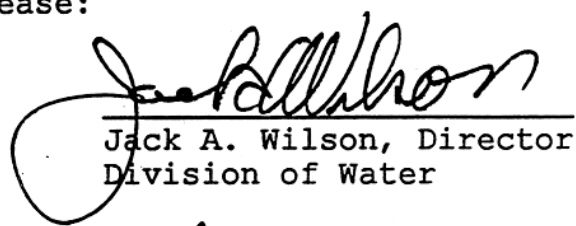


**Impacts of Deicing Fluids on Elijahs and Gunpowder Creeks
Boone County, Kentucky**

**KENTUCKY DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF WATER**

Frankfort, Kentucky

This report has been approved for release:



Jack A. Wilson, Director
Division of Water

Feb 5, 1998

Date

**Impacts of Deicing Fluids on Elijahs and Gunpowder Creeks
Boone County, Kentucky**

List of Contributors

David Leist, Report Preparation and Data Analysis

Scott Hankla, GIS Mapping

Data Collection Conducted By:

Florence Regional Office:

Kevin Flowers
Gretchen Bartley
Bob Beebe
Todd Giles
Eric Ratcliff

&

Cincinnati/Northern Kentucky International Airport

The Natural Resources and Environmental Protection Cabinet does not discriminate on the basis of race, color, national origin, sex, age, religion, or disability and provides, on request, reasonable accommodations including auxiliary aids and services necessary to afford an individual with a disability an equal opportunity to participate in all services, programs, and activities.

**Impacts of Deicing Fluids on Elijahs and Gunpowder Creeks
Boone County, Kentucky**

Table of Contents

	Page
List of Contributors	i
List of Figures, Tables and Appendices	iii
Introduction	1
Description of Study Area	3
Airports and Deicing Fluids	6
Water Quality Impacts in Elijahs and Gunpowder Creeks	8
Establishing Total Maximum Daily Loads for Deicing Fluids .	17
Implementation of the Total Maximum Daily Loads	19
Summary	20
References	21

Figures

	Page
1) Map of Elijahs and Gunpowder Creeks, Boone County, Kentucky	2
2) Map of Sampling Stations	4

Tables

1) Sampling Stations	5
2) BOD Data in Elijahs and Gunpowder Creeks	9
3) Data from Station #1	10
4) Data from Station #2	10
5) Data from Station #3	11
6) Data from Station #4	11
7) Data from Station #5	12
8) Data from Station #6 (Control Site)	14
9) Data from Station #7	14
10) Data from Station #8	15
11) Data from Station #9	15
12) Data from Station #10 (Control Site)	16
13) Data from Station #11	16

Appendices

I) Discharge Permit Issued Feb. 19, 1997	22
II) Agreed Order Filed March 28, 1997	36

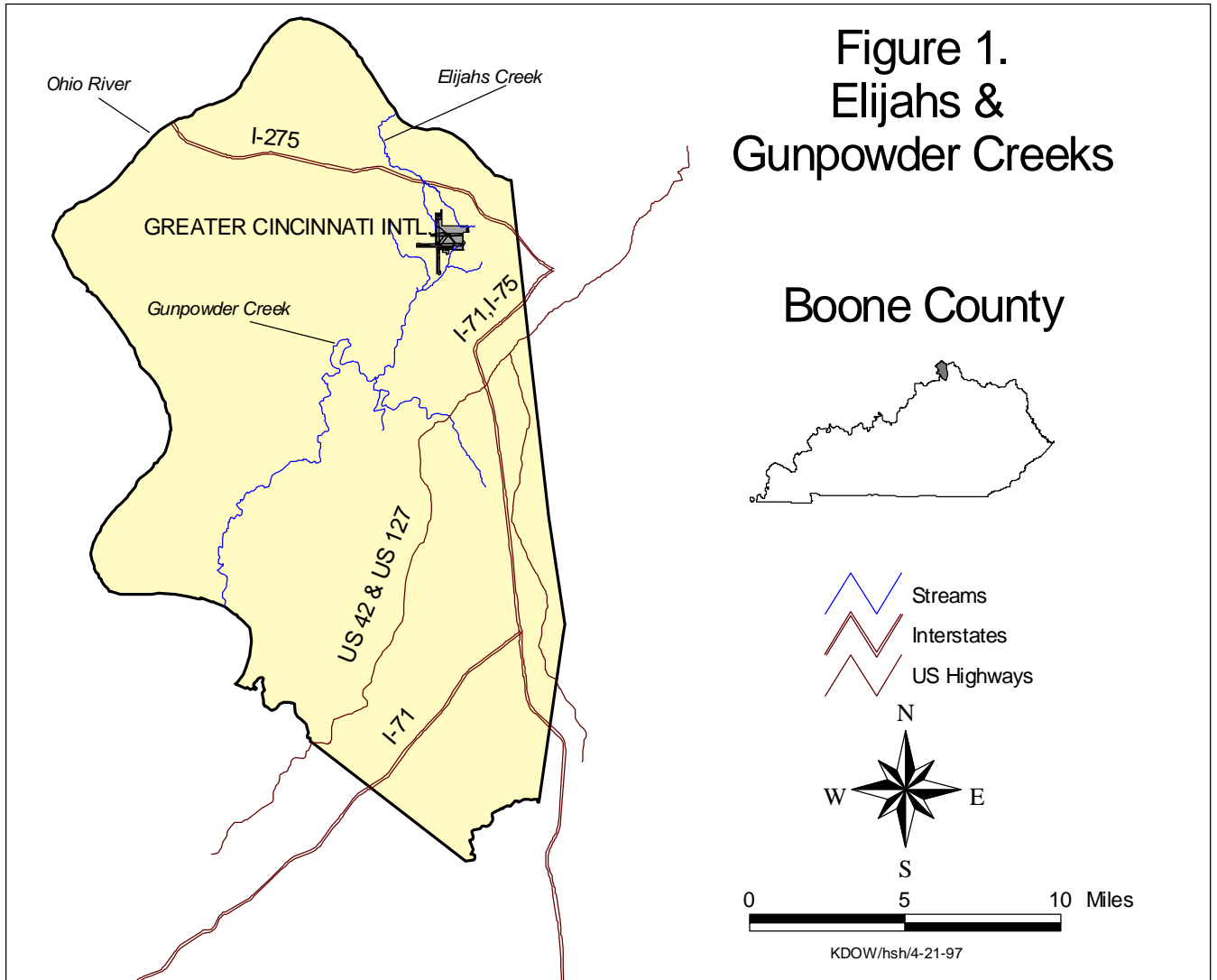
Introduction

Water quality in Elijahs and Gunpowder creeks in Boone County, Kentucky, has been severely impacted by deicing fluids from the Cincinnati/Northern Kentucky International Airport. The headwaters of both Elijahs Creek and Gunpowder Creek are located on airport property (Figure 1). In 1992, the Kentucky Division of Water (KDOW) began documenting this problem in Elijahs Creek. In 1993, the KDOW conducted a stream study and issued the report "Elijahs Creek Drainage Biological and Water Quality Investigation." This study found that Elijahs Creek, which drains the northern portion of the airport, had been severely degraded by intermittent discharges of ethylene glycol from the airport. Ethylene glycol, the main component of deicing fluids, creates a high biochemical oxygen demand and provides a high carbon source of food, which fuels extensive growths of *Sphaerotilus* bacteria. *Sphaerotilus* was found to cover the entire stream channel at two locations, crowding out indigenous forms of aquatic life. Decomposing *Sphaerotilus* caused the substrate of the channel to be anoxic. These nuisance conditions are in violation of Kentucky water quality regulations.

The KDOW cited the airport for polluting Elijahs Creek; and, in addition to paying a fine, the airport began to take remedial measures. Specific deicing pads were constructed for deicing fluids to drain into holding tanks. Fluids would then be pumped to the regional wastewater treatment plant, mixed with normal domestic wastewater, treated, and discharged to the Ohio River. Despite these efforts, water quality problems in Elijahs Creek persisted. In 1995, as a result of significant airport expansion, similar water quality problems began to be found in Gunpowder Creek, at the southern end of the airport.

Various meetings, enforcement actions, and additional sample collections were conducted during these years. The airport proposed several additional remedial measures and intensified monitoring efforts. The local media also became interested in this issue, and during these years several articles were published to keep the public informed of these problems. In 1996, the KDOW listed both streams as high priority in Kentucky's 303(d) list of waters not meeting designated uses. This listing requires the state to establish a Total Maximum Daily Load (TMDL) for deicing fluids and to implement solutions for these problems. This report is intended to satisfy these requirements.

Figure 1.
Elijahs &
Gunpowder Creeks



Description of Study Area

The headwaters of Elijahs Creek are located on airport property, and the stream then flows about five miles in a northwesterly direction to its confluence with the Ohio River. The entire length was listed (in the 1996 303(d) list) as impaired by deicing fluids. The U.S. EPA river reach number is 05090203-049. Drainage area is about 7 square miles, and the stream and its tributaries lie entirely within Boone County. This portion of the county has experienced rapid growth and development in the last 10 years, in some cases preceding sanitary sewer infrastructure. The local Sanitation District began constructing sewers to this area in the early 1990s, and during the period from 1994 to 1997 five package wastewater treatment plants were removed. These served small industries, a school, a church, and a subdivision. No other package treatment plants remain in the Elijahs Creek basin. The KDOW began stream sampling at two locations near the airport in 1992 and has conducted sampling at various other sites since that time. The airport also began collecting samples as a result of an Agreed Order with the KDOW. Six sampling locations are located in the Elijahs Creek drainage (Figure 2, Table 1). Elijahs Creek is classified for the warm water aquatic habitat and primary and secondary contact recreation stream use designations.

