Missouri Department of Natural Resources' Air Pollution Control Program

Airport Selection —Meteorological Data Representative of Exide Technologies-Canon Hollow

Background and Purpose

The Exide Technologies' Canon Hollow facility (Exide) is located on about 640 acres 4 miles northwest of Forest City, Missouri, in Holt County. Exide is an active facility that recycles lead-acid storage batteries and other lead-bearing raw materials purchased offsite by smelting the material into new lead ingots. The facility uses four pot furnaces and a blast furnace to smelt the recycled lead components. The plastic and acid are collected and shipped off site. The installation uses baghouses, an after-burner, a scrubber, and street sweepers to control sulfur, lead, volatile organic compounds and particulate matter emissions. This facility is a major source of volatile organic compound (VOC) and sulfur dioxide (SO_2) emissions.

Monitoring data from March through September 2012 indicate that Exide is violating the 2008 lead National Ambient Air Quality Standard (NAAQS). The Missouri Department of Natural Resources' Air Pollution Control Program and Exide are working cooperatively on developing a State Implementation Plan (SIP) to address this issue and bring the facility into compliance with the 2008 lead NAAQS as expeditiously as practicable. The Air Program, Exide and EPA Region 7 met on November 6, 2012 to kick off the SIP development process. The group agreed to submit the SIP to EPA on an expedited timeline, no later than April 2014.

A key component of the SIP will be an air dispersion modeling analysis showing that Exide will attain and maintain the lead NAAQS based on proposed control measures taken by the facility. Based on EPA modeling guidance, it is preferable that one year or more, up to five years, of on-site meteorological data be used in the dispersion modeling exercise (40 CFR Part 51 Appendix W (November 2005)). The document entitled "Meteorological Monitoring Guidance for Regulatory Modeling Applications" describes the criteria that should be considered when siting meteorological instruments for modeling purposes. Typically, wind instruments should be placed on a boom that is located at least two meters away from an open lattice ten-meter tower in an area that is free from obstructions. The placement of wind instruments on buildings, cooling towers or stacks should be avoided due to the potential for downwash influences. The effect on the wind speed and direction can be significant and can result in non-representative, poor quality data. If an instrument is placed on a building, the probe would have to be clear of any wake zones that are present and should be representative of the conditions that are occurring at the point of release (minimum of ten meters). Due to the fact that Exide's meteorological station is located on a roof of a building, it was determined that data collected by it is not appropriate for a SIP attainment demonstration modeling evaluation.

Due to the expedited SIP development schedule, at the November 6, 2012 meeting, the group agreed that collecting one year of on-site meteorological data is not feasible at this time. Instead, meteorological data collected at a representative airport should be used for the SIP modeling analysis. This document will evaluate three airports' meteorological data (Kansas City International Airport, Rosecrans Memorial Airport, and Brenner Field located near Falls City, Nebraska) to determine which data most closely represent conditions at the facility. These airports were selected since they are the closest to Exide. Other airports located farther away have weather patterns which are quite different from that of the facility.

Representative Airport Determination

To determine a representative airport for Exide, three characteristics that describe the surface surrounding the airport and facility must be compared: the surface roughness length, albedo and Bowen ratio. The surface roughness length is related to the height of obstacles to the wind flow and is, in principle, the height at which the mean horizontal wind speed is zero based on a logarithmic profile. The surface roughness length influences the surface shear stress and is an important factor in determining the magnitude of mechanical turbulence and the stability of the boundary layer. The albedo is the fraction of total incident solar radiation reflected by the surface back to space without absorption. The daytime Bowen ratio, an indicator of surface moisture, is the ratio of sensible heat flux to latent heat flux and, together with albedo and other meteorological observations, is used for determining planetary boundary layer parameters for convective conditions driven by the surface sensible heat flux. Because these surface characteristics can influence the similarity profiles that are utilized by the dispersion model, AERMOD, one must determine if the surface characteristics at the meteorological site are similar to those at the facility site. A direct comparison between the surface characteristics at the meteorological site and those at the surface site is necessary to determine if the differences that result will significantly impact the overall pollutant concentrations.

