The Environmental Impacts of Airport Deicing - Water Quality

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14. ABSTRACT

The Clean Water Act requires EPA to promulgate effluent limitation guidelines and standards that reflect pollutant reductions that can be achieved by categories or subcategories of industrial point sources using specific technologies, including airports. On August 28, 2009 EPA published a proposed rule recommending that best available technology (BAT) be installed at most large airports capable of collecting up to 60% of aircraft deicing fluids and treating the collected fluids. A public comment period was provided until February 26, 2010. EPA is now in the process of finalizing the rule. When performed without adequate discharge controls in place, airport deicing operations can result in significant adverse impacts on water quality, such as reductions in dissolved oxygen (DO), which can lead to fish kills and other aquatic ecosystem problems. Aircraft deicing fluids also contain additives, and some of these have potential aquatic life and human health impacts due to their toxicity. In addition, deicing fluid discharges have been shown to affect drinking water treatment processes and the quality of finished drinking water. This presentation will discuss the data and information on the environmental impacts of deicing discharges EPA has accumulated during the rulemaking process.

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THE IMPACTS OF AIRPORT DEICING OPERATIONS ON WATER QUALITY

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EPA Environmental Impact Assessment Document

- ***Environmental Impact and Benefit Assessment for Proposed Effluent Limitation Guidelines and Standards for the Airport Deicing Category***

EPA-821-R-09-003

July 2009

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U.S. Commercial Airports - National Estimate of Aircraft Deicing and Anti-Icing Fluid Use/Purchase *

Chemical	Total Airport (million gallons/year)	Percent
Type I Propylene Glycol Aircraft Deicing Fluid	19.3	77.1
Type IV Propylene Glycol Aircraft Anti-Icing Fluid	2.8	11.4
Type I Ethylene Glycol Aircraft Deicing Fluid	2.5	10.3
Type IV Ethylene Glycol Aircraft Anti-Icing Fluid	0.3	1.2

Source: US EPA Airline Deicing Questionnaire (2006).

*EPA primarily relied on ADF purchase records to estimate annual ADF usage levels. See US EPA (2009) for additional details.

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U.S. Commercial Airports - National Estimate of Pavement Deicer Chemical Use

Pavement Deicer Chemical	**Estimated Total Airport Use** (tons/year)
Potassium acetate	22,538
Urea	4,127
Propylene glycol-based fluids	3,883
Sodium acetate	3,100
Sodium formate	1,117
Ethylene glycol-based fluids	774

Source: US EPA Airport Deicing Questionnaire (2006).

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Deicing/Anti-Icing Chemicals

- Applied outdoors
- Designed to slough off
- Deposits throughout airfield
- Collects in storm sewers
- ADFs mostly composed of glycol
- Approximately 99 chemicals that may be components or decay products of ADFs and airfield pavement deicers

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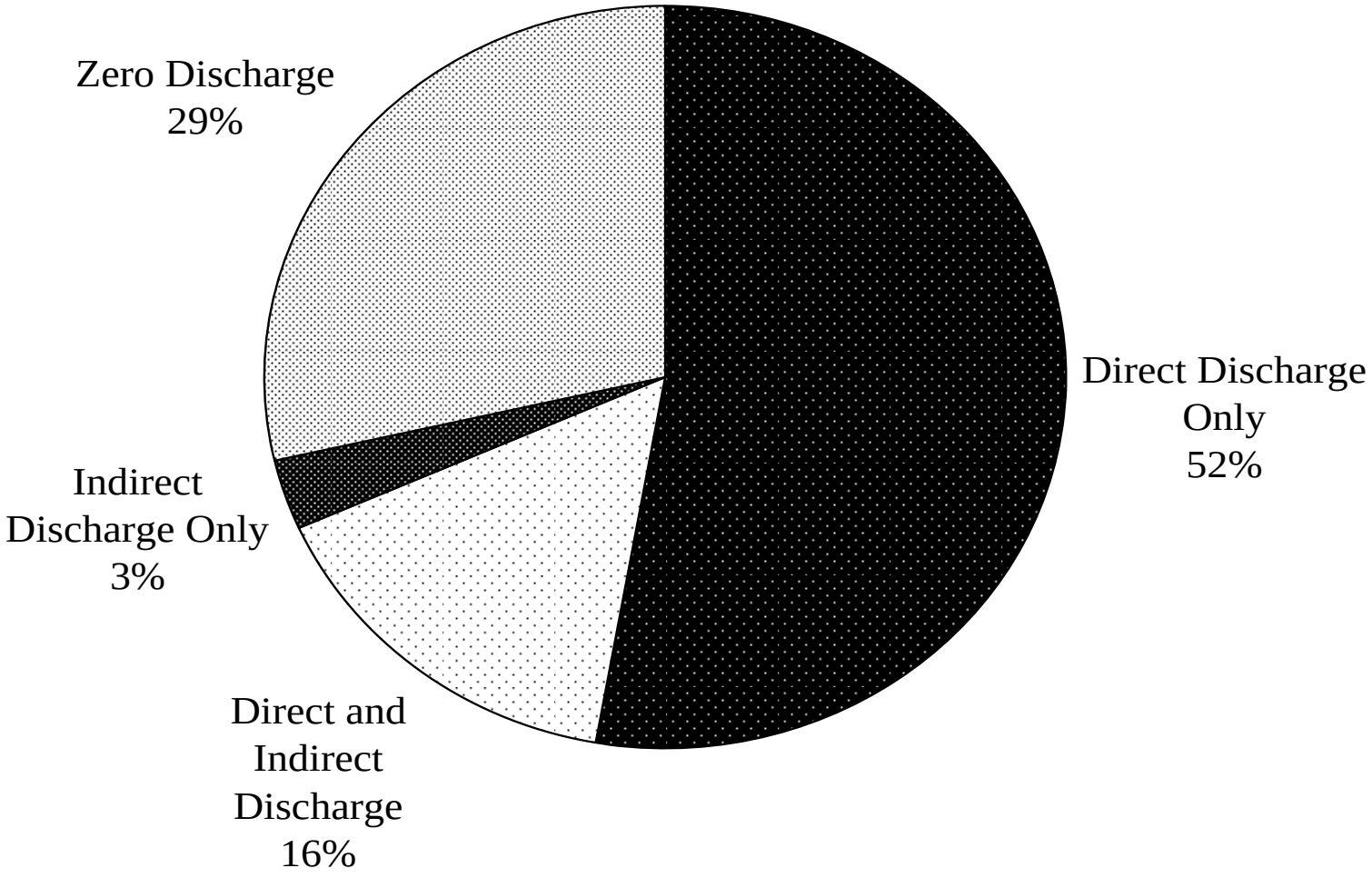
Discharge Status of Airports