The main stem of Gunpowder Creek begins just west of the airport. Two headwater tributaries are located on airport property and receive storm water runoff from the southern half of the airport. Gunpowder Creek then flows about 20 miles to its confluence with the Ohio River. The 1996 303(d) report listed the length between milepoints 15.7 to 18.9 as impaired by deicing fluids, but this should be extended to at least mile 15.0, to the confluence of the South Fork of Gunpowder Creek. The South Fork of Gunpowder Creek is the major tributary, flowing about 8 miles from its headwaters to its confluence with Gunpowder, at mile 15.0. The total drainage area of Gunpowder Creek is about 58 square miles. The entire basin also lies within Boone County, with U.S. EPA river reach number 05090203-006. Five stream sampling sites are located in the upper portion of Gunpowder Creek, in and near the airport property (Figure 2, Table 1). The earliest sampling began in 1994.

Similar to Elijahs Creek, many areas of Gunpowder Creek have experienced growth and development without sanitary sewer infrastructure. The Sanitation District constructed sewers to portions of the basin in the early 1990s, and KDOW records indicate about 25 package wastewater treatment plants have been eliminated in the past few years. Several areas remain to be served, especially the area around the small town of Union, along a tributary of the South Fork Gunpowder Creek. Six package plants remain, and the KDOW has denied permits for other requested facilities in this area. Gunpowder Creek is classified for the warm water aquatic habitat and primary and secondary contact recreation use designations.

Figure 2. Sampling Stations

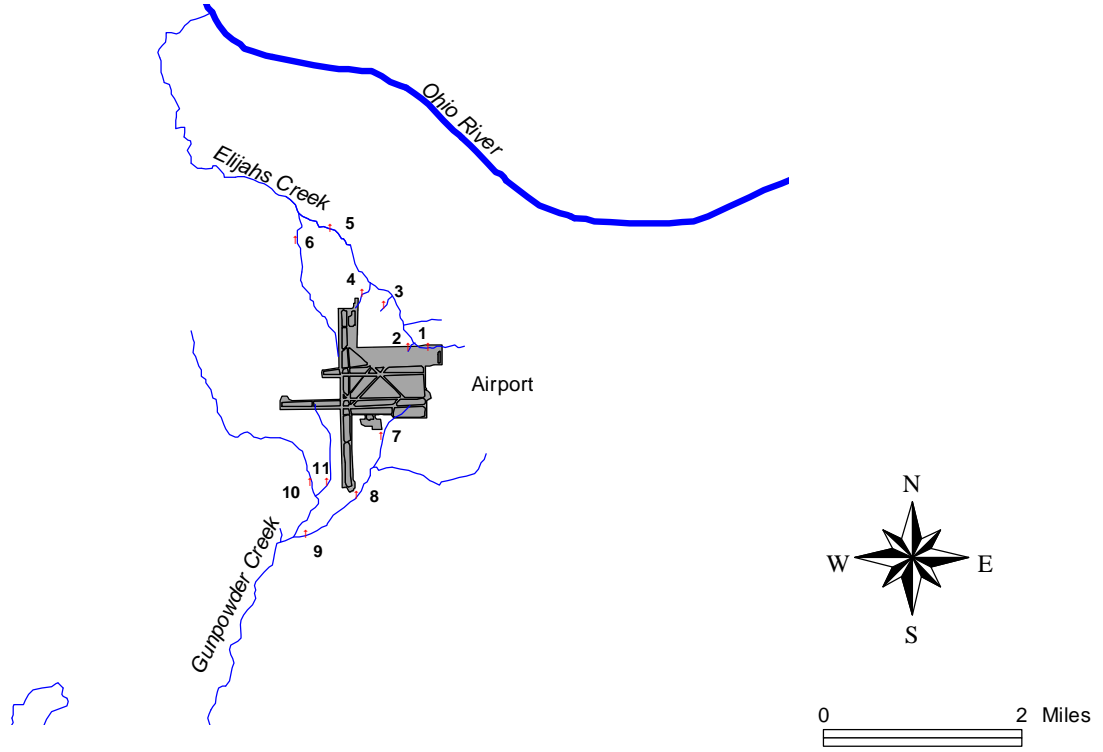


Table 1. Sampling Stations

<u>Station Number</u>	<u>Description</u>
1.	Culvert outfall behind airport police station. This storm sewer drains the eastern portion of airport property, which includes the Delta hangar, deicing pad 7, glycol storage building, filling area for deicing trucks, and the valve system that routes used deicing fluid to the comprehensive sewer.
2.	Outfall from the terminal area box culvert. Immediately downstream of the edge of the concrete pad and below the outlet of the storm water culvert that drains the Terminal I area.
3.	Outfall from terminal lift station box culvert. Drains the northwestern portion of the airport terminals, including a deicing pad and containment system used by DHL Airlines. Site is located next to a sanitary sewer pump station.
4.	Downstream of the box culvert at the end of the construction access road. Receives runoff from the taxi lane/runway in the DHL Airlines area.
5.	Elijahs Creek 100 feet below the North Gabion Storm water Control structure. This is also permit outfall 001. This is the edge of airport property and the compliance point for the north side of the airport.
6.	Unnamed tributary to Elijahs Creek. This has been used as a control site for water quality sampling. Receives minimal runoff from airport areas; however, recent airport expansion has encroached into the upper part of this tributary.
7.	Unnamed tributary to Gunpowder Creek at the airport tower. Downstream of the glycol containment tanks and valves that route used deicing fluid to the regional wastewater treatment plant.
8.	Outlet of the South Gabion Storm water Containment structure on the unnamed tributary to Gunpowder Creek.
9.	Mouth of unnamed tributary to Gunpowder Creek, downstream of the South Gabion.
10.	Gunpowder Creek draining Hossman Road. The control site for Gunpowder Creek since it receives minimal runoff from airport property.
11.	Mouth of the unnamed tributary that runs parallel to the North/South runway. Also receives runoff from the East/West runway.

AIRPORTS AND DEICING FLUIDS

Airports across the globe are required to use deicing fluids to ensure safe airline operations. These chemicals, however, can cause severe environmental degradation if allowed to reach surface waterways. Increasing attention and research are underway to counter the environmental problems while still ensuring safe flying conditions. In 1995, for example, world experts gathered in London, England, to discuss these issues and describe projects being studied at airports worldwide to address this problem. Use of deicing chemicals is still increasing as greater safety requirements are imposed on airports and airlines. These increasing requirements are the direct result of airline crashes caused by icing and the overwhelming need to better protect the flying public from future disasters.

Two categories of deicing protection are necessary: aircraft and runway. There are two main types of aircraft deicing fluids, which are made up ethylene glycol or propylene glycol solutions. Type I deicing fluid is a thin liquid that is applied to an airplane immediately prior to departure from a hangar or gate. Type II fluid is a thicker material that clings to aircraft surfaces to prevent further icing. It is used during taxiing and takeoff. Much of the Type I fluid runs off the airplane immediately at the point of application. Type II fluid sloughs off the airplane during takeoff and is deposited along runways as planes depart. Both types mix with stormwater runoff and snowmelt and often flow into the airport's storm drains and then into the nearest waterway. Deicing fluids also are spread along runways and taxiways to prevent ice formation on these surfaces. Typically this is a mixture of ethylene glycol and urea. Again these materials can reach local waterways.

These chemicals and mixtures create a variety of environmental problems. The 5-Day Biochemical Oxygen Demand (BOD₅) of ethylene glycol ranges from 400,000 to 800,000 milligrams per liter (mg/L), and propylene glycol can exceed 1,000,000 mg/L. The aircraft deicing fluid volume required to deice a typical large passenger jet has a BOD₅ equivalent to the daily domestic wastewater generated by 5000 people (6). In addition to the high oxygen demand of these chemicals, they also fuel the growth of *Sphaerotilus* bacteria. *Sphaerotilus* grows rapidly in waters with a high carbon content and low dissolved oxygen. It was common in streams receiving paper mill waste, sugar refining waste, brewery waste, and municipal sewage in the days prior to environmental laws that required treatment of these wastes. *Sphaerotilus* grows in long streamers attached to the sides and bottom of a stream. It smothers normal bottom dwelling organisms and can overwhelm an entire stream habitat. Dead and decaying *Sphaerotilus* consume all oxygen in a stream bed and give off hydrogen sulfide, creating objectionable odors. Urea deicers break down and release ammonia, which is toxic to aquatic species and adds to the oxygen demand problems of the glycol compounds.

Problems caused by deicing fluids are documented at numerous airports. In 1995, a federal magistrate ruled in favor of citizens suing the Dayton, Ohio International Airport to stop allowing deicing fluids to reach Mill Creek, a stream draining the airport. Streams surrounding Chicago's O'Hare International Airport and Newcastle International Airport in the United Kingdom have had water quality problems because of runoff of deicing fluids. This clearly is a worldwide problem.