In order to provide a consistent method for determining surface characteristics, the EPA developed a mathematical tool, AERSURFACE, to determine surface roughness length, Bowen ratio, and albedo values for input into AERMET.

AERSURFACE employs land cover data from the United States Geological Survey 1992 National Land Cover data archives. Each of the 21 land use categories contained within the land cover database are linked to a set of seasonal surface characteristics as defined in Tables A-1, A-2, A-3 and 2-2 of the AERSURFACE User's Guide. The seasonal categories represent the same categories employed by the AERMOD system for its gas deposition algorithms.

As noted in the AERSURFACE User's Guide, EPA's recommendations for determining surface characteristics in Section 3.1 of the AERMOD Implementation Guide dated, March 19, 2009, have been incorporated into the AERSURFACE tool. The Department's Air Pollution Control Program executed AERSURFACE using the default values described below:

- Bowen ratio
  - Ten kilometer by ten kilometer domain centered on the site.
- Albedo
  - Ten kilometer by ten kilometer domain centered on the site.
- Surface roughness length
  - Default upwind distance of one kilometer centered on the site.
  - Twelve, 30 degree meteorological sectors.

Other considerations made in the execution of the AERSURFACE tool include the site type (is the site an airport?), site climatology (arid or not?) and surface moisture (dry, average, wet). Because the surface moisture can vary based upon the meteorological period, AERSURFACE was executed for each moisture condition.

For this project, the surface characteristics surrounding three airports (Kansas City International Airport, Rosecrans Memorial Airport, and Brenner Field located near Falls City, Nebraska) were compared to the surface characteristics surrounding Exide. Figures 1, 2, 3 and 4 show aerial photos at Exide, Kansas City International Airport, Rosecrans Memorial Airport, and Brenner Field, Nebraska, respectively. In addition, each of the three airports was evaluated based upon proximity to Exide, shown in Figure 5. Refer to the attached Excel document (Exide & Airports Site Characteristics Tables.xls) for the surface characteristics results.

The first site under consideration was Brenner Field, Nebraska. This airport is the closest to the Exide facility at a distance of 31-kilometers; refer to Figures 4 and 5, and "Brenner Field, NE" sheet in the attached Excel document. The primary difference in the land use between Exide and Brenner Field is the presence of the forested areas immediately surrounding Exide. In addition, 8% and 1% of the land uses are developed areas around Brenner Field and Exide, respectively; refer to the pie charts in "Brenner Field, NE" worksheet in the Excel document. The similarity in land use is the presence of large areas of herbaceous (89%) surrounding the airport and large herbaceous (67%) to the west of Exide within the Missouri River floodplain as shown in Figure 1 and the pie charts. Based upon surface characteristics, without terrain considerations, the land use between the two sites is not identical, with greater roughness values noted near Exide due to the presence of trees; refer to the pie charts in "Brenner Field, NE" worksheet and Table 3 in the Excel document.

The second site under consideration was the Kansas City International Airport. It is approximately 92-kilometers from Exide and has similar land use characteristics to the Brenner Field, Nebraska airport site, refer to Figure 2. Kansas City International does have some forested areas, however. The surface roughness parameters for Brenner Field, Nebraska are slightly better than those at Kansas City International as compared to the parameters at Exide as shown in Table 3 and Table 1 in the "Brenner Field, NE" and "Kansas City International" worksheets, respectively. For example, as shown in these tables, the differences in average surface roughness between Exide and Brenner airport for average moisture conditions in winter, spring, summer and fall are 0.0550, 0.1105, 0.1975 and 0.2024, respectively. While the differences in average surface roughness between Exide and Kansas City airport for average moisture conditions in winter, spring, summer and fall are 0.0613, 0.1264, 0.2619 and 0.2696, respectively.

Rosecrans Memorial Airport has the least surface roughness amongst the three airports as compared to Exide. In addition, 43% of the land surrounding the airport is developed, as shown in the pie chart in "Rosecrans Memorial" worksheet, as compared to only 1%, 8% and 16% of the lands surrounding Exide, Brenner Field and Kansas City International Airport, respectively. Therefore, this airport is the least similar and was not considered in the final airport selection.

