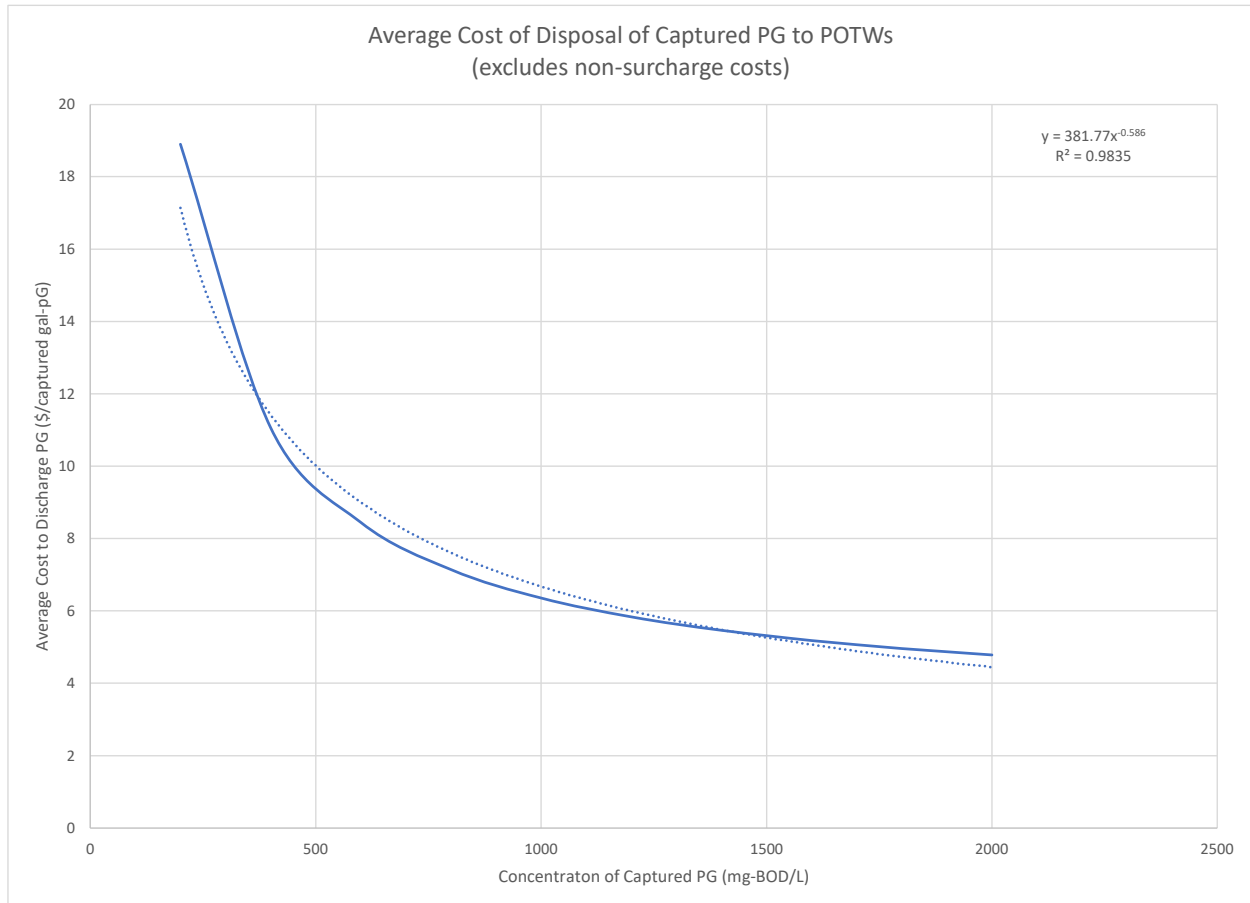


Figure 2: Average Cost of PG Discharge vs. Concentration

SUMMARY OF FINDINGS

1. The BOD and flow surcharge rates charged by POTWs (\$ per pound or gallon) to airports vary widely across the industry.
2. The total fee paid by airports for discharging to POTWs is affected by both the surcharge rates and the amounts discharged. As such the total fees vary widely based on climate, weather, deicer use, drainage areas and the surcharge rates. This results in the economics of the POTW discharge as a deicer treatment option a highly situational assessment.
3. For some airports discharging to POTWs, the flow volume discharged has a much greater impact on total fee than the BOD surcharge. POTWs may not explicitly consider the uniqueness of airports as large stormwater volume dischargers when setting their rates. As such airports with high flow volumes may be paying a disproportionately high proportion of total industrial user fees received by POTWs.

4. As is the case with other deicer treatment technology options, reducing the total volume of stormwater impacted by stormwater through upstream management can have a large impact on reducing total costs for POTW discharges.
5. The curve in **Figure 2** showing the average cost of discharging to a POTW per gallon of applied PG based on average PG concentration can be used as an initial point of comparison when comparing POTW discharge to other treatment technology options.
6. In general, airports with average PG (BOD) concentrations of greater than 1,000 mg/L are likely to find discharge to POTW as the most economical option (in some cases, factors other than economics drive decisions to use onsite treatment). At lower average concentrations, onsite treatment options likely become more economically viable. However, this analysis should be applied using site-specific rates for a given airport's POTW.

REFERENCES

Airport Cooperative Research Program. (2012). *ACRP Report 72: Guidebook for Selecting Methods to Monitor Airport and Aircraft Deicing Materials*. Transportation Research Board, Washington, DC.

Airport Cooperative Research Program. (2013). *ACRP Report 99: Guidance for Treatment of Airport Stormwater Containing Deicers*. Transportation Research Board, Washington, DC.