Solutions are being studied and implemented at many airports around the globe. Research is underway to find less damaging chemicals while still providing the necessary level of safety. Potassium acetate, calcium magnesium acetate, and sodium formate have fewer environmental impacts and are being tested as runway deicers (6). No substitute is yet approved for aircraft deicing; thus methods of reducing the volumes needed and collecting what is used are becoming more prevalent. Special deicing pads are being built with runoff catch basins and storage facilities. Runoff can be slowly released to municipal sewer systems once the storms have passed or treated on site. Glycol recycling can also be conducted in areas with concentrated runoff. Although the recycled material is not of sufficient quality to be reused on aircraft, it can be used for runway deicing, automobile radiator coolant, deicing of coal trains and coal piles, and as a raw material in the plastics industry (6). Special vacuum trucks can be used on runways and taxiways to minimize runoff from these areas. The airport in Zurich, Switzerland, has been experimenting with a reed bed treatment system. The microorganisms in reed beds are reported to be "very effective at metabolizing glycol's" (3). Zurich collects and recycles as much material as possible, while storm runoff from runways and other areas drain into reed beds before flowing into local streams. The Buffalo Airport in Cheektowga, New York, has been testing an infrared-heat deicing system conducted in a large shed structure prior to takeoff that can greatly reduce the need for chemical deicers. Ultimately a variety of methods will be available that will allow safe airline operation as well as protect the environment.

Water Quality in Elijahs and Gunpowder Creeks

The KDOW began collecting water quality data in Elijahs Creek in 1992 and Gunpowder Creek in 1994. During this period of time, various stations were added or deleted and not all sites shown on Figure 2 and listed in Table 1 were sampled each time. Two stations, 6 and 10, were located on tributaries that did not receive airport runoff and were used as control sites. Consultants for the airport have also collected samples at various locations and times. Data collected by both parties are presented in Tables 2 through 13. Various parameters have also been measured at different times and locations and are listed in the tables.

The water quality constituent of most concern and readily measurable is BOD₅. It is a direct indication of deicing fluid contamination as described in the previous section of this report. BOD₅ data for all stations is presented in Table 2. Values ranged from 1 mg/L to 2920 mg/L at stations 1 through 4, all of which drain to Elijahs Creek. As a comparison, untreated domestic sewage has a typical BOD₅ of 200 to 250 mg/L, with an effluent value after treatment ranging from 10 to 30 mg/L. Typical stream background levels are 1 or 2 mg/L. Values ranged from 2 to 1400 mg/L at station 5, which is the airport's North Gabion storm water structure in Elijahs Creek, at the edge of airport property. It is interesting to note that in July 1994, BOD₅ was 360 mg/L at station 5 and 300 mg/L on June 10, 1996. It is not known if this represents some sort of leakage of deicing fluids from storage areas, decay of *Sphaerotilus* bacteria, or other problem. It would appear from these measurements that deicing operations can affect water quality in these streams even during summer periods when actual deicing is not occurring. Nuisance growths of *Sphaerotilus* have been observed at all these sites, which is a violation of Kentucky water quality regulation 401 KAR 5:031, Section 2(1)(e). BOD₅ concentrations ranged from 1 to 5 mg/L at station 6, which is the control site for the Elijahs Creek basin. It seems obvious that deicing fluids are having a severe impact on Elijahs Creek.

Concentrations of BOD₅ at stations 7, 8, 9 and 11 in Gunpowder Creek and its tributaries receiving airport runoff ranged from 1 to 644 mg/L. Nuisance growths of *Sphaerotilus* have also been observed at these locations. BOD₅ at station 10, the control site for Gunpowder Creek, ranged from 1 to 3 mg/L. This indicates that deicing fluids are also impacting the Gunpowder Creek basin.

There are some interesting items to note from the other parameters that have been collected at various sites and times. Actual samples for ethylene glycol were collected only once, in December 1996. Values ranged from not detected at stations 2, 5, 6, 9, 10, and 11 to 171 mg/L at station 4. Corresponding levels of BOD₅ were low at the non-detect stations and elevated at those with ethylene glycol, but a numerical correlation was not attempted with such a small sample size. Ammonia concentrations were elevated at several stations, with a high value of 39.1 mg/L at station 4.

Table 2. BOD Data in Elijahs and Gunpowder Creeks

(5 Day, in mg.L)

Date	St. # 1	St. # 2	St. # 3	St. # 4	St. # 5	St. # 6	St. # 7	St. # 8	St. # 9	St. # 10	St. # 11
3/11/92		1,530	2,920								
3/10/93					97	1					
2/14/94		392	339		144						55
4/5/94		30	216		10				1	1	2
7/7/94		4	4		360						
8/11/94					8						
11/21/94	20	5	5		13	5		6		2	
12/14/94	36	24	53		53			8			
1/4/95					120						
1/25/95	1,220	351	546	267	549	2		307			
2/6/95	2,760	197	654		239			262			
3/8/95					490						
3/14/95	796	741	198		42	3		49	11	3	37
4/5/95	1,300	5	201		21	3		55	12	3	17
4/13/95					1,400						
6/5/95					30						
1/18/96					369						
1/30/96	172	39	172	94	49	0	644	157	95	0	196
2/8/96					200						
3/5/96					43						
4/18/96					2						
5/10/96					3						
6/10/96					300						
7/18/96					2						
12/3/96	266	0	64	282	4	0	44	11	2	0	2

Table 3. Data from Station #1

Date	Dissolved Oxygen (mg/L)	BOD (mg/L)	Water Temperature (Deg. C.)	Total Suspended Solids (mg/L)	pH (Units)	Total Organic Carbon (mg/L)	Ammonia (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ethylene Glycol (mg/L)
11/21/94	6.8	20	14.2	4	7.5				
12/14/94	6.2	36	11.0	10	7.4	19.9			
1/25/95	6.7	1,220	7.0	6	7.1				
2/6/95	7.2	2,760	5.0	26	7.6				
3/14/95	5.4	796	10.5	24	7.1				
4/5/95	6.9	1,300	8.0	34	6.9				
11/8/95	14.0		9.0	1	8.2				
1/30/96	5.5	172	3.1	30	7.1		0.58	2.4	
12/3/96	5.4	266	5.0	22	6.8			0.87	79.7

Table 4. Data from Station #2

Date	Dissolved Oxygen (mg/L)	BOD (mg/L)	Water Temperature (Deg. C.)	Total Suspended Solids (mg/L)	pH (Units)	Total Organic Carbon (mg/L)	Ammonia (mg/L)	Kjeldahl Nitrogen (mg/L)	Ethylene Glycol (mg/L)
3/11/92		1,530							
2/14/94		392							
4/5/94		30							
7/7/94		4							
11/21/94	11.0	5	15.5	6	8.1				
12/14/94	9.5	24	7.5	3	7.9	15.3			
1/25/95	8.4	351	5.0	3	7.5				
2/6/95	8.5	197	2.0	16	8.1				
3/14/95	8.4	741	10.5	10	8.0				
4/5/95	10.6	5	7.3	9	7.8				
11/8/95	5.8		11.0	21	7.8				
1/30/96	10.2	39	3.9	2	8.0	33.7	0.106	0.309	
12/3/96	12.4	0	7.0	3	7.1		0.118	0.472	ND

ND- Not detected

Table 5. Data from Station #3

Date	Dissolved Oxygen (mg/L)	BOD (mg/L)	Water Temperature (Deg. C.)	Total Suspended Solids (mg/L)	pH (Units)	Total Organic Carbon (mg/L)	Ammonia (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ethylene Glycol (mg/L)
3/11/92		2,920							
2/14/94		339							
4/5/94		216							
7/7/94		4							
11/21/94	9.4	5	17.0	4	7.6				
12/14/94	5.5	53	2.0	4	7.9	37.6			
1/25/95	7.4	546	7.0	10	7.4				
2/6/95	12.2	654	1.0	36	7.5				
3/14/95	7.0	198	12.0	11	7.6				
4/5/95	2.6	201	10.5	12	7.7				
1/30/96	7.4	172	6.0	12	7.5	74.1	5.8	9.5	
12/3/96	7.4	64	7.5	8	6.8			0.337	37.6

Table 6. Data from Station #4

Date	Dissolved Oxygen (mg/L)	BOD (mg/L)	Water Temperature (Deg. C.)	Total Suspended Solids (mg/L)	pH (Units)	Total Organic Carbon (mg/L)	Ammonia (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ethylene Glycol (mg/L)
1/25/95		267		10					
1/30/96	8.4	94	4.6	14	8.6	48.7	39.1	40.3	
12/3/96	7.8	282	6.0	8	7.0		0.74	1.5	171