Based upon the information that is available and given the similar land use characteristics to both Kansas City International and Brenner Field airports, the proximity of Brenner Field, Nebraska to the Exide facility indicates that it is the best choice for the Exide model evaluation.

Figure 1: Aerial Photo Showing Exide Site Characteristics

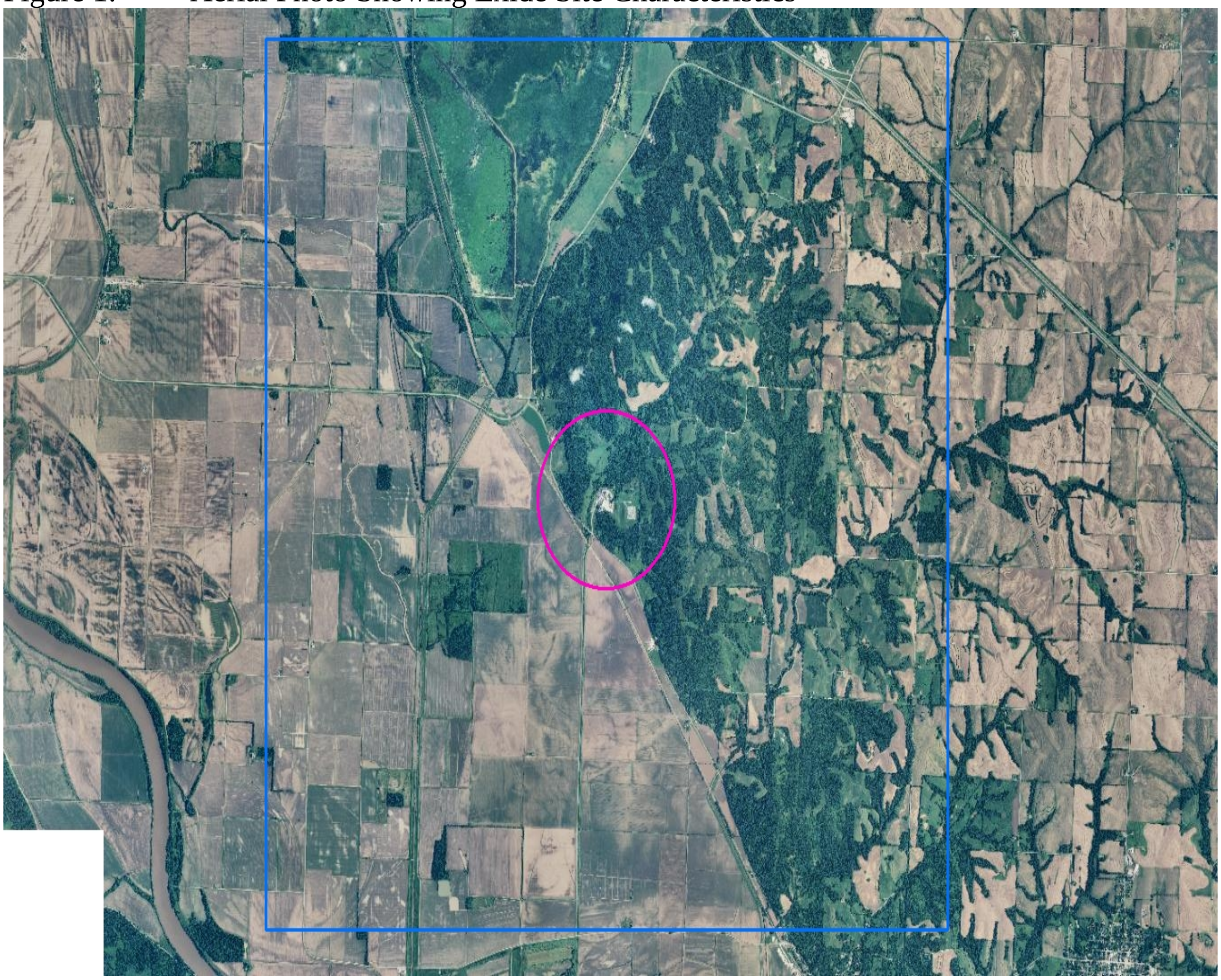

Figure 2: Aerial Photo Showing Kansas City International Airport Site Characteristics