Airport Discharge Overview

- **383 Primary Commercial airports in U.S. - about 320 of these conduct occasional or frequent deicing operations.**
  - Aircraft deicing:
    - Of the 24 million gallons of Aircraft Deicing Fluid (ADF) sprayed on aircraft annually…….
    - 36% of this ADF is discharged untreated, resulting in 127 million lbs. of **Chemical Oxygen Demand (COD)**
  - Runway deicing:
    - Of the 7.2 million lbs. of urea applied to runways most gets into storm water runoff
      - Urea generates **ammonia** and **COD**
- **Airport industry is a growing industry.**
  - FAA projects 50-75% percent growth in airline travel by 2020

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Estimate of National Baseline COD Discharges from ADF Application Sites and Airfield Pavement Deicing by Airport Hub Size Category

Airport Hub Size	ADF Application Site COD Discharge (pounds/year)	Pavement Deicer COD Discharge (pounds/year)
Large	70,287,571	36,926,292
Medium	28,433,086	10,337,507
Small	9,863,368	8,097,151
Nonhub	17,382,976	6,232,568
General Aviation/Cargo	2,412,898	1,213,047
Total	**128,379,900**	**62,806,565**

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Estimate of National Baseline Ammonia Discharges from Airfield Payment Deicing by Airport Hub Size Category

Airport Hub Size	Ammonia Discharge (pounds/year)
Large	1,001,238
Medium	1,022,690
Small	1,577,948
Nonhub	1,051,967
General Aviation/Cargo	NA
Total	**4,653,843**

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Overview of Impacts

- COD consumes oxygen in a waterbody. Depressed oxygen levels harm aquatic organisms and allow toxic chemicals to become bioavailable.
- COD discharged from a large airport in a single day can be equal to one day's worth of **raw sewage from a city of 15 million people**

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Overview of Impacts

- **Documented impacts include:**
  - low oxygen conditions in surface waters (COD/BOD)
  - waterbody color, odor, and foam concerns
  - fish kill events; damaged aquatic communities or absence of aquatic life
  - groundwater contamination
  - drinking water source contamination (surface water); drinking water taste & odor problems
  - aesthetic impacts to surface waters, including foaming, noxious odors, and discoloration
  - low-grade illness complaints
  - complaints of headaches and nausea by people exposed to deicing stormwater odors

- **Most documented impacts have been in smaller streams**

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Receiving Water Body Type

- **Assimilative Capacity varies:**
  - Small streams
  - Lakes
  - Estuaries
- According to available data, 62% of initial receiving waters have a flow rate of 20 cubic feet per second (cfs) or less.

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Groundwater Resources Potentially Impacted

- Airport grounds above an aquifer – **67**
  - Drinking water aquifers – **30**
- Within 10 miles downstream of deicing outfall:
  - Public water supply drinking water intakes - **16**
  - Parks - **41**

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Additives - Still A Question

Aquatic toxicity from:

- Corrosion inhibitors, flame retardants - Triazoles, esp. benzotriazoles
- Surfactants, esp. APEs (alkyl phenol ethoxylates)
  - Chronic toxicity:
    - Potential endocrine disruption from APE biodegradation products
- Thickeners
- Others

Documented Impacts

- **Impacts at 34 airports, possible documentation for 12 more**
- **Of the 50 airports that do the most deicing:**
  - 25 have impact documentation
  - 11 have possible impacts documented
  - 25 or more discharge to §303(d)-listed impaired waters (oxygen depletion, ammonia, nutrients, nitrogen, total toxicity, salinity, toxic organics, aesthetics, biological integrity, or "cause unidentified“)

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Documented Environmental Impacts Associated with Airport Deicing Discharges

Impact	Connection to Airport Deicing Definitive	Connection to Airport Deicing Suggested	Total Number of Studies
COD or BOD	11	5	16
DO	10	10	20
Nutrients	8	9	17
Fish Kill	8	10	18
Other Organisms	25	20	45
Health	4	4	8
Drinking Water	1	7	8
Foam	4	6	10
Odor	14	17	31
Color	11	9	20
Permit Violations	17	10	27

303(d) Impairment Categories for Fresh Waters Receiving Direct Airport Deicing Discharges

303(d) Impairment Category	Number of Airports with Impairment	Airport Deicing Pollutant Potentially Contributing to Impairment
Algal Growth	1	Yes
Ammonia	7	Yes
Cause Unknown	6	Yes
Cause Unknown - Impaired Biota	4	Yes
Fish Consumption Advisory - Pollutant Unspecified	2	Yes
Nutrients	8	Yes
Organic Enrichment/Oxygen Depletion	16	Yes
Salinity/TDS/Sulfates/Chlorides	3	Yes
Total Toxicity	6	Yes
Toxic Organics	6	Yes

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