

**Technical Support Document for Recommendation of
Nonattainment Boundaries in Missouri for the
2008 Lead National Ambient Air Quality Standard**

**Adopted by the
Missouri Air Conservation Commission
December 3, 2009**



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Introduction

On October 15, 2008, the U.S. Environmental Protection Agency (EPA) promulgated a revision to the National Ambient Air Quality Standard (NAAQS) for lead, which establishes 0.15 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) as the primary and secondary standard. Compliance with the 2008 standard is determined by calculating the monthly average of the lead concentrations at each monitor and averaging that value with the prior two months' averages (e.g. three-month rolling average). When calculating the three-month average, concentrations below $0.155 \mu\text{g}/\text{m}^3$ are rounded to $0.15 \mu\text{g}/\text{m}^3$ and are still in compliance, while concentrations equal to or above $0.155 \mu\text{g}/\text{m}^3$ are rounded to $0.16 \mu\text{g}/\text{m}^3$ and represent a violation of the standard. It should be noted that compliance with the old standard of $1.5 \mu\text{g}/\text{m}^3$ was based on a calendar quarterly average.

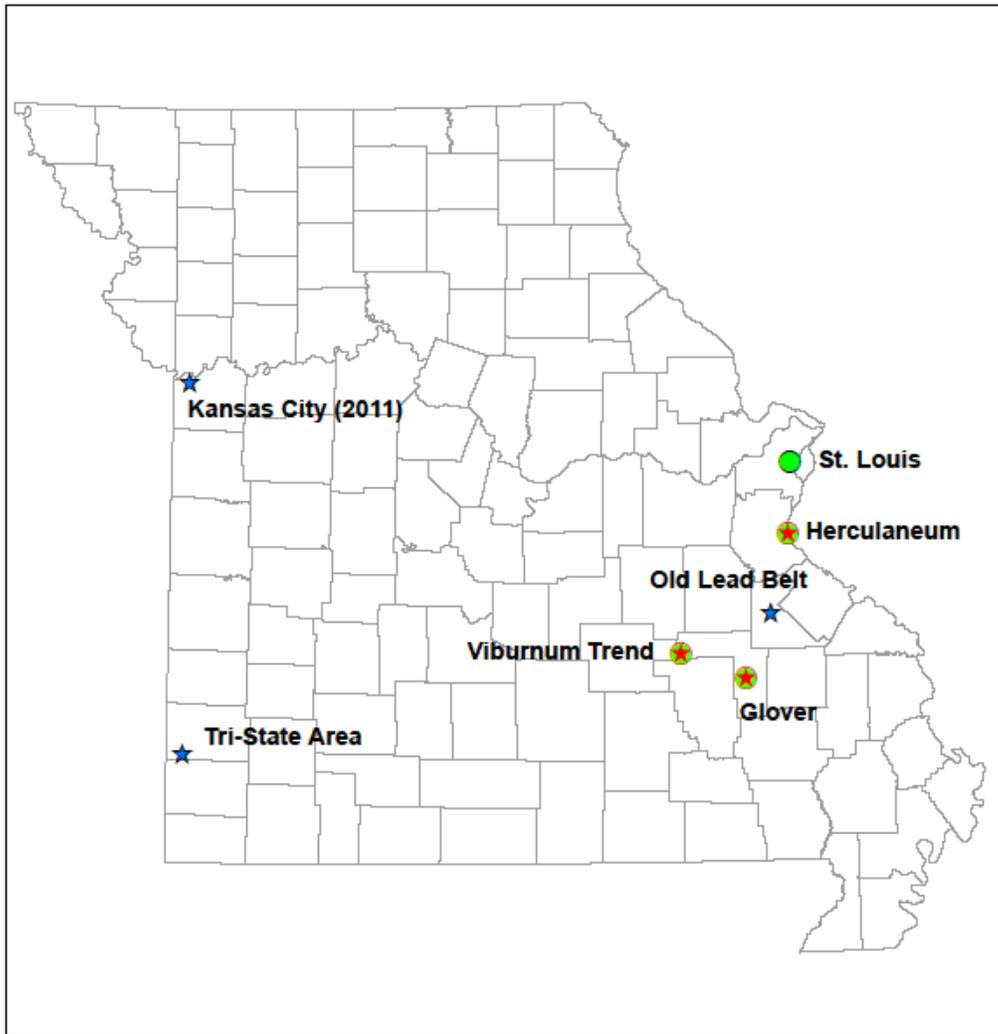
As provided under Clean Air Act Subparagraph 107(d)(1)(A), the governor of each state is required to submit to the EPA a recommendation regarding the attainment status of all areas within that state. Each area (or portion thereof) of the state shall be designated as: nonattainment for areas that do not meet the NAAQS or contain sources that contribute to nonattainment in a nearby area that does not meet the NAAQS; attainment for areas that meet the NAAQS; or unclassifiable for areas that cannot be classified attainment or nonattainment based on available information. The purpose of this document is to provide the technical bases for the recommendations described in the *Lead Designation and Boundary Recommendation*.