Figure 3: Aerial Photo Showing Rosecrans Memorial Airport Site Characteristics

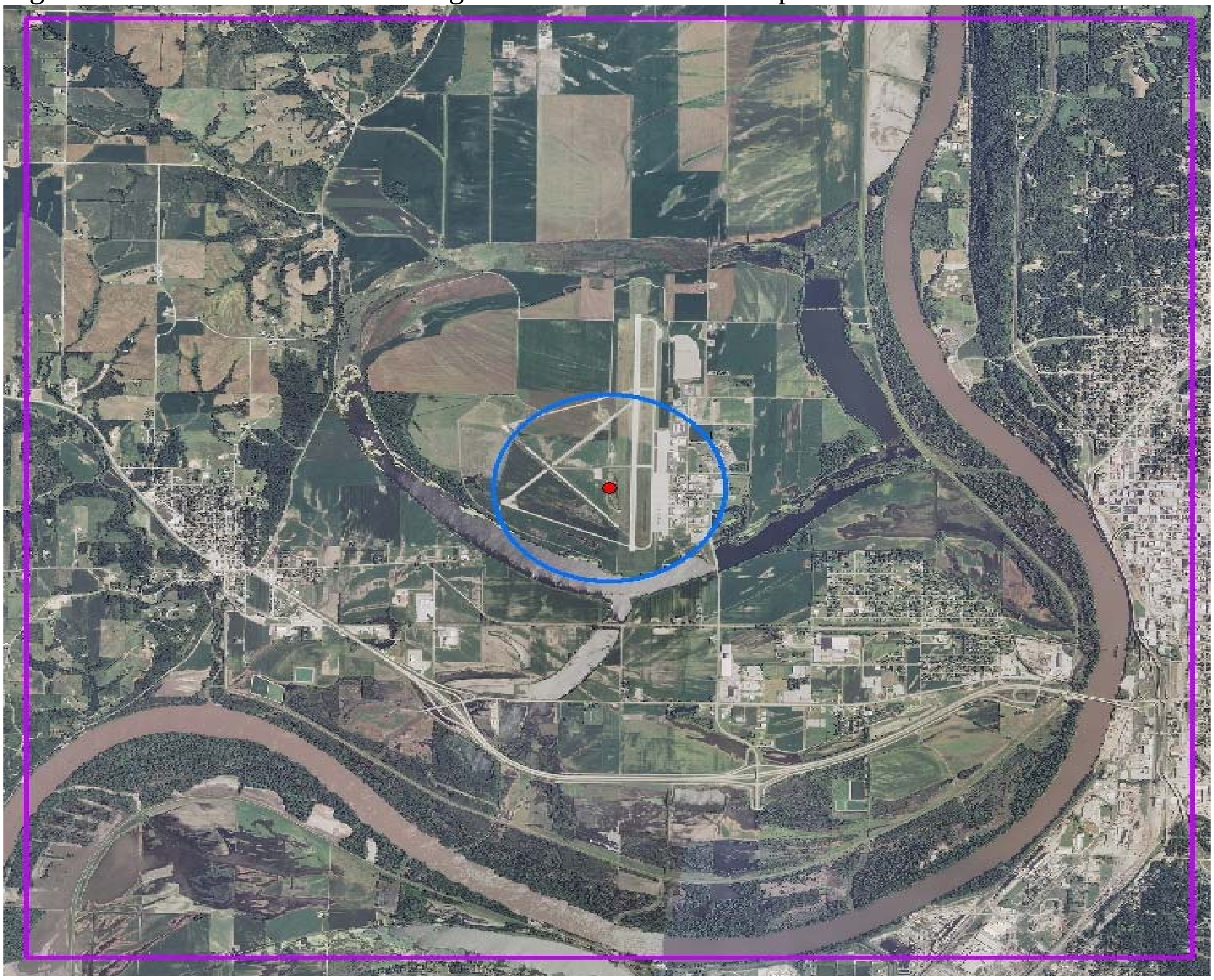

Figure 4: Aerial Photo