Table 7. Data from Station #5

Date	Stream Flow (mgd)	Dissolved		Water		Total Suspended		Total Organic Carbon (mg/L)	Ammonia (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ethylene Glycol (mg/L)
		Oxygen (mg/L)	BOD (mg/L)	Temperature (Deg. C.)	Solids (mg/L)	pH (Units)					
3/10/93			97			1	7.7	44.4	0.18	0.82	
2/14/94			144								
4/5/94			10								
4/14/94	0.024	5.9	148	12.5			7				
5/17/94	0.74	8.8		16.7	4		7.6				
7/6/94	1.67	4.6		25.2			7.3				
7/7/94			360								
8/11/94	1.51	5.7	8	21.7	1		8.4				
9/21/94		5.6	8	18.2	10		7.1				
10/27/94	0.9	6.3	1	9.4	15		6.6				
11/21/94		8.8	13	13.0	5		7.8				
11/23/94	0.72	9.5		16.7			7.8				
12/9/94	53.8	15		10.0	56		7.8				
12/14/94		10.2	53	2.0	4		7.9	37.6			
12/20/94	0.9	10.1		2.0			8.2				
1/4/95	0.33	9.4	120	1.1	7.8		7.6	49			
1/17/95	1.53	7.3		5.5			7.5				
1/25/95		8.9	549	1.0	5		7.4				
2/6/95		7.8	239	0.1	14		7.1				
2/8/95		8.3	260	0.2	5		7.1	129			
3/8/95		12.4	490	3.9	42		7.2	270			
3/14/95		7	42	10.0	11		7.7				
4/5/95		5.8	21	8.0	12		7.6				
4/13/95	1.55	6.8	1,400	10.1	11		7.7				
5/4/95	1.51	7.1	40	12.5	40		7.6	9.2			

Table 7. Data from Station #5

6/5/95	2.35	8.3	30	19.4	42	8	5		
7/12/95	0.32		6	27.8	1	7.7	4		
1/18/96	15.4	11.5	369	2.7	16	7.3	147		
1/30/96		11.6	49	2.2	7	8.0	25.4	2.3	3.1
2/8/96		10.6	200	0.1	25	7.3	150		
3/5/96	32.3	9.3	43	7.9	301	8.1	65		
3/19/96		2.9		13.3					
3/20/96		3.1		6.3					
4/18/96	3.2	7.1	2	17.2	5	7.5	4.8		
5/10/96	1.61	8.6	3	18.5	2	7.9	4.4		
6/10/96	8.3	7.8	300	17.8	29	7.9	9.8		
7/18/96	3.6	8.1	2	23.1	5	8.1	5.1		
12/3/96		12.4	4	2.5	6	7.1		0.29	ND

ND- Not
detected

Table 8. Data from Station #6 (Control Site)

Date	Dissolved Oxygen (mg/L)	BOD (mg/L)	Water Temperature (Deg. C.)	Total Suspended Solids (mg/L)	pH (Units)	Total Organic Carbon (mg/L)	Ammonia (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ethylene Glycol (mg/L)
3/10/93		1.5		7	8.3	3.4	0.06	0.32	
11/21/94	10.4	4.6	13.5	23	8.0				
1/25/95	16.0	1.6	1.0	1	8.1				
3/14/95	14.4	2.8	10.0	6	8.6				
4/5/95	14.4	2.9	4.5	4					
1/30/96	13.4	0.5	1.7	3	8.4	1.8		0.38	
12/3/96	14.2	0.7	1.8	7	7.2		0.108	0.39	ND

Table 9. Data from Station #7

Date	Dissolved Oxygen (mg/L)	BOD (mg/L)	Water Temperature (Deg. C.)	Total Suspended Solids (mg/L)	pH (Units)	Total Organic Carbon (mg/L)	Ammonia (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ethylene Glycol (mg/L)
1/30/96	8.6	644	3.2	12	7.7	264	6.7	11	
12/3/96	9.3	43.7	1.0	10	7.4		0.681	0.894	20.2

ND- Not Detected

Table 10. Data from Station #8

Date	Dissolved Oxygen (mg/L)	BOD (mg/L)	Water Temperature (Deg. C.)	Total Suspended Solids (mg/L)	pH (Units)	Total Organic Carbon (mg/L)	Ammonia (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ethylene Glycol (mg/L)
11/21/94	9.5	6	13.5	30	8.3				
12/14/94	7.4	8	5.0	52	7.7	6.8			
1/25/95	8.4	307	2.0	6	7.5				
2/6/95	7.8	262	0.5	168	7.6				
3/14/95	6.4	49	17.2	19	7.4				
4/5/95	5.2	55	11.5	14	7.5				
1/30/96	8.8	157	1.6	182	7.8	67.1	2.07	3.96	
12/3/96	8.4	11	5.0	16	7.2		0.224	0.52	0.8

Table 11. Data from Station #9

Date	Dissolved Oxygen (mg/L)	BOD (mg/L)	Water Temperature (Deg. C.)	Total Suspended Solids (mg/L)	pH (Units)	Total Organic Carbon (mg/L)	Ammonia (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ethylene Glycol (mg/L)
4/5/94		1							
3/14/95	6.9	11	16.0	4	7.9				
4/5/95	3.2	12	15.0	13	7.7				
1/30/96	10.6	95	1.7	14	8.3	43	1.24	2.1	
12/3/96	13.2	2	2.5	9	7.0			0.244	ND

ND- Not detected

Table 12. Data from Station #10 (Control Site)

Date	Dissolved Oxygen (mg/L)	BOD (mg/L)	Water Temperature (Deg. C.)	Total Suspended Solids (mg/L)	pH (Units)	Total Organic Carbon (mg/L)	Ammonia (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ethylene Glycol (mg/L)
4/5/94		1.0							
11/21/94	8.6	1.6	12.6	80	8.0				
3/14/95	14.4	2.5	14.0	23	8.6				
4/4/95	13.0	2.9	15.0	21	8.6				
1/30/96	13.6	0.6	2.0	10	8.4	2	0.1	0.346	
12/3/96	13.4	0.8	2.0	8	7.2		0.12	0.4	ND

Table 13. Data from Station #11

Date	Dissolved Oxygen (mg/L)	BOD (mg/L)	Water Temperature (Deg. C.)	Total Suspended Solids (mg/L)	pH (Units)	Total Organic Carbon (mg/L)	Ammonia (mg/L)	Total Kjeldahl Nitrogen (mg/L)	Ethylene Glycol (mg/L)
2/14/94		55							
4/5/94		2							
3/14/95	4.9	37	17.0	21	7.8				
4/4/95	11.9	17	15.0	7	8.3				
1/30/96	9.6	196	1.8	8	8.0	86.5	6.7	8.6	
12/3/96	12.0	2	3.0	35	7.0		0.478	0.84	ND

ND- Not Detected

Untreated domestic sewage is normally about 20 mg/L, and a typical effluent value after treatment is 4 mg/L or less for discharge to small streams. Typical background concentrations are 0.1 to 0.2 mg/L, which is what was measured at the control stations. Elevated ammonia concentrations are likely the result of urea runoff from runways and other paved areas. Dissolved oxygen concentrations occasionally violated the state standard of 5 mg/L at stations 3, 5, 9, and 11. Although not direct violations, dissolved oxygen levels were often lower than would be expected from a normal stream during cold weather at those sites impacted by deicing fluids. As a comparison, dissolved oxygen was considered normal at control stations 6 and 10.

ESTABLISHING TOTAL MAXIMUM DAILY LOADS FOR DEICING FLUIDS

The Total Maximum Daily Load (TMDL) is a term used to describe the maximum amount of pollution a water body can receive without violating water quality standards. A true load is a measurement of mass per unit time, such as a calculation resulting in units of pounds per day. In order to determine this value for a pollutant, two items are required: a flow value from the source of the pollutant (such as a wastewater treatment plant) plus the allowable concentration of the pollutant in that flow. In the case of a pollutant being mixed with storm water runoff created by an infinite variety and magnitude of possible storms comprised of rain, sleet, snow and a combination of these occurring over varying periods of time and temperatures, it is not possible to assign a specific flow value. Thus assigning a TMDL in terms of a single load is also not feasible. The task remains, however, to describe in some manner the maximum amount of pollution the water can receive and to apply some margin of safety for these calculations.

In order to achieve this goal, it is first necessary to determine the water quality parameters of concern and the pollutants responsible for causing these problems. In the case of deicing fluids, the water quality parameters of concern are dissolved oxygen, ammonia toxicity, and nuisance growths of *Sphaerotilus* bacteria. As per Kentucky water quality regulations, dissolved oxygen shall be maintained at a minimum concentration of 5 mg/L daily average, the concentration of un-ionized ammonia shall not be greater than 0.05 mg/L at any time instream after mixing, and nuisance conditions are prohibited. To protect water quality, maximum concentrations are needed for BOD₅ and ammonia, which are the main attributes of deicing fluids that cause these water quality problems.

The KDOW and Dames and Moore consulting engineers, who were retained by the airport to work on these issues, conducted water quality modeling of Elijahs and Gunpowder creeks using the QUAL2E water quality model. QUAL2E is commonly used by the KDOW to establish effluent limits for wastewater treatment facilities. Specific modeling procedures and assumptions used by the KDOW have been approved by the U.S. EPA and are fully documented (4). The model was run under several scenarios, testing possible effluent values from airport runoff flow amounts of 50,000 gallons per day (gpd), 100,000 gpd, and one million gpd. These were chosen to simply provide a wide range of possible runoff volumes. Both summer and winter conditions were tested and effluent limits were established for both periods. Summer conditions were tested because the data presented in the previous section of this report indicated possible contamination during this period. Temperatures applied in the model were 25° centigrade (C.) for summer conditions and 16 for winter conditions.