Lead is a pollutant primarily emitted from the combustion of fuel that contains lead, processing of recycled materials that contain lead (e.g. batteries), and the conversion of lead ore into refined lead. Since lead is a dense material that cannot be transported significant distances like other air pollutants, the impact from lead sources is usually in close proximity to the source.

Since the 2008 NAAQS requires the use of the most recent three-year period for determination of compliance, the Missouri Department of Natural Resources (Department) has evaluated the lead monitoring data from the years 2006-2008 to begin the recommendation process. Also, the EPA guidance for developing the lead designation recommendations included in the final lead NAAQS rule published in the November 12, 2008, *Federal Register* has been utilized in the development of these recommendations. In addition, the Department has published a lead monitoring network plan for implementation under the 2008 standard. The recommendations for sites under this network plan have been considered in the development of this document.

The current lead monitoring network in Missouri has several components. There is one site in St. Louis County that monitors extremely low concentrations and was located to provide a site representative of the St. Louis metropolitan area. The remaining sites in the current network are located near three lead smelting facilities operated by the Doe Run Company. The Department and Doe Run operate several monitors near Herculaneum in Jefferson County, which is the only existing lead nonattainment area in the state. These monitors were sited for compliance evaluations with the 1978 lead standard and most are located in close proximity to the primary lead smelter at Herculaneum. At this time, all these sites monitor violations of the 2008 standard. Doe Run operates two lead monitoring sites near the Buick secondary lead smelter in western Iron County that are in violation of the 2008 standard. Doe Run also operates two

monitors at the inactive Glover smelting operation in eastern Iron County. Since the shutdown of the pyro-processing equipment at the Glover facility, these sites have monitored concentrations below the 2008 NAAQS. In the past, many other monitoring lead monitoring sites were located in Missouri. Some of these sites were temporary in nature and did not evaluate compliance with the 1978 NAAQS. Figure 1 presents the current and newly proposed lead monitoring areas in Missouri.



Lead Areas

- **Active**
- ★ **Active & Proposed**
- ★ **Proposed**


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Figure 1: Statewide Active and Proposed Monitoring Sites

Note: Glover, Herculaneum, and the Viburnum trend have monitors in place and will be adding new samplers with the expansion of the lead monitoring network by January 1, 2010.

In addition to the monitoring data review, the Department has conducted several sets of dispersion modeling analyses for different lead sources in Missouri. One of these analyses evaluated the impact of a large combustion source of lead compared to the 2008 standard. The other analyses focused on Doe Run properties (Viburnum Trend lead mine/mills, Buick Resource Recycling, and Herculaneum). The Department has determined that these stationary sources have the potential to contribute to violations of the 2008 standard. However, the extent of this contribution to concentrations over the standard is limited due to the density of the lead particles and the corresponding lack of lead transport over distance. This finding is based on multiple plans developed for control of lead at the Doe Run facilities and the monitoring data associated with those areas. Therefore, the Department is recommending areas considerably smaller than the presumptive county boundaries due to the proximity of each source's contribution to areas of violation. These recommendations are supported by the eight factors included in the final rulemaking for the 2008 lead NAAQS. These include:

- 1) emissions,
- 2) air quality concentrations,
- 3) population density and degree of urbanization including commercial development,
- 4) expected growth,
- 5) meteorology,
- 6) geography/topography,
- 7) jurisdictional boundaries, and
- 8) level of control of emission sources.

In the next few sections, the Department will provide rationale for the draft recommendation for each area under consideration as unclassifiable or nonattainment.

Combustion Source Analysis

As part of the monitoring network plan development, the Department evaluated several coal combustion sources of lead emissions. Many of these sources have very tall stacks and the emissions from many of these stacks are very small [less than 0.1 tons per year (TPY)]. Nonetheless, a dispersion modeling exercise was conducted to evaluate the potential for one of these sources to violate the new air quality standard. The source selected was a cement kiln in Jefferson County and was modeled at an emission rate over two TPY (nearly 40 times the actual emission rate). The surface meteorological data was obtained from nearby St. Louis (2001-2005) and the upper air data was obtained from Lincoln, Illinois. The stack height of this source is 250 feet and the maximum monthly impact was $0.0045 \mu\text{g}/\text{m}^3$. Based on this finding, there is virtually no risk for a source of this type to contribute to an ambient violation of the 2008 NAAQS. Therefore, no additional analyses were conducted for coal combustion sources of lead in Missouri and no nonattainment designations will be recommended near any large coal-fired combustion sources.