Showing Brenner Field, Nebraska Site Characteristics

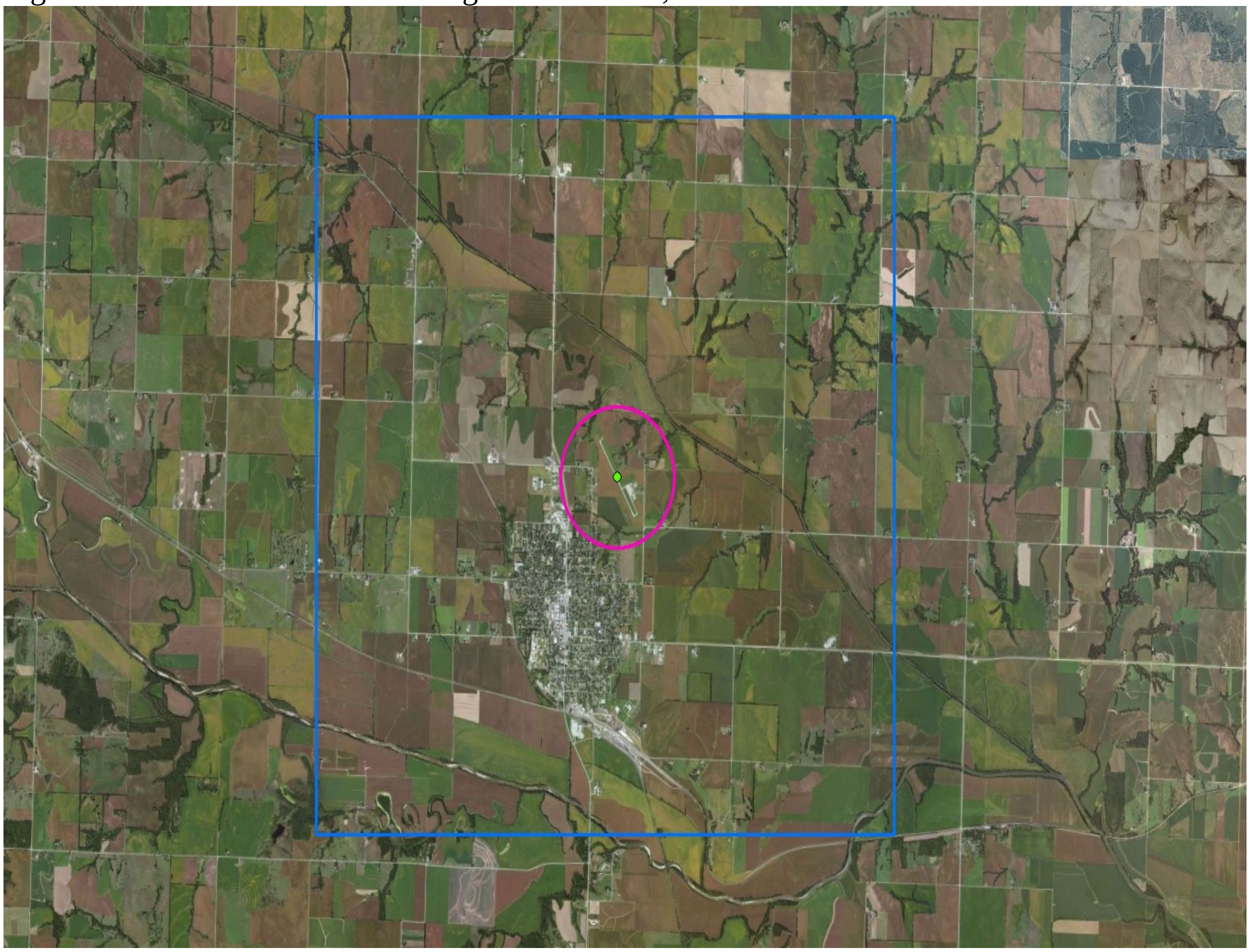

Figure 5: Proximity of the Three Airports to Exide