

# **Dispersion Modeling and Historic Monitoring Data Analysis for Logan County**

## ***Technical Support for Lead Nonattainment Area Boundary Determination***

**August 2009**

As a result of the recent enactment of a more-stringent National Ambient Air Quality Standard for lead, three of four monitors in Logan County that showed compliance under the previous standard will now show non-compliance under the new standard if they continue to exhibit readings similar to those of the recent past. Ohio is required to propose a suggested non-attainment area boundary indicative of the area where violations occur, which is defined as the region over which there may occur an airborne concentration greater than 0.15 microgram per cubic meter ( $\mu\text{g}/\text{m}^3$ ), expressed as a rolling three-month average.

As part of the proposed monitoring plan for lead, Logan County will only be monitored in the future by one monitor. Historical monitoring in this area was a result of one facility, Daido, located in Bellefontaine, Ohio. In June of 2009 the Daido facility permanently shut down all operations related to lead. However, Ohio EPA will continue to monitor the area, using the one worst case monitor, until three years of clean data are obtained. For the purpose of this analysis, to determine an appropriate nonattainment boundary, all four historical monitors are being used to evaluate historical trends.

The simplest procedure for defining the perimeter of that region, involving spatial interpolation of historic monitor data, was found to be inapplicable due to an unsuitable number and distribution of monitors showing exceedances of the standard. Rather, a hybrid approach was followed, involving the use of the AERMOD dispersion model in conjunction with historic data. The model is used to generate reasonable concentration gradients throughout the study area, while the monitor data is used to generate actual/modeled concentration ratios that can serve as "correction factors" for adjustment of any apparent systematic tendency of the model to over, or under, predict monitor values. The Kriging algorithm is used for spatial interpolation of modeled concentrations and drawing of isopleths. Because a value of 0.145 rounds upwards to 0.15, a concentration of  $0.145 \mu\text{g}/\text{m}^3$  (after application of the actual/modeled correction factor) is to be taken as the bounding isopleth.

The following four monitors at three sites are included in the analysis:

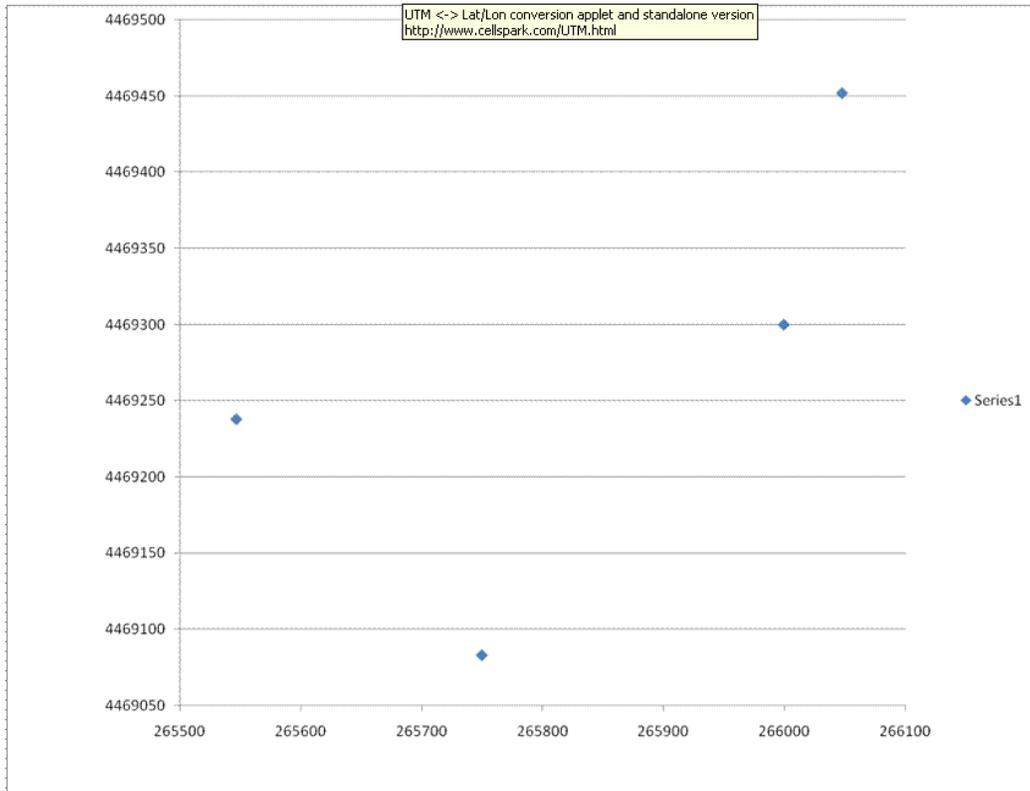
**Selected lead monitoring sites in Logan Co.**  
(zone 17; base plane NAD83)