These are the same as those applied by the KDOW during routine modeling. Results from modeling found that summer concentrations of 70 mg/L BOD₅ and 4 mg/L ammonia and winter concentrations of 150 mg/L BOD₅ and 10 mg/L ammonia will protect the dissolved oxygen and ammonia stream criteria in Elijahs Creek. Corresponding summer allowable loads in Elijahs Creek are 29.2 pounds per day (lbs/day) of BOD₅ and 1.67 lbs/day of ammonia at a runoff flow of 50,000 gpd, 58.4 lbs/day of BOD₅ and 3.34 lbs/day of ammonia at a runoff flow of 100,000 gpd, and 584 lbs/day BOD₅ and 33.4 lbs/day of ammonia at a runoff flow of one million gpd. Allowable loads for winter conditions are 62.5 lbs/day of BOD₅ and 4.17 lbs/day of ammonia at a runoff flow of 50,000 gpd, 125 lbs/day of BOD₅ and 8.34 lbs/day of ammonia at 100,000 gpd, and 1252 lbs/day of BOD₅ and 83.4 lbs/day of ammonia at one million gpd. Values for Gunpowder Creek are 50 mg/L BOD₅ and 4 mg/L ammonia during summer conditions and 85 mg/L BOD₅ with 10 mg/L ammonia for winter conditions. The corresponding summer allowable loads in Gunpowder Creek are 20.8 lbs/day of BOD₅ and 1.67 lbs/day of ammonia at a runoff flow of 50,000 gpd, 41.7 lbs/day of BOD₅ 3.34 lbs/day of ammonia at 100,000 gpd, and 417 lbs/day and 33.4 lbs/day of ammonia at one million gpd. Allowable loads for winter conditions are 35.4 lbs/day of BOD₅ and 4.17 lbs/day of ammonia at a runoff flow of 50,000 gpd, 70.9 lbs/day of BOD₅ and 8.34 lbs/day of ammonia at 100,000 gpd, and 709 lbs/day of BOD₅ and 83.4 lbs/day at one million gallons per day.

The KDOW has not found from a literature search a specific numeric "TMDL" for any constituent whereby nuisance growths of *Sphaerotilus* can be avoided. The TMDL for this problem then becomes the qualitative narrative language found in Kentucky regulation 401 KAR 5:031, Section 2(1)(e) whereby nuisance growths are prohibited. Implementation of this narrative plus the numerical values determined above are described in the next section of this report.

Margins of Safety: The TMDL process requires that various margins of safety be employed when establishing permit limits to better ensure water quality protection. Two significant safety factors were incorporated in the water quality modeling. First is the assumption that no flow was available in the streams for dilution of airport runoff. In reality, there will most likely always be flow in these streams during deicing operation since this activity occurs as a result of snow/rain/sleet conditions. The second is that the model was operated at 25° C summer and 15° C winter temperatures. Deicing activities actually occur at much lower temperatures. This provides a margin of safety because streams are able to assimilate more biodegradable wastes at lower temperatures due to the various physical and biological processes that occur. A third margin of safety applied to the airport is the permit condition that if nuisance growths of *Sphaerotilus* continue to occur, then the effluent limits will be reduced further and/or other control measures will be applied as necessary.

IMPLEMENTATION OF THE TOTAL MAXIMUM DAILY LOADS

The KDOW has implemented two actions to ensure that deicing fluids do not continue to create water quality problems in Elijahs and Gunpowder creeks. A new permit was issued to the airport in February 1997 (Appendix I) to implement the TMDL values discussed in the previous section, and a formal enforcement action resulted in an Agreed Order (AO) between the state and the airport filed March 28, 1997 (Appendix II). In addition to the margins of safety applied through the conservative model assumptions, the permit and AO outline several items to provide additional margins of safety and ensure water quality protection. These are:

1. The permit specifies in Part III, Section B(2) that "If nuisance growths continue, the Division of Water reserves the right to impose additional/modified limitations/ requirements in order to achieve compliance with applicable water quality standards."
This was implemented as a means of recognizing that the effluent values calculated from modeling may not be sufficient to inhibit nuisance growths and provides a mechanism to rectify these limits if necessary.
2. Both the permit and the AO require the airport to establish a Best Management Practices (BMP) control plan to contain deicing fluids and all hazardous materials from reaching local waterways. This plan has been submitted and approved by the KDOW. The airport reports that over 5 million dollars has been spent on implementing this plan, which includes elaborate deicing pads and collection systems.
3. The AO required the airport to submit a Groundwater Protection Plan. This plan also has been submitted and approved.
4. The AO describes penalties that were assessed the airport from previous violations. The state agreed to forego \$50,000 in penalties and credit that amount toward the purchase of a vacuum sweeper truck. The truck has been operational since late December 1997 and should help control deicing fluid runoff from runways and other paved areas.
5. AO condition number 10 required the airport to submit an update to the "Master Plan, De-Icing Fluid Containment and Runoff Control for the Cincinnati/Northern Kentucky International Airport."
This updated plan describes actions already taken to control de-icing fluid runoff and outlines future work to better define and control this problem. This plan was submitted to the Division in November 1997.

Summary

The use of deicing fluids is an essential component of airline safety in areas subject to freezing conditions. Yet the use of these chemicals has caused environmental degradation in surface waters near airports that use them. Research is underway worldwide to find effective alternatives to these chemicals, to reduce the volumes needed for safe operation, and to prevent environmental impacts through various collection and treatment scenarios.

Beginning in 1992, the Kentucky Division of Water began documenting water quality problems caused by runoff of deicing fluids in Elijahs Creek, draining the northern portion of the Cincinnati/Northern Kentucky International Airport. Various actions were begun by the KDOW as a result of these problems, including increased monitoring of stream quality, meetings with airport officials, and enforcement actions. Remedial measures were implemented by the airport, but water quality problems persisted and also became evident in Gunpowder Creek, at the southern end of the airport, as a result of airport expansion. In 1996, both streams were listed in Kentucky's 303(d) list of impaired waters and ranked as high priority for establishing Total Maximum Daily Loads for the pollutants of concern. Through the use of an Agreed Order and a new discharge permit, allowable effluent concentrations were established, a Best Management Practices Plan and a Groundwater Protection Plan were required, and a vacuum sweeper truck was purchased. Water quality is expected to improve significantly from these actions. Monitoring will continue to ensure this occurs, and additional control measures will be taken if necessary to restore Elijahs and Gunpowder creeks.

References

- 1) Brown, L.C. and Barnwell, T.O. Jr., 1987, The Enhanced Stream Water Quality Models QUAL2E and QUAL2E-UNCAS: Documentation and User Manual, EPA/600/3-87/007, U.S. Environmental Protection Agency, Athens, GA.
- 2) Foppe, Lawrence E., Miller, Michael L., Results of Instream Monitoring, Elijahs Creek, for the Cincinnati/Northern Kentucky International Airport, Quarterly Reports 1994-1996, Foppe Thelen Group, Inc., Cincinnati, Ohio.
- 3) Gould, Rick, June 1995, New Solutions to the Waste Glycol Problem, *Janes Airport Review*, 44-45.
- 4) Kentucky Department for Environmental Protection, Division of Water, 1990, Wasteload Allocation Modeling Methodology for Rivers and Streams.
- 5) Kentucky Department for Environmental Protection, Division of Water, 1994, Elijahs Creek Drainage Biological and Water Quality Investigation, Technical Report No. 40.
- 6) Mericas, Dean and Wagoner, Bryan, December 1994, Balancing Safety and the Environment, *Water Environment and Technology*, 38-43.
- 7) Phaup, John D., 1968, The Biology of Sphaerotilus Species, University of Georgia, Marine Institute, *Water Research Vol. 2*, 597-614.
- 8) Turnbull, D. A. and Bevan, J. R., 1995, The Impact of Airport Deicing on a River: The Case of the Ouseburn, Newcastle Upon Tyne, Great Britain, *Environmental Reporter 88*, 321-332.

Appendix I: Discharge Permit Issued February 19, 1997

Receiving Stream: Gunpowder Creek: Outfall 002-G - Unnamed tributary (UT) RMI 0.1
(Continued) flows to RMI 19.6
Outfall 003-G - UT RMI 0.1 flows to RMI 18.85
Outfall 004 - RMI 18.3
Outfall 009-G - RMI 18.4

Outfalls 002-G, 003-G, 009-G, and 005-E - 008-E inclusive are internal outfalls.

Stream Segment Use Classification: Warmwater Aquatic Habitat, Primary/Secondary Contact Recreation

Stream Low Flow Condition: Elijah Creek: 7Q10 = 0 cfs
Gunpowder Creek: 7Q10 = 0 cfs

Water Quality or Effluent Limited: Water Quality Limited

Justification of Permit Conditions:

All regulations cited are pursuant to KRS 224.70-100, 224.10-100, and 224.70-110.

Outfalls 001, 004

Total Suspended Solids and Oil & Grease

The limitations for these parameters are based on the Permit Writer's "Best Professional Judgment" (BPJ) of the "Best Conventional Pollutant Control Technology" (BCT) consistent with 401 KAR 5:080, Section 1(2)(c)2.

pH

The limitations for this parameter are consistent with the requirements of 401 KAR 5:031, Section 4.

Dissolved Oxygen

The limitation for this parameter is consistent with the requirements of 401 KAR 5:031, Section 4.

Ammonia (as N) and Biochemical Oxygen Demand

The limitations for these parameters are consistent with the requirements of 401 KAR 5:031 and the Division of Water's Wasteload Allocation Model.

Benzene, Toluene, Ethylbenzene, Xylene, and Naphthalene

The monitoring requirements for these parameters are consistent with 401 KAR 5:065, Section 2(8).

Nondegradation

The conditions of 401 KAR 5:029, Section 2(1) and (3) have been satisfied by this permit action. A review under Section 2(2) and (4) is not applicable.

Outfalls 002-G, 003-G, and 005-E - 009-E

Total Suspended Solids, Oil & Grease, Biochemical Oxygen Demand, Dissolved Oxygen, Ammonia (as N), Benzene, Toluene, Ethylbenzene, Xylene, and Naphthalene

The monitoring requirements for these parameters are consistent with 401 KAR 5:065, Section 2(8).

pH

The limitations for this parameter are consistent with the requirements of 401 KAR 5:031, Section 4.

Nondegradation

The conditions of 401 KAR 5:029, Section 2(1) and (3) have been satisfied by this permit action. A review under Section 2(2) and (4) is not applicable.

PERMIT NO. KY0082864

**AUTHORIZATION TO DISCHARGE UNDER THE
KENTUCKY POLLUTANT DISCHARGE ELIMINATION SYSTEM**

Pursuant to Authority in KRS 224,

Kenton County Airport Board
P.O. Box 752000
Cincinnati, Ohio 45275-2000

is authorized to discharge from a facility located at

Cincinnati/Northern Kentucky International Airport
2939 Terminal Drive
Hebron, Boone County, Kentucky

to receiving waters named

Elijah Creek - Outfalls 001, 005-E, 006-E, 007-E, and 008-E
Gunpowder Creek - Outfalls 002-G, 003-G, 004, and 009-G

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, III, and IV hereof. The permit consists of this cover sheet, and Part I 4 page(s), Part II 1 page(s), Part III 1 page(s), and Part IV 3 page(s).

This permit shall become effective on APR 1 1997

This permit and the authorization to discharge shall expire at midnight, MAR 31

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s): 001 - Storm water runoff, aircraft deicing fluids, runway deicing fluids, dilute urea and fuel residuals discharged to Elijah Creek.

Such discharges shall be limited and monitored by the permittee as specified below:

<u>EFFLUENT CHARACTERISTICS</u>	<u>DISCHARGE LIMITATIONS</u>				<u>MONITORING REQUIREMENTS</u>	
	kg/day(lbs/day)		Other Units(Specify)		Measurement Frequency <u>1/</u>	Sample Type
	Monthly Avg.	Daily Max.	Monthly Avg.	Daily Max.		
Flow (MGD)						
Summer <u>2/</u>	Report	Report	N/A	N/A	1/Month	Instantaneous
Winter <u>2/</u>	Report	Report	N/A	N/A	1/Week <u>3/</u>	Instantaneous
Total Suspended Solids (TSS)						
Summer <u>2/</u>	N/A	N/A	30 mg/l	60 mg/l	1/Month	Grab
Winter <u>2/</u>	N/A	N/A	30 mg/l	60 mg/l	1/Week <u>3/</u>	Grab
Oil & Grease						
Summer <u>2/</u>	N/A	N/A	10 mg/l	15 mg/l	1/Month	Grab
Winter <u>2/</u>	N/A	N/A	10 mg/l	15 mg/l	1/Week <u>3/</u>	Grab
Biochemical Oxygen Demand (5-day, BOD ₅)						
Summer <u>2/</u>	N/A	N/A	70 mg/l	105 mg/l	1/Month	Composite
Winter <u>2/</u>	N/A	N/A	150 mg/l	225 mg/l	1/Week <u>3/</u>	Composite
Ammonia (as N)						
Summer <u>2/</u>	N/A	N/A	4 mg/l	8 mg/l	1/Month	Grab
Winter <u>2/</u>	N/A	N/A	10 mg/l	20 mg/l	1/Week <u>3/</u>	Grab
Benzene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Toluene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Ethylbenzene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Xylene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Naphthalene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Dissolved Oxygen shall not be less than 5.0 mg/l					1/Month	Grab

The pH of the effluent shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/month during the summer months and 1/week during the winter months 1/ 2/ by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

- 1/ Samples shall be taken during discharge. If no discharge occurs during the reporting period, then record "no discharge" on the Discharge Monitoring Report (DMR).
- 2/ Summer - May 1 through September 30
Winter - October 1 through April 30
- 3/ See Other Requirements, Item D, Page III-1, regarding changes in the permit monitoring frequency.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s): 004 - Storm water runoff, aircraft deicing fluids, runway deicing fluids, dilute urea and fuel residuals discharged to Gunpowder Creek.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	kg/day(lbs/day)		Other Units(Specify)		Measurement Frequency <u>1/</u>	Sample Type
	Monthly Avg.	Daily Max.	Monthly Avg.	Daily Max.		
Flow (MGD)						
Summer <u>2/</u>	Report	Report	N/A	N/A	1/Month	Instantaneous
Winter <u>2/</u>	Report	Report	N/A	N/A	1/Week <u>3/</u>	Instantaneous
Total Suspended Solids (TSS)						
Summer <u>2/</u>	N/A	N/A	30 mg/l	60 mg/l	1/Month	Grab
Winter <u>2/</u>	N/A	N/A	30 mg/l	60 mg/l	1/Week <u>3/</u>	Grab
Oil & Grease						
Summer <u>2/</u>	N/A	N/A	10 mg/l	15 mg/l	1/Month	Grab
Winter <u>2/</u>	N/A	N/A	10 mg/l	15 mg/l	1/Week <u>3/</u>	Grab
BOD ₅						
Summer <u>2/</u>	N/A	N/A	50 mg/l	75 mg/l	1/Month	Composite
Winter <u>2/</u>	N/A	N/A	85 mg/l	128 mg/l	1/Week <u>3/</u>	Composite
Ammonia (as N)						
Summer <u>2/</u>	N/A	N/A	4 mg/l	8 mg/l	1/Month	Grab
Winter <u>2/</u>	N/A	N/A	10 mg/l	20 mg/l	1/Week <u>3/</u>	Grab
Benzene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Toluene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Ethylbenzene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Xylene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Naphthalene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Dissolved Oxygen shall not be less than 5.0 mg/l					1/Month	Grab

The pH of the effluent shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/month during the summer months and 1/week during the winter months 1/ 2/ by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

- 1/ Samples shall be taken during discharge. If no discharge occurs during the reporting period, then record "no discharge" on the Discharge Monitoring Report (DMR).
- 2/ Summer - May 1 through September 30
Winter - October 1 through April 30
- 3/ See Other Requirements, Item D, Page III-1, regarding changes in the permit monitoring frequency.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall(s) serial number(s): 002-G, 003-G, 005-E, 006-E, 007-E, 008-E, and 009-G (Internal Outfalls) - Storm water runoff, aircraft deicing fluids, runway deicing fluids, dilute urea and fuel residuals.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTICS	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	kg/day(lbs/day)		Other Units(Specify)		Measurement Frequency <u>1/</u>	Sample Type
	Monthly Avg.	Daily Max.	Monthly Avg.	Daily Max.		
Flow (MGD)						
Summer <u>2/</u>	Report	Report	N/A	N/A	1/Month	Instantaneous
Winter <u>2/</u>	Report	Report	N/A	N/A	1/Week <u>4/</u>	Instantaneous
TSS (mg/l)						
Summer <u>2/</u>	N/A	N/A	Report	Report	1/Month	Grab
Winter <u>2/</u>	N/A	N/A	Report	Report	1/Week <u>4/</u>	Grab
Oil & Grease (mg/l)						
Summer <u>2/</u>	N/A	N/A	Report	Report	1/Month	Grab
Winter <u>2/</u>	N/A	N/A	Report	Report	1/Week <u>4/</u>	Grab
BOD ₅ (mg/l)						
Summer <u>2/</u>	N/A	N/A	Report	Report	1/Month	Composite
Winter <u>2/</u>	N/A	N/A	Report	Report	1/Week <u>4/</u>	Composite
Ammonia (as N) (mg/l)						
Summer <u>2/</u>	N/A	N/A	Report	Report	1/Month	Grab
Winter <u>2/</u>	N/A	N/A	Report	Report	1/Week <u>4/</u>	Grab
Benzene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Toluene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Ethylbenzene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Xylene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Naphthalene (µg/l)	N/A	N/A	Report	Report	1/Month	Grab
Dissolved Oxygen (mg/l)	N/A	N/A	N/A	Report <u>3/</u>	1/Month	Grab

The pH of the effluent shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored 1/month during the summer months and 1/week during the winter months 1/ 2/ by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

1/ Samples shall be taken during discharge. If no discharge occurs during the reporting period, then record "no discharge" on the Discharge Monitoring Report (DMR).

2/ Summer - May 1 through September 30
Winter - October 1 through April 30

3/ Report Daily Minimum on DMR.

4/ See Other Requirements, Item D, Page III-1, regarding changes in the permit monitoring frequency.

B. Schedule of Compliance

The permittee shall achieve compliance with all requirements on the effective date of this permit.

STANDARD CONDITIONS FOR KPDES PERMIT

The permittee is also advised that all KPDES permit conditions in KPDES Regulation 401 KAR 5:065, Section 1 will apply to all discharges authorized by this permit.

This permit has been issued under the provisions of KRS Chapter 224 and regulations promulgated pursuant thereto. Issuance of this permit does not relieve the permittee from the responsibility of obtaining any other permits or licenses required by this Cabinet and other state, federal and local agencies.