Glover Smelter

The Doe Run Company owns a primary lead smelting facility at Glover, Missouri (DRG), located in eastern Iron County. Operation of the Glover primary smelter was suspended in December 2003 and it currently does not have an operating permit to use the pyro-processing equipment for lead smelting. The operation of this equipment led to the previous violations of the 1978 lead NAAQS. However, some lead ore has been stored in the past at the facility; zinc and copper concentrate from the mine/mill facilities is shipped by rail/truck from Glover; and other lead processing operations may begin in the future.

Existing Lead Monitoring Network and Past Monitoring Results

Airborne lead monitoring is done near the primary lead smelter in Glover, Missouri by Doe Run:

- Post Office (two collocated samplers)
- Big Creek

The Department and Doe Run have conducted airborne lead monitoring at multiple sites near the Glover smelter in the past. Figure 2 shows monitoring results (calendar quarter average concentrations) from third quarter 1987 through third quarter 2008. Results are plotted on the time scale at the initial month for each quarter. In other words, results plotted at “January” are for the January-February-March quarter, etc. The Hogan, Dunn, and South sites were operated by the Department’s Environmental Services Program (ESP). The North, Post Office (two collocated), Big Creek, and Chloride sites were operated by Doe Run Company (abbreviated in the figure legend as DRG N, DRG PO(1 and 2), DRG BC, and DRG CL). The Glover facility is located in a narrow valley that trends from North to South, and the monitoring sites, as listed in the legend, generally trend from north to south. Approximate locations of these monitoring sites are indicated in Figure 3. Results in Figure 2 clearly fall into three periods with different levels of lead concentrations: results through the end of 1996, results from 1997 through 2003, and results since 2003. In late 1996, under a revision to the State Implementation Plan (SIP) for the 1978 NAAQS, the sinter plant was enclosed and ventilated under negative pressure, and some other operations at the facility were also enclosed. These controls installed at Glover resulted in emission reductions that correspond to the lower concentrations seen in the figure starting at January 1997. In December 2003, pyro-processing operations were discontinued. This shutdown resulted in no process emissions from the sinter plant, blast furnace, or refinery operations and resulted in the significant reduction in concentrations seen in the figure starting January 2004.

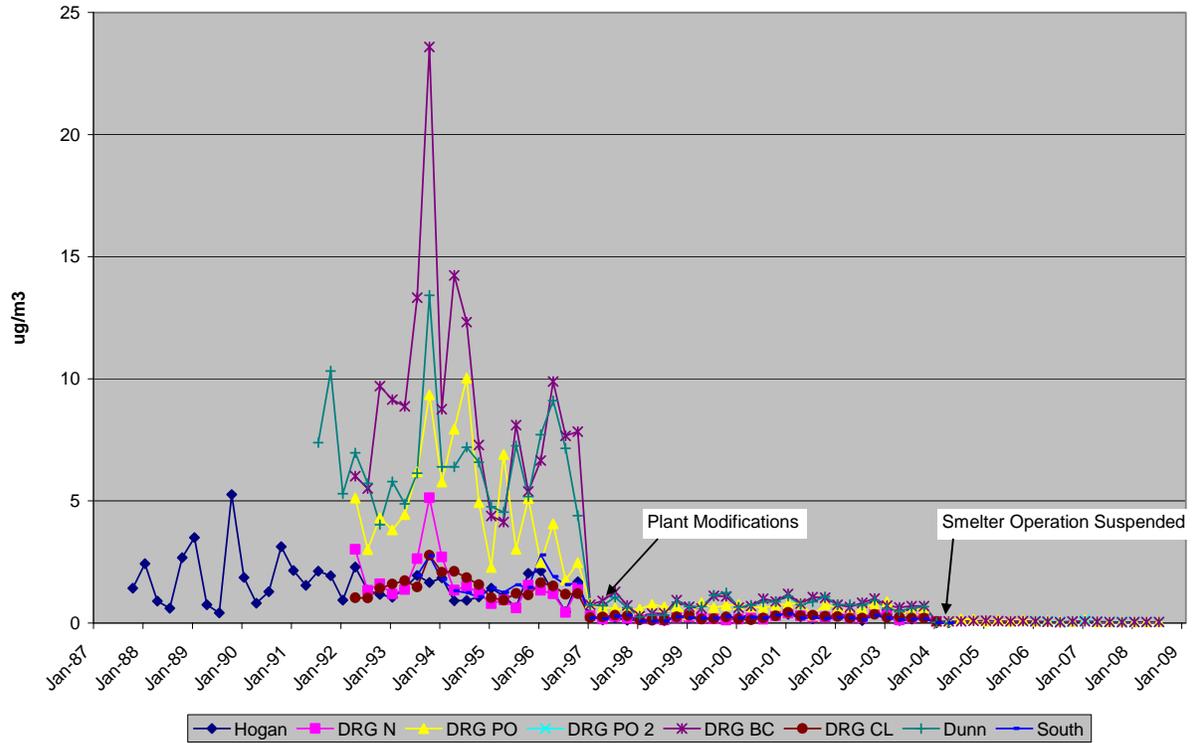


Figure 2: Glover Airborne Lead Concentrations, Calendar Quarter Averages (1987-2008)

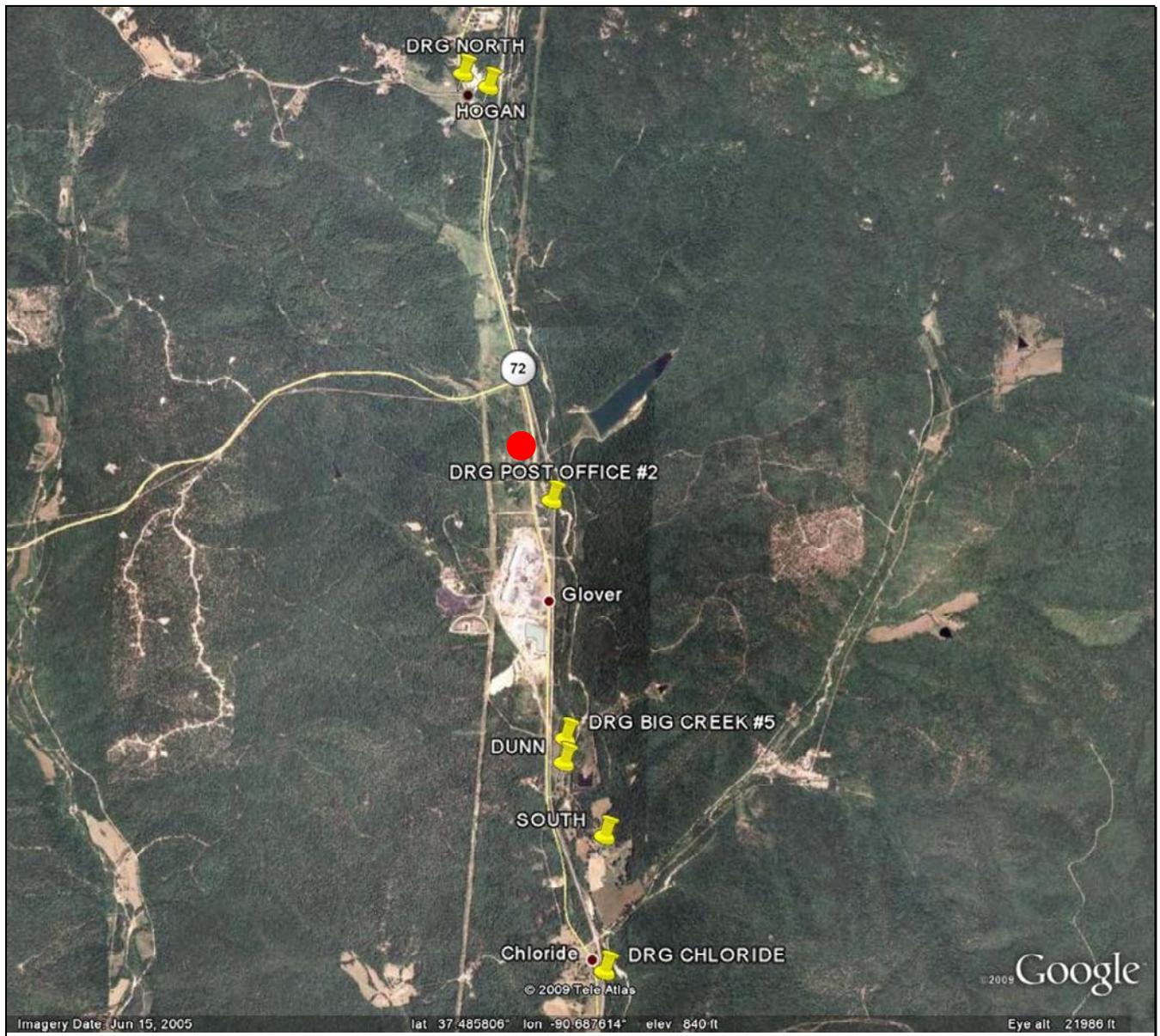


Figure 3: Glover Monitoring Sites

Note: Figure 3 shows the past and present (DRG Post Office and DRG Big Creek) monitoring sites (yellow pins), and a recommended site (Glover Baptist Church, indicated by the red dot) near the Doe Run Glover facility.

Figure 4 illustrates the second and third periods with expanded scales. Following the facility changes in late 1996, measured results indicated compliance with the old lead NAAQS ($1.5 \mu\text{g}/\text{m}^3$, calendar quarter average). The highest concentrations were observed at the Big Creek site, south of the facility, and the nearby Dunn site. The Post Office site, located to the northeast of the facility, monitored slightly lower concentrations. The other sites (Hogan and DRG North to the north, and South and DRG Chloride to the south) monitored lower concentrations.

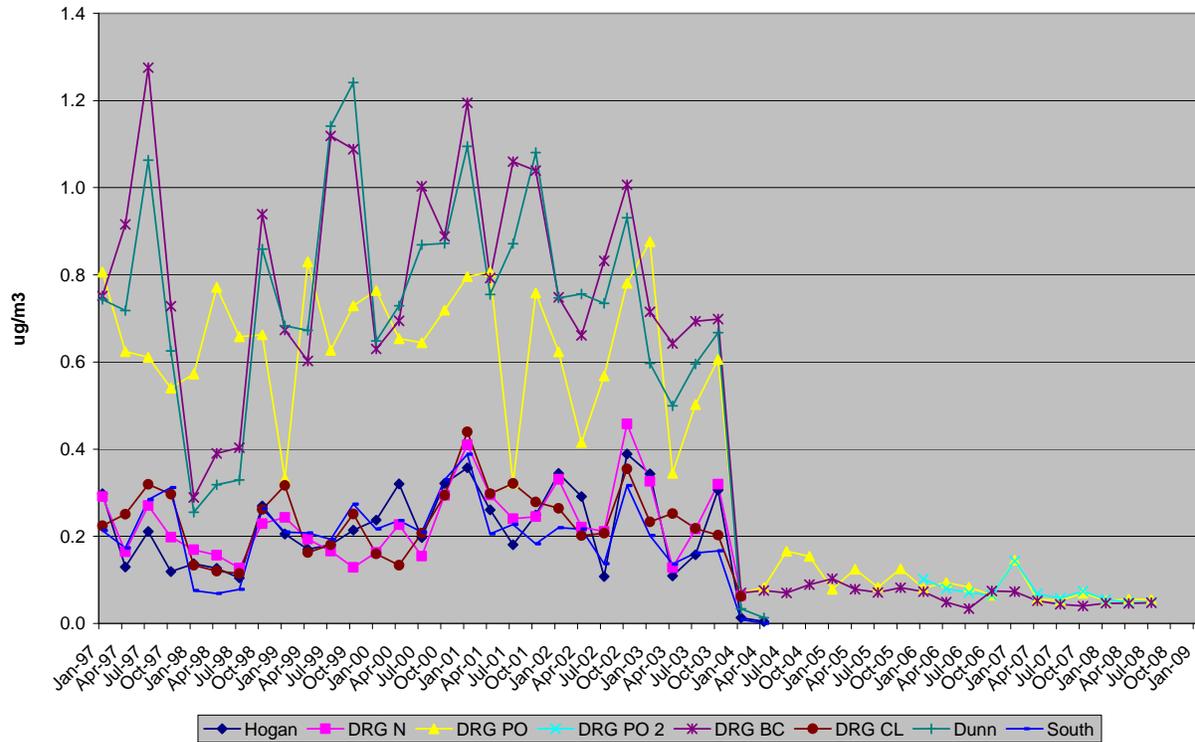


Figure 4: Glover Airborne Lead Concentrations, 3-Month Averages (1997-2008)

Monitoring was discontinued at all but the DRG Post Office and Big Creek sites following the shutdown of pyro-processing operations. Figure 5 illustrates three-month rolling average airborne lead concentrations (calculated per the 2008 NAAQS) measured at these sites for January 2006 through September 2008. Results would be in compliance with the 2008 NAAQS, averaging about half the level of the standard.

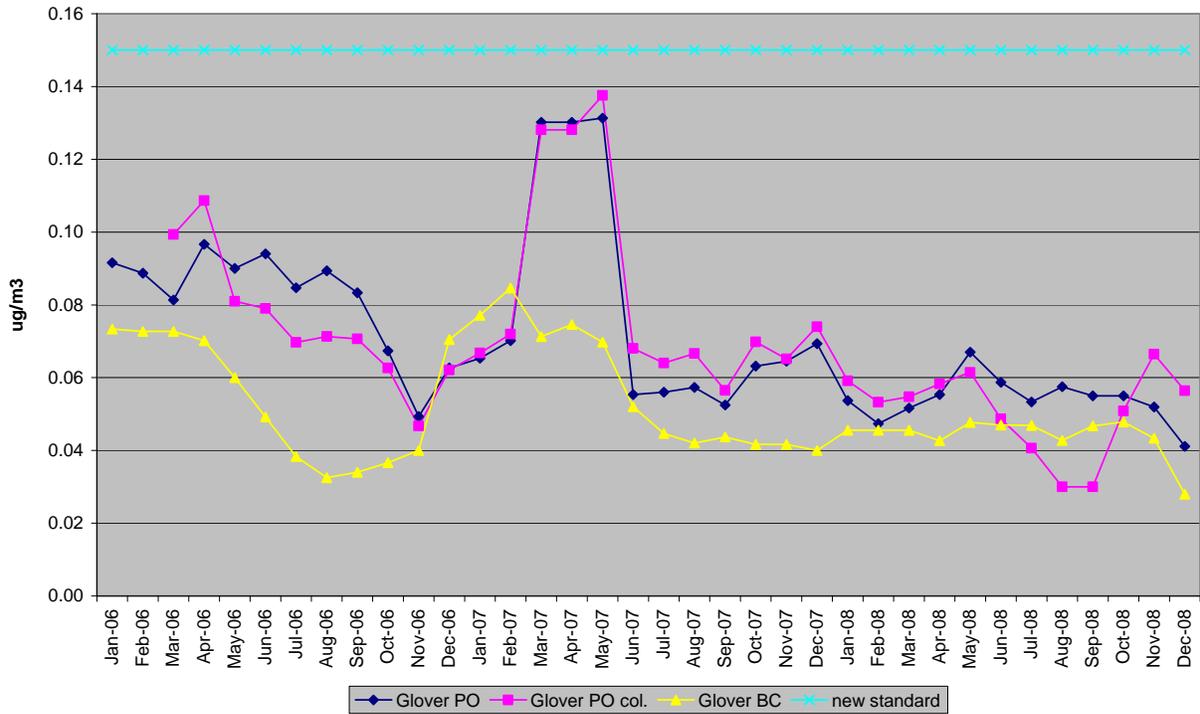


Figure 5: Glover Airborne Lead Concentrations, 3-Month Rolling Averages (2006-2008)

Conclusion

Based on the review of the monitoring data, the Department has found that the ongoing operations at the Glover site will not cause or contribute to a violation of the NAAQS. Therefore, the area near Doe Run – Glover is recommended for designation as attainment under the 2008 lead standard.

Herculaneum Smelter

The Doe Run – Herculaneum lead smelter is the only operating primary lead smelter in the United States. The Department has developed multiple lead attainment plans as revisions to the Missouri SIP for the Herculaneum area, with the latest submitted to EPA in May 2007. A brief discussion of the 2001 and 2007 plan revisions is included here. The emission control strategy of the 2001 plan involved enclosure of the main processes at the plant, and the installation of building ventilation systems. The ventilation gases are filtered by high-efficiency baghouse systems prior to release to the atmosphere. The refinery building was enclosed and ventilated. All these projects were completed by July 31, 2002. The 2007 plan revision required extensive control on material handling/delivery operations, haul roads, additional process enclosures/ventilation, reduction of process emissions within buildings already controlled under the 2001 plan, additional measures to reduce emissions from equipment failures, and a requirement for continual improvement that directs Doe Run to identify and implement “new” control requirements. These projects were completed in April 2008. No other stationary sources of lead are located within the area. Operations within and supporting the Herculaneum smelter are solely responsible for the concentrations in violation of the 2008 standard.

Existing Lead Monitoring Network and Past Monitoring Results

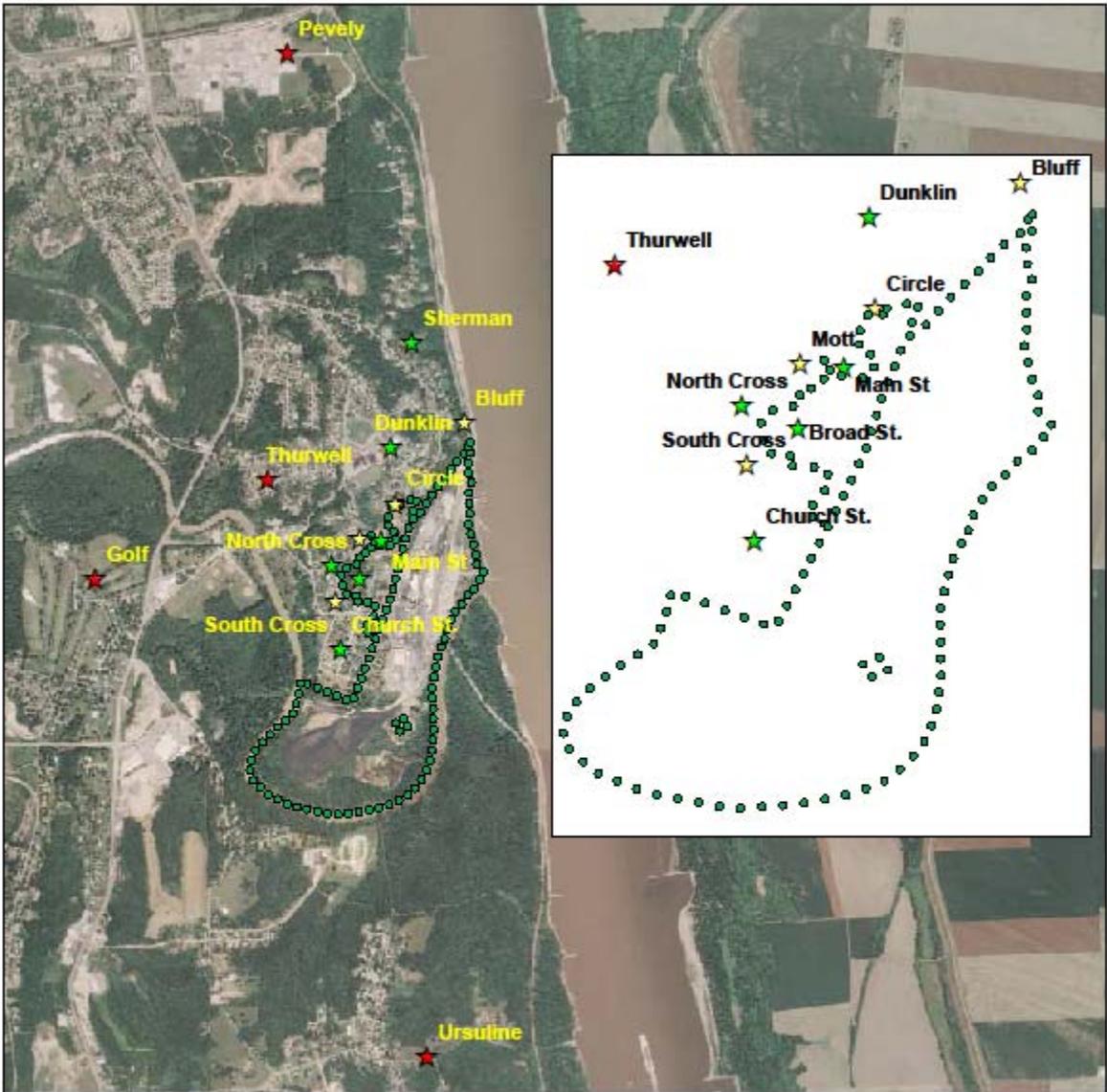
Airborne lead monitoring is done near the primary lead smelter in Herculaneum, Missouri both by the Department and by Doe Run. The Department operates samplers at:

- Bluff
- Broad Street (non-ambient; inside the facility fence line)
- Circle Street
- Dunklin High School (two collocated samplers through August 2008)
- Main Street (two collocated samplers starting September 2008)

The Doe Run Company operates samplers at:

- Bluff
- Broad Street (see above)
- Church Street (two collocated samplers)
- Circle Street (discontinued at the end of September 2008)
- Dunklin High School (two collocated samplers through March 2008)
- Main Street/City Hall
- Mott Street
- Sherman Drive
- South Cross Street
- North Cross Street

The location of these sites is included in Figure 6 with locations of previous sites in the Herculaneum area. Each of the current sites has monitored violations of the 2008 standard in the recent past. There are also three historical sites that were discontinued in 2005 due to monitoring concentrations well under the 1978 standard. The Dow site was located about 1.5 miles to the



0 0.125 0.25 0.5 Miles

Status

- ★ Active
- ★ Discontinued
- ★ to be discontinued


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Figure 6: Herculaneum Facility Fence Line and Monitoring Sites

Note: Doe Run's Herculaneum facility is delineated by green dots.

north-northwest of the Doe Run facility. The Golf Course site was located about 0.9 miles to the west of the facility. The Ursuline site was located about 0.5 miles to the south of the facility. In addition to these three sites, the Department operated a temporary site (2004-2005) on Thurwell Street to the west north-west of the facility (~1 mile away). Since the standard has been tightened, the three-month rolling average concentrations at these more distant sites have been in violation of the 2008 standard in the past as seen in Figure 7. The red line on Figure 7 represents the 2008 standard.

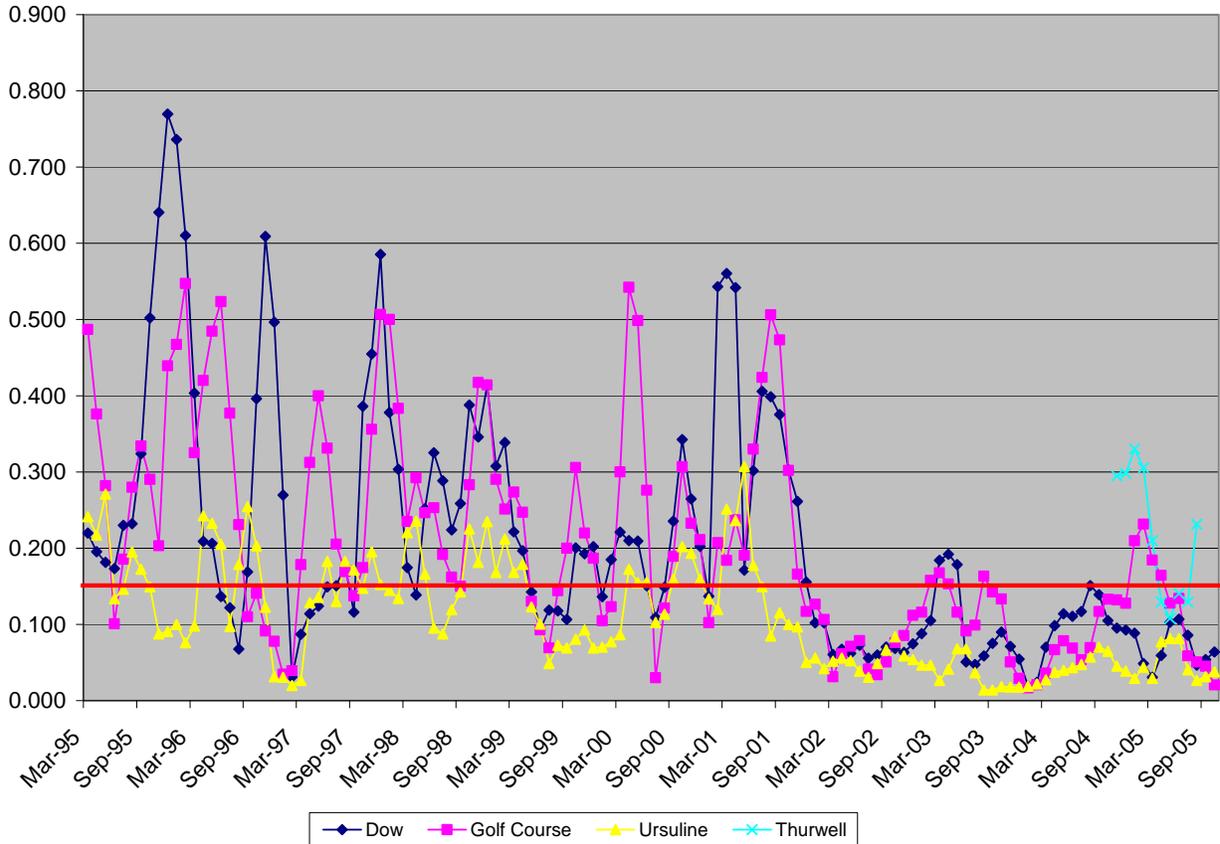


Figure 7: Discontinued Herculaneum Monitoring Sites (1995-2005)

Note: The red line on Figure 7 represents the new lead standard.

Since these sites were discontinued in 2005, it is nearly impossible to estimate the current monitored concentrations due to the process, emission, and operational changes at the facility resulting from the 2007 plan. To better understand the impact of the recent controls, the Department evaluated the three-month rolling average concentrations at the Broad St. and High School sites during 1995-2008. The data contained in Figure 8 from these sites provides a better understanding regarding the impact of both the 2001 and 2007 control measures at these nearby monitoring sites.

**Lead Concentration Data in Herculaneum, Missouri
(3-month Rolling Average)**