Site name	AQS number	probe height	uncorrected latitude	uncorrected longitude	corrected latitude	corrected longitude	easting	northing
1222 Superior	39-091-0003	5.	40.34306	-83.755	40.34394	-83.75610	265910	4469579
1205 Superior	39-091-0007	5.	40.34472	-83.75444	40.34394	-83.75610	265910	4469579
S. Main	39-091-0005	5.	40.34278	-83.76028	N/A	N/A	265551	4469461
Richard Ave.	39-091-0006	5.	40.34111	-83.75778	40.34147	-83.75868	265682	4469311

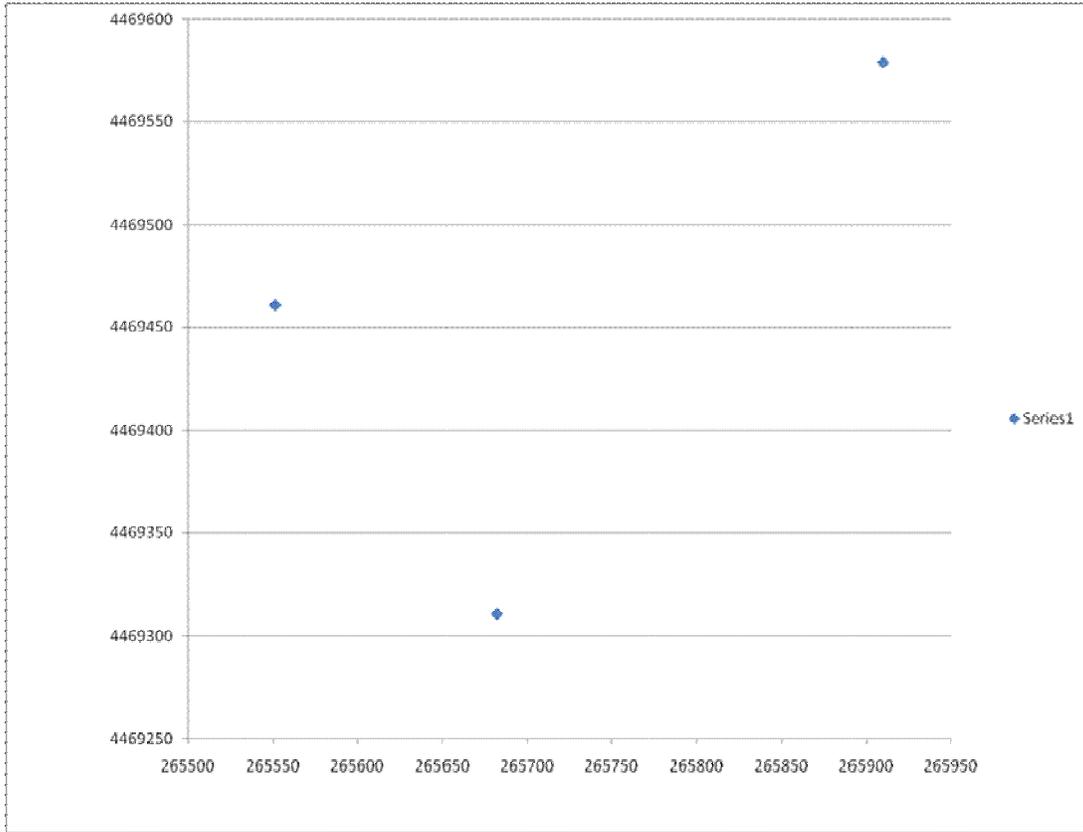
At the Superior Avenue location, the 39-091-003 and 39-091-007 monitors are mounted on the same pedestal, despite having different street addresses. The coordinates of the Richard Avenue and Superior Avenue monitors in the AQS database were found to be somewhat imprecise, so improved locations were used for this study. They are shown on these plots:

**selected lead monitors in Logan County**  
(zone 17 eastings and northings in meters)

(prior to corrections)



(corrected)



The historic data for these sites showed the following time periods to be of interest, based on rolling three-month averages:

**Selected concentrations at lead monitor sites in Logan Co.**  
ug/m<sup>3</sup> 3-month averages ending on the stated month

Site name	August, 2005	July, 2006	August, 2006
1222 Superior	0.073	0.088	0.086
S. Main	0.120	0.128	0.100
Richard Ave.	0.253	0.173	0.220
1205 Superior	0.163	0.237	0.207

Modeling of all known lead sources in the county was conducted with AERMOD. Below is a list of all lead sources along with the modeled values:

### Logan County Lead Sources

Longitude	Latitude	Facility Name	2005 NEI Emissions (tpy)	TRI2005 TRI Emissions (tpy)	Maximum Modeled Value (tpy)
-83.7598	40.34411	QUINCY CASTINGS INC.	0.035	0.035	0.035
-83.5664	40.33883	HONDA OF AMERICA, EAST LIBERTY PLANT	0.0075	0.0075	0.0075
-83.88	40.46	HONDA TRANSMISSION MANUFACTURING OF AMERICA INC	0.0075	0.0075	0.0075
-83.9726	40.29898	DAIDO METAL BELLEFONTAINE LLC	0.121	0.121	0.1447

Additional details for these facilities can be found in Appendix A.

The release points of the Daido facility in the town of Bellefontaine are located in close proximity to the monitors in question, and are believed to be predominantly responsible for the elevated readings. Source information from lead sources for Daido was not provided to the Ohio EPA due to the shutdown of facility as discussed above. The entire facility was modeled as an area source. Property dimensions were used as the size of the area source.

Both the Honda East Liberty Plant and Honda Transmission Manufacturing facilities were modeled as single point sources using the emissions identified in the table above. Stack information from lead sources provided to Ohio EPA by the Honda East Liberty facility were averaged to create a single lead emission source. Stack information from lead sources for the Honda Transmission Manufacturing facility was not provided to the Ohio EPA. The averaged source parameters for the Honda East Liberty facility were also used for the Honda Transmission Manufacturing facility.

Source information from lead sources for Quincy Castings was not provided to the Ohio EPA. It is believed that the lead source at Quincy Castings is an area source; therefore, it was modeled as such. Building dimensions provided to Ohio EPA were used as the size of the area source.

Surface data from Columbus, Ohio (National Weather Service Site 14821) and Upper Air data from Dayton, Ohio (National Weather Service Site 13840) were determined to

be representative of Logan County. AERSURFACE was run using one sector and four seasons.

A total of 1001 receptors, with 200 meters spacing, were modeled. A discrete receptor was added at each of the monitor locations. Because the monitors at 1222 Superior Avenue and 1205 Superior Avenue are co-located only one discrete receptor was modeled for these monitors. A background concentration was not added to the modeled concentration because all surrounding sources were included in the modeling.