It is the responsibility of the permittee to demonstrate compliance with permit parameter limitations by utilization of sufficiently sensitive analytical methods.

PART III

OTHER REQUIREMENTS

A. Reporting of Monitoring Results

Monitoring results must be obtained for each month and reported on a preprinted Discharge Monitoring Report (DMR) Form which will be mailed to you each quarter for the upcoming quarter. The completed DMRs for each month must be sent to the Division of Water at the address listed below (with a copy to the appropriate Regional Office) postmarked no later than the 28th day of the month following the completed quarter.

Division of Water Kentucky
Florence Regional Office
7964 Kentucky Drive, Suite 8
Florence, Kentucky 41042
ATTN: Mr. Kevin Flowers

Natural Resources and
Environmental Protection Cabinet
Dept. for Environmental Protection
Division of Water
Inventory & Data Management
14 Reilly Road, Frankfort Office Park
Frankfort, Kentucky 40601

B. Reopener Clause

1. This permit shall be modified, or alternatively revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved under 401 KAR 5:050 thru 5:085, if the effluent standard or limitation so issued or approved:
 - a. Contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or
 - b. Controls any pollutant not limited in the permit.
2. If nuisance growths continue, the Division of Water reserves the right to impose additional/modified limitations/requirements in order to achieve compliance with applicable water quality standards.

The permit as modified or reissued under this paragraph shall also contain any other requirements of KRS Chapter 224 when applicable.

C. Changes in Monitoring Frequency

Upon submittal of monitoring report data for a period of one (1) year, the permittee may request that monitoring frequencies for the parameters Flow, Total Suspended Solids, Oil and Grease, Biochemical Oxygen Demand, Ammonia, and pH be reduced. The written request shall include a summary of all monitoring report data as well as any additional information to be utilized in justifying a less frequent monitoring schedule. Provided sufficient information is presented, the monitoring frequencies for the above-mentioned parameters will be reduced from 1/week to 1/month.

PART IV

BEST MANAGEMENT PRACTICES

SECTION A. GENERAL CONDITIONS

1. Applicability

These conditions apply to all permittees who use, manufacture, store, handle or discharge any pollutant listed as toxic under Section 307(a)(1) of the Clean Water Act, oil, as defined in Section 311(a)(1) of the Act, and any pollutant listed as hazardous under Section 311 of the Act and who have ancillary manufacturing operations which could result in (1) the release of a hazardous substance, pollutant, or contaminant in a reportable quantity, or (2) an environmental emergency, as defined in KRS 224.01-400, as amended, or any regulation promulgated pursuant thereto (hereinafter, the "BMP pollutants"). These operations include material storage areas; plant site runoff; in-plant transfer, process and material handling areas; loading and unloading operations, and sludge and waste disposal areas.

2. BMP Plan

The permittee shall maintain a Best Management Practices (BMP) plan consistent with 401 KAR 5:065, Section 2(10) pursuant to KRS 224.70-110, which prevents, or minimizes the potential for, the release of "BMP pollutants" from ancillary activities through plant site runoff; spillage or leaks, sludge or waste disposal; or drainage from raw material storage. Modifications of the BMP Plan shall be in accordance with the requirements of Sections 8, 9 and 10 of this Part.

3. Implementation

The plan shall continue in effect and shall be modified as necessary.

4. General Requirements

The BMP plan shall:

- a. Be documented in narrative form, and shall include any necessary plot plans, drawings or maps.
- b. Establish specific objectives for the control of toxic and hazardous pollutants.
 - (1) Each facility component or system shall be examined for its potential for causing a release of "BMP pollutants" due to equipment failure, improper operation, natural phenomena such as rain or snowfall, etc.
 - (2) Where experience indicates a reasonable potential for equipment failure (e.g., a tank overflow or leakage), natural condition (e.g., precipitation), or other circumstances which could result in a release of "BMP pollutants", the plan should include a prediction of the direction, rate of flow and total quantity of the pollutants which could be released from the facility as result of each condition or circumstance.

- c. Establish specific best management practices to meet the objectives identified under Paragraph b of this section, addressing each component or system capable of causing a release of "BMP pollutants."
- d. Include any special conditions established in Part B of this section.
- e. Be reviewed by plant engineering staff and the plant manager.

5. Specific Requirements

The plan shall be consistent with the general guidance contained in the publication entitled "NPDES Best Management Practices Guidance Document" and shall include the following baseline BMP's as a minimum.

- a. BMP Committee
- b. Reporting of BMP Incidents
- c. Risk Identification and Assessment
- d. Employee Training
- e. Inspections and Records
- f. Preventive Maintenance
- g. Good Housekeeping
- h. Materials Compatibility
- I. Security
- j. Materials Inventory

6. SPCC Plans

The BMP plan may reflect requirements for Spill Prevention Control and Countermeasure (SPCC) plans under Section 311 of the Act and 40 CFR Part 151, and may incorporate any part of such plans into the BMP plan by reference.

7. Hazardous Waste Management

The permittee shall assure the proper management of solids and hazardous waste in accordance with the regulations promulgated under the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1978 (RCRA) (40 U.S.C. 6901 et seq). Management practices required under RCRA regulations shall be referenced in the BMP plan.

8. Documentation

The permittee shall maintain a description of the BMP plan at the facility and shall make the plan available to representatives of the Division of Water upon request. Copies of modified BMP Plans shall be submitted within thirty (30) days of completion to the following:

Division of Water
Florence Regional Office
7964 Kentucky Drive, Suite 8
Florence, Kentucky 41042
ATTN: Mr. Kevin Flowers

Kentucky Natural Resources and
Environmental Protection Cabinet
Dept. for Environmental Protection
Division of Water
Inventory & Data Management
14 Reilly Road, Frankfort Office Park
Frankfort, Kentucky 40601

9. BMP Plan Modification

The permittee shall amend the BMP plan whenever there is a change in the facility or change in the operation of the facility which materially increases the potential for the ancillary activities to result in the release of "BMP pollutants."

10. Modification for Ineffectiveness

If the BMP plan proves to be ineffective in achieving the general objective of preventing the release of "BMP pollutants" then the specific objectives and requirements under Paragraphs b and c of Section 4, the permit and/or the BMP plan shall be subject to modification to incorporate revised BMP requirements.

If at any time following the issuance of this permit, the BMP plan is found to be inadequate pursuant to a state or federal site inspection or plan review, the plan shall be modified to incorporate such changes necessary to resolve the concerns.

SECTION B. SPECIFIC CONDITIONS

- Address spill notification procedures for individual airport tenants.
- Include oil/water separator inspection/maintenance procedures.

Appendix II: Agreed Order Filed March 28, 1997

COMMONWEALTH OF KENTUCKY

NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET

DEPARTMENT FOR ENVIRONMENTAL PROTECTION

IN THE MATTER OF:

AGREED ORDER

Kenton County Airport Board
c/o Cincinnati/Northern
Kentucky International Airport
P.O. Box 75200
Cincinnati, Ohio 45275-2000

Case No. DOW 94190

* * * * *

WHEREAS, the parties to this Agreed Order, the Natural Resources and Environmental Protection Cabinet (hereinafter the Cabinet) and the Kenton County Airport Board (hereinafter KCAB), state:

1. The Cabinet is charged with the statutory duty of enforcing KRS Chapter 224 and the regulations promulgated pursuant thereto.

2. KCAB operates the Cincinnati/Northern Kentucky International Airport (hereinafter Airport) in Boone County, Kentucky.

3. KCAB held valid Kentucky Pollutant Discharge Elimination System (KPDES) permits No. KY0082554 and No. KY0082864 for discharges to the headwaters of the Elijah Creek and Gunpowder Creek tributary drainages. On February 19, 1997, the Division of Water reissued Permit No. KY0082864 to KCAB to cover all discharges formerly permitted under the two previously noted permits.

4. Between May 25, 1994, and June 18, 1996, authorized representatives of the Cabinet documented, and issued Notices of Violation to KCAB for the following violations of KCAB's KPDES permits, KRS Chapter 224, and the regulations promulgated pursuant thereto:

- degrading of the waters of the Commonwealth, a violation of 401 KAR 5:031;
- discharges from point sources not permitted by a KPDES permit, a violation of 401 KAR 5:055;

- failure to abide by KPDES permit limits and KPDES program standards, a violation of 401 KAR 5:065 (1);
- failure to properly operate and maintain the facility, a violation of 401 KAR 5:065 (4);
- failure to submit Discharge Monitoring Reports (hereinafter DMRs), a violation of 401 KAR 5:065;
- failure to properly complete DMRs, a violation of 401 KAR 5:065; and
- failure to mitigate advanced impact, a violation of 401 KAR 5:065 (1)(4).

5. Following documentation of the May 25, 1994, violations, representatives of KCAB and the Division of Water attended numerous administrative conferences to discuss the ongoing issues of noncompliance with the KPDES permits.

6. The execution of this Agreed Order by the KCAB shall not be construed as an admission by KCAB of any wrongful acts, violations of any law, statute, ordinance and/or regulation. KCAB enters into this Agreed Order solely in the interest of settling all claims and controversies addressed herein.

