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Glycol Mitigation Strategies: The Canadian Approach

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Transport Canada Transports Canada

Canada

Outline

- Safety vs. Environment
- Consultation Process
- Issues
  - Science
  - Regulatory
  - Management
- CEPA Guideline
- Airport Responsibilities
- Air Carrier Responsibilities
- Glycol Management Plans
- Monitoring
- Partnerships / Guidance

Balance

- Safety
- Environment

Safety

- **Canadian Aviation Regulations**
  - **Air Regulations**
  - **Air Navigation Orders**

Environment

- Fisheries Act
- CEPA Guideline
- CCME Guideline
- Provincial/Municipal

Dryden Accident
March 10, 1989


C-FONC

Moshansky Commission

Consultation Process

- Government
- Industry

Working Group

Issues

- Science
- Regulatory
- Management

Environmental Impacts

- Glycol has a high biochemical oxygen demand (BOD)
- Degradation of glycol in water is an oxygen depleting process
- Water can become oxygen deficient and unsuitable for aquatic life
- Toxic to aquatic organisms

Environmental Impacts

- Large volumes of ethylene glycol in surface water can lead to oxygen depletion which can threaten the survival of aquatic life
- Low oxygen levels can cause a variety of lethal and non-lethal effects to aquatic organisms, with young fish being more sensitive than older fish

Environmental Impacts

Toxicity of ethylene glycol-based products vs pure ethylene glycol[a]

Toxic endpoint	Pure Ethylene Glycol (mg/L)	Ethylene Glycol-Based Products (mg/L)
48-h LC_{50}[b] for water flea	34,440	13,140
96-h LC_{50} for fathead minnow	72,860	8,050
Survival for water flea	24,000	8,400
Reproduction for water flea	8,590	< 3,330
Survival for fathead minnow	32,000	6,090
Growth for fathead minnow	15,380	< 3,330

[a]Pillard, D.A. (1995).

[b]Concentration at which 50% of the exposed population die

National Airports System

- Composed of 26 airports within Canada
- These airports include all national, provincial and territorial capitals as well as airports with annual traffic of 200,000 passengers or more
- These airports serve 94% of all scheduled passenger and cargo traffic in Canada

Canadian Environmental Protection Act Glycol Guideline

- Pursuant to Section 53 of the Act, the responsible Federal department shall ensure that discharges of total glycols from aircraft de-icing and anti-icing activities at federal airports to surface waters does not exceed 100 milligrams per litre (100 milligrams of glycol per litre of stormwater effluent)

Canadian Environmental Protection Act Glycol Guideline

- **“Federal airport”** means all airports owned and/or operated by the federal government

- **“Total glycols”** means the sum total of ethylene, diethylene and propylene glycols measured in accordance with specified sampling and analytical methods

CEPA Guideline

- Legally binds Transport Canada to comply with the proposed level

- Reduces the risk of airport operational staff being charged with violations under Section 36 of the *Fisheries Act*

Responsibilities

Transport Canada Responsibilities

- Responsible as landlord for the ownership of the land

Airport Authorities Responsibilities

- Responsible for the infrastructure associated with stormwater run-off
- Responsible for the monitoring of stormwater run-off
- Responsible for the approval of de-icing procedures and mitigation plans

Air Carriers Responsibilities

- Responsible for the de-icing of aircraft and must determine when de-icing/anti-icing action is required
- Must ensure that the usage of the de-icing fluids are not in contravention of provincial and federal environmental legislation
- Responsible for funding remedial action plans


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Aircraft De-icing/Anti-icing Mitigation Plan

- **Define**
  - Facilities
  - Equipment
- **Management of glycol wastes**
  - Collection
  - Handling
  - Transportation
  - Storage
  - Processing
  - Disposal

Aircraft De-icing/Anti-icing Mitigation Plan

- **General Information & Site Specifications**
  - Name of De-icing Operator
  - De-icing Season
  - Fluid Volumes (type of fluid, mixture ratio)
  - Surface type (asphalt, concrete)
  - Location of Storm Drains, ponds, creeks and glycol tanks


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Aircraft De-icing/Anti-icing Mitigation Plan

- **Glycol Storage & Handling**
  - Tanks to meet CCME Environmental Code of Practice
  - How transported to site
  - Location of storage and heating facilities (including spill containment)
  - Spill response procedure

Aircraft De-icing/Anti-icing Mitigation Plan

- **Application**
  - Location of de-icing
  - Equipment description
  - Measures taken to reduce volumes of fluid

- **Containment of Effluent**
  - Description of containment measures
  - Estimate effectiveness of containment system

Aircraft De-icing/Anti-icing Mitigation Plan

- **Collection & Storage**
  - Description of collection measures and spill contingency plans
  - Collection equipment

Glycol Monitoring

- Since 1994, airports have been monitoring and reporting results of glycol usage
- Many airports have automatic sampling stations to collect samples of stormwater
- Automatic sampling stations collect both event and composite samples and continuously record flow rates
- These stations are located in the most active areas of the airport: aprons, runways, taxiways


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Glycol Monitoring

- Composite samples can be collected over a specific time period and are analyzed for various properties including pH, BOD, total glycols, total suspended solids etc.
- Airports without permanent water monitoring facilities may use grab or composite samples
- Grab samples are taken at a selected location, depth, and time and then analyzed
- Airports then send the results to Transport Canada

Glycol Monitoring Results

- Environmental authorities must evaluate the toxicity of ethylene glycol
- Since airports are the largest users of ethylene glycol, it is important to determine whether any trends have been established as to:
    - usage rate
    - glycol residuals in stormwater
    - excursions from the voluntary guidelines
    - magnitude of the excursions

Data Handling

- Collection
- Verification
- Compliance Assessment
- Reporting
- Response

Data Parameters - Annual

- Biochemical Oxygen Demand - BOD (Organics)
- Chemical Oxygen Demand - COD
- Oil & Grease (Operations)
- Phenols (Solvents, Petrochemicals)
- Total Organic Carbons (Fuel, Glycol)
- Volatile Organics (Solvents, Fuels)
- Alkalinity
- Total Suspended Solids

Success

- Since 1994, there has been a downward trend in the number of glycol exceedances due to better glycol management and glycol mitigation plans
- Airport authorities have refined de-icing systems, and air carriers have refined their plans and procedures
- Airports have been in compliance with the Fisheries Act since the promulgation of the CEPA Glycol Guideline

Glycol Analysis

- The number and magnitude of the exceedances have been lowered
- At Toronto's Pearson International Airport, the number of exceedances in 2000-2001 was 16 compared to 319 in 1992-1993

% Glycol Exceedances

Partnerships / Guidance

- TP 14052 “Guidelines for Aircraft Ground Icing Operations”
- ARP 5660 “Deicing Facility Operational Procedures”
- Transportation Research Board
  - ACRP Project No. 10-01 “Optimizing the Use of Aircraft Deicing and Anti-icing Fluids”
  - ACRP Project 02-01 “Alternative Aircraft and Airfield Deicing and Anti-icing Formulations With Reduced Aquatic Toxicity and Biological Oxygen Demand”

Summary

- Safety / Environment
- Consultation
- Management
- Communicate
- Continual Improvement