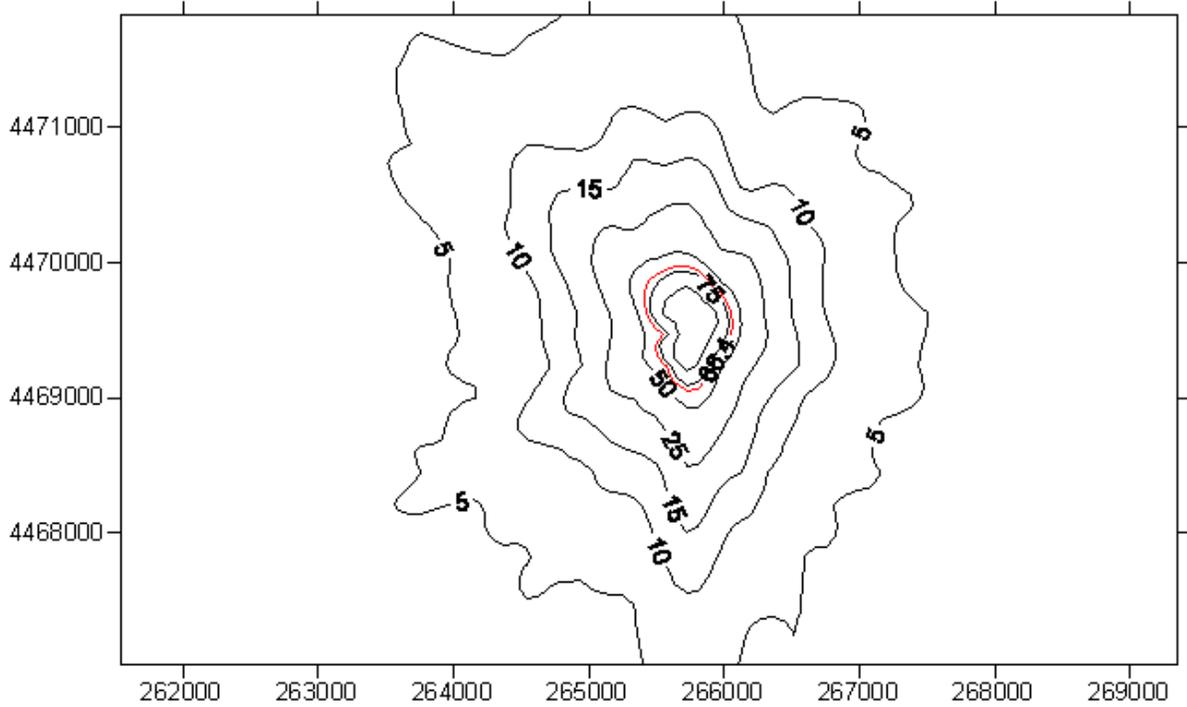
The lead post processor results showed the highest modeled concentration at three of the four monitors well below historical actual monitored data. In order to establish an appropriate nonattainment boundary that is conservative for this area it was necessary to correct for the discrepancy between the modeled monitor value and the worst case historical actual monitor value. The following depicts the modeled results and computed correction factors by monitor location:

**Modeled and corrected concentrations at lead monitor sites in Logan Co.**  
 ug/m<sup>3</sup> 3-month averages ending on the stated month  
 with highest modeled concentration over a three-year period, and corresponding  
 monitor/model correction factor

Site name	August, 2005	July, 2006	August, 2006	modeled conc.	monitor/model factor
1222 Superior	0.073	0.088	0.086	0.1167	0.754
S. Main	0.120	0.128	0.100	0.0586	2.184
Richard Ave.	0.253	0.173	0.220	0.1159	2.183
1205 Superior	0.163	0.237	0.207	0.1167	2.031

Using the worst case (to be conservative) monitor/model correction factor of 2.184, the isopleth defining the boundary of the nonattainment area was taken as  $145/2.184 = 66.4$  nanograms/m<sup>3</sup>. Use of Golden Software Surfer 8 to generate a Kriging concentration plot of the highest 3-month rolling averages of all the modeled receptors gives the following result (with the 66.4 nanogram/m<sup>3</sup> isopleth defining the proposed nonattainment area drawn in red):