NOW THEREFORE, in the interest of settling all civil claims and controversies involving the violations described above, the parties hereby consent to the entry of this Agreed Order and agree as follows:

REMEDIAL MEASURES

7. KCAB submitted, on February 20, 1997, for Division of Water review and approval, a Groundwater Protection Plan (GPP) to address groundwater pollution control at the facility. If the Division of Water does not approve the GPP, modifications in the plan shall be made in accordance with Division of Water specifications and resubmitted within thirty (30) days of receipt of the aforementioned specifications from the Division of Water's written approval of the plan. A copy of the GPP shall be maintained at the facility identified in paragraph 2 of this Agreed Order. Future updates in the GPP shall be provided to the Division of Water's Groundwater Branch and the Florence Regional Office within fifteen (15) days of each update.

8. KCAB shall, within ninety (90) days of execution of this Agreed Order by the Secretary of the Cabinet, update and submit its Best Management Practices (BMP) plan as appropriate according to current conditions at the facility to maintain compliance with the terms and conditions of its KPDES Permit No. KY0082864. The BMP plan shall address water pollution control and prevention management practices, including all de-icing and anti-icing activities, and describe spill and bypass reporting procedures, materials handling practices, and erosion and sediment control for construction activities. If the Division of Water does not accept the BMP plan, modifications in the plan shall be made in accordance with Division of Water specifications and resubmitted within sixty (60) days of receipt of the aforementioned specifications. The KCAB shall implement the BMP plan within fifteen (15) days of receiving the Division of Water's written acceptance of the plan. A copy of the plan shall be maintained at the facility identified in paragraph 2 of this Agreed Order. The KCAB shall annually review the BMP plan and make changes as appropriate to current facility operating conditions. Copies of the original BMP plan and future updates to the BMP plan shall be provided to the Florence Regional Office within fifteen (15) days of implementation of the respective plans and updates.

9. KCAB shall comply with all requirements of 401 KAR 5:065 to ensure that samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. Monitoring and analysis shall be conducted according to procedures approved under 40 CFR Part 136, unless other test procedures have been specified in the permit.

10. KCAB shall comply with all terms and conditions of KPDES permit No. KY0082864. KCAB shall modify the "Master Plan for De-Icing Fluid Containment and Runoff Control Project", dated September 29, 1995, by deleting Tasks 3.2, 3.4, and 3.5. In accordance with the provisions of Task 3.6 of said Master Plan, KCAB shall identify and evaluate the feasibility of additional de-icing fluid containment and runoff control measures. This identification and evaluation shall be submitted to the Cabinet for its review on or before October 31, 1997. This submittal by KCAB shall delineate any operational and construction mitigation measures already undertaken and/or completed by KCAB and shall further delineate additional measures and a schedule for implementation thereof.

PENALTIES

11. KCAB shall be assessed a civil penalty in the amount of one hundred thousand dollars (\$100,000). KCAB shall pay a civil penalty in the amount of fifty thousand dollars (\$50,000) within

ten (10) days of execution of this Agreed Order by the Secretary of the Cabinet for the violations referenced in this Agreed Order. In lieu of cash payment of the remaining fifty thousand dollars (\$50,000), the Division of Water will credit the amount towards the purchase of a Vquip Sweeper, or its equivalent, by KCAB before the beginning of the 1997/1998 de-icing season.

12. KCAB shall pay the Cabinet a civil penalty in the amount of five thousand dollars (\$5,000) within ten (10) days of receipt of written notice from the Cabinet for failure to comply with paragraphs 7 and 8 of this Agreed Order. This penalty is in addition to, and not in lieu of, any other penalty which could be assessed. The additional penalty specified in this paragraph only shall be waived after a period of one year from the date of execution of this Agreed Order by the Secretary of the Natural Resources and Environmental Protection Cabinet if all terms of this Agreed Order have been complied with.

13. KCAB shall pay the Cabinet a civil penalty in the amount of one thousand dollars (\$1,000) within ten (10) days of receipt of written notice from the Cabinet for failure to comply with paragraphs 9 and 10 of this Agreed Order. This penalty is in addition to, and not in lieu of, any other penalty which could be assessed. The additional penalty specified in this paragraph only shall be waived after a period of one year from the date of execution of this Agreed Order by the Secretary of the Natural Resources and Environmental Protection Cabinet if all terms of this Agreed Order have been complied with.

14. KCAB shall tender all penalty payments to the Cabinet by certified check, cashier's check or money order, **payable to the Kentucky State Treasurer**. Payment shall be tendered to the Kentucky Division of Water, Enforcement Branch, 14 Reilly Road, Frankfort, Kentucky 40601. Note "Case No. DOW 94190" on the instrument of payment.

MISCELLANEOUS PROVISIONS

15. This Agreed Order addresses only those violations specifically described above. Nothing contained herein shall be construed to waive or to limit any remedy or cause of action by the Cabinet based on statutes or regulations under its jurisdiction, and KCAB reserves its defenses thereto. The Cabinet expressly reserves its right at any time to issue administrative orders and to take any other action it deems necessary, including the right to order all necessary remedial measures, assess penalties for violations, or recover all response costs incurred, and KCAB reserves its defenses thereto.

16. This Agreed Order shall not prevent the Cabinet from issuing, renewing, modifying, revoking, suspending, denying, terminating, or reopening any permit to KCAB. KCAB reserves its defenses thereto, except that KCAB shall not use this Agreed Order as a defense.

17. KCAB waives its right to any hearing on the matters alleged herein. However, failure by KCAB to comply strictly with the terms of this Agreed Order shall be grounds for the Cabinet to seek enforcement of this Agreed Order in Franklin Circuit Court and to pursue any other appropriate administrative or judicial action under KRS Chapter 224 and the regulations promulgated pursuant thereto.

18. Each separate provision, condition or duty contained in this Agreed Order may be the basis for an enforcement action for a separate violation and penalty pursuant to KRS Chapter 224 upon failure to comply with the terms of this Agreed Order.

19. This Agreed Order may not be amended except by a written order of the Cabinet's Secretary or his designee. KCAB may request an amendment by writing the Director of the Division of Water at 14 Reilly Road, Frankfort, Kentucky 40601 and stating the reasons for the request. If such request is granted, the amended Agreed Order shall not affect any provision of this Agreed Order unless expressly provided in the amended Agreed Order.

20. The Cabinet does not, by its consent to the entry of this Agreed Order, warrant or aver in any manner that KCAB's complete compliance with this Agreed Order will result in compliance with the provisions of KRS Chapter 224, and the regulations promulgated pursuant thereto. Notwithstanding the Cabinet's review and approval of any plans formulated pursuant to this Agreed Order, KCAB shall remain solely responsible for compliance with the terms of KRS Chapter 224 and the regulations promulgated pursuant thereto, this Agreed Order and any permit requirements.

21. The provisions of this Agreed Order shall apply to and be binding upon KCAB. The acts or omissions of KCAB's officers, directors, agents, and employees shall not excuse the performance of any provision of this Agreed Order. The Cabinet reserves the right to seek enforcement of this Agreed Order against the successors and assigns of KCAB, and KCAB reserves its defenses thereto. KCAB shall give notice of this Agreed Order to any purchaser, lessee or successor in interest who will act as operator of the airport facilities now known as the Airport occurring prior to termination of this Agreed Order, shall notify the Cabinet that such notice has been

given, and shall follow all statutory and regulatory requirements for a transfer. Whether or not a transfer takes place, KCAB shall remain fully responsible for payment of all civil penalties and response costs and for performance of all remedial measures identified in this Agreed Order.

22. The Cabinet agrees to allow the performance of the above-listed remedial measures and payment of civil penalties by KCAB to satisfy KCAB's obligation to the Cabinet generated by the alleged violations described above.

23. The Cabinet and KCAB agree that the remedial measures agreed to herein are facility-specific and designed to comply with the statutes and regulations cited herein. This Agreed Order applies specifically and exclusively to the unique facility referenced herein and is inapplicable to any other site or facility.

24. This Agreed Order shall be of no force and effect unless and until it is entered by the Secretary or his designee as evidenced by his signature thereon. If this Agreed Order contains any date by which KCAB is to take any action, and the Secretary enters the Agreed Order after that date, then KCAB is nonetheless obligated to have taken the action by the date contained in this Agreed Order.

AGREED TO BY:

Authorized Agent for
Kenton county Airport Board

DATE

APPROVAL RECOMMENDED BY:

Jack A. Wilson, Director
Division of Water

DATE

Attorney for the Cabinet
Office of Legal Services

DATE

Case No. DOW 94190

Glenna Jo Curry, General
Counsel
Office of Legal Services

DATE

Case No. DOW !

ORDER

WHEREAS, the foregoing Agreed Order is entered as the final Order of the Natural Resources and Environmental Protection Cabinet this _____ day of _____, 1998.

JAMES E. BICKFORD, SECRETARY
NATURAL RESOURCES AND
ENVIRONMENTAL PROTECTION CABINET

CERTIFICATE OF SERVICE

I hereby certify that a true and accurate copy of the foregoing AGREED ORDER was mailed, postage prepaid, to the following this _____ day of _____, 1997.

Mr. Dale Keith
Director of Operations
Cincinnati/Northern Kentucky
International Airport
P.O. Box 752000
Cincinnati, Ohio 45275-2000

DOCKET COORDINATOR

DISTRIBUTION:

Division of Water
Order File
Attorney, Office of Legal Services