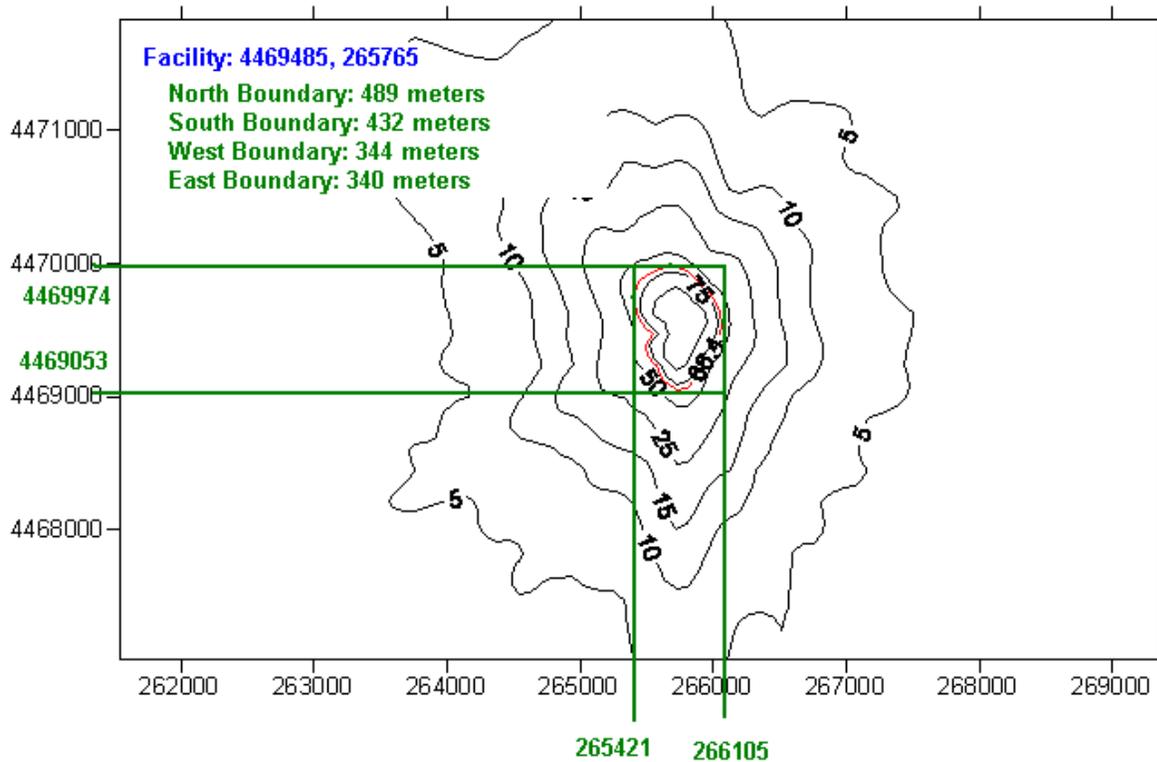
**Modeled lead concentration isopleths and proposed lead nonattainment area for Logan County**  
(zone 17 eastings and northings, NAD83 base plane)



Kriged isopleths of highest (non-concurrent) 3-month rolling average modeled lead concentrations in Logan County nanogram per cubic meter

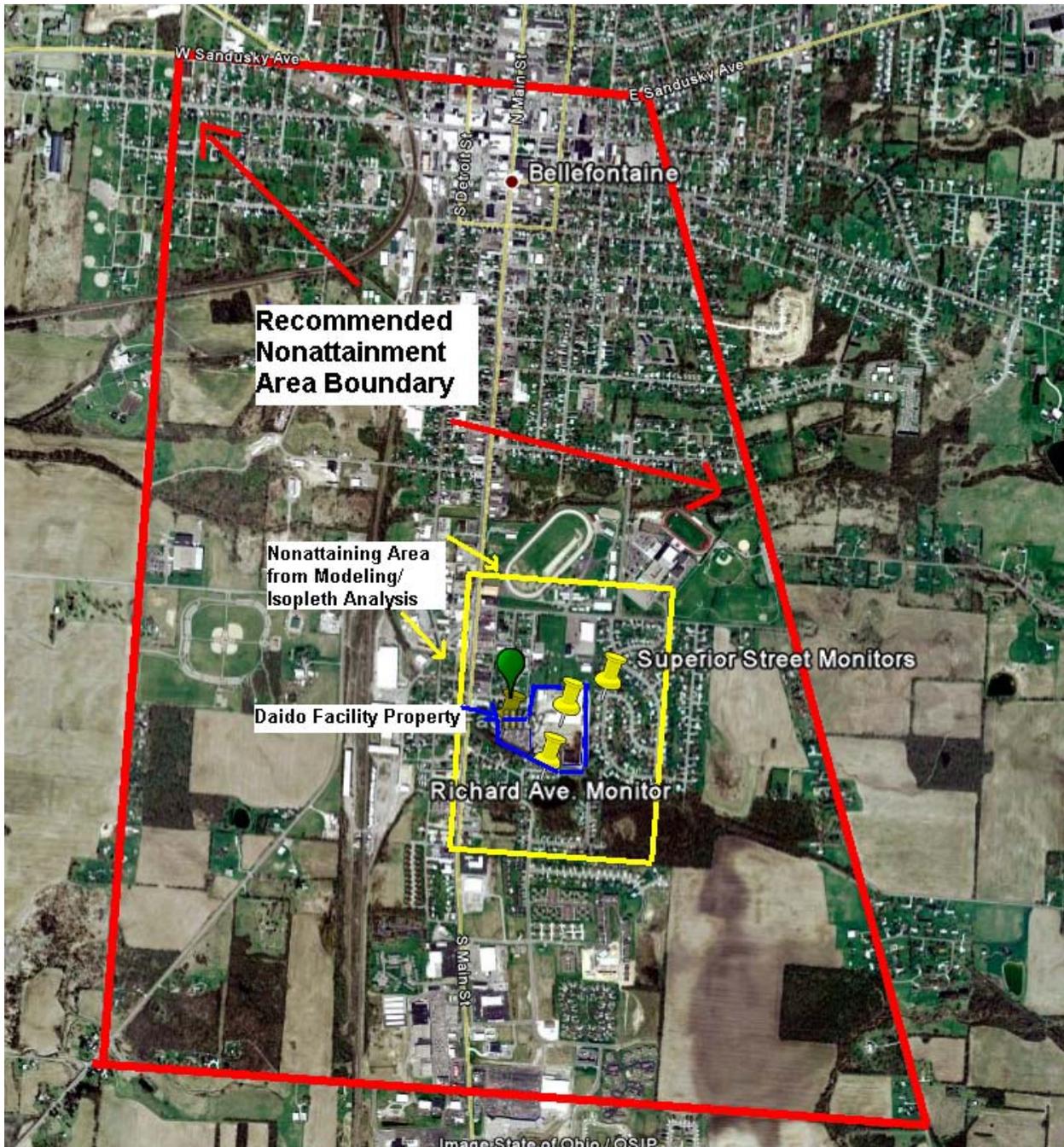
As depicted below, the outer north, south, east and west boundary edges of the 66.4 nanogram/m<sup>3</sup> isopleth were used to calculate the distance, in meters, from the Daido facility.

Kriged isopleths of highest (non-concurrent) 3-month rolling average modeled lead concentrations in Logan County nanogram per cubic meter



The image shows good symmetry in all directions, with the bounds of the enclosed area extending about 489 meters to the north and 432 meters to the south while it extends 344 meters to the west and 340 meters to the east.

These distances from the Krigé plot were then overlaid on a map of the area to help define an appropriate boundary that would conservatively encompass an area where violations could occur, as depicted below:



As can be seen above, the recommended nonattainment boundary is very conservative in encompassing the 66.4 nanogram/m<sup>3</sup> boundary. This boundary was selected by viewing Logan County township and township-section boundaries. The following township sections demark the boundary for recommendation:

Lake Township – Sections 27, 28, 33 and 34

As depicted in the township section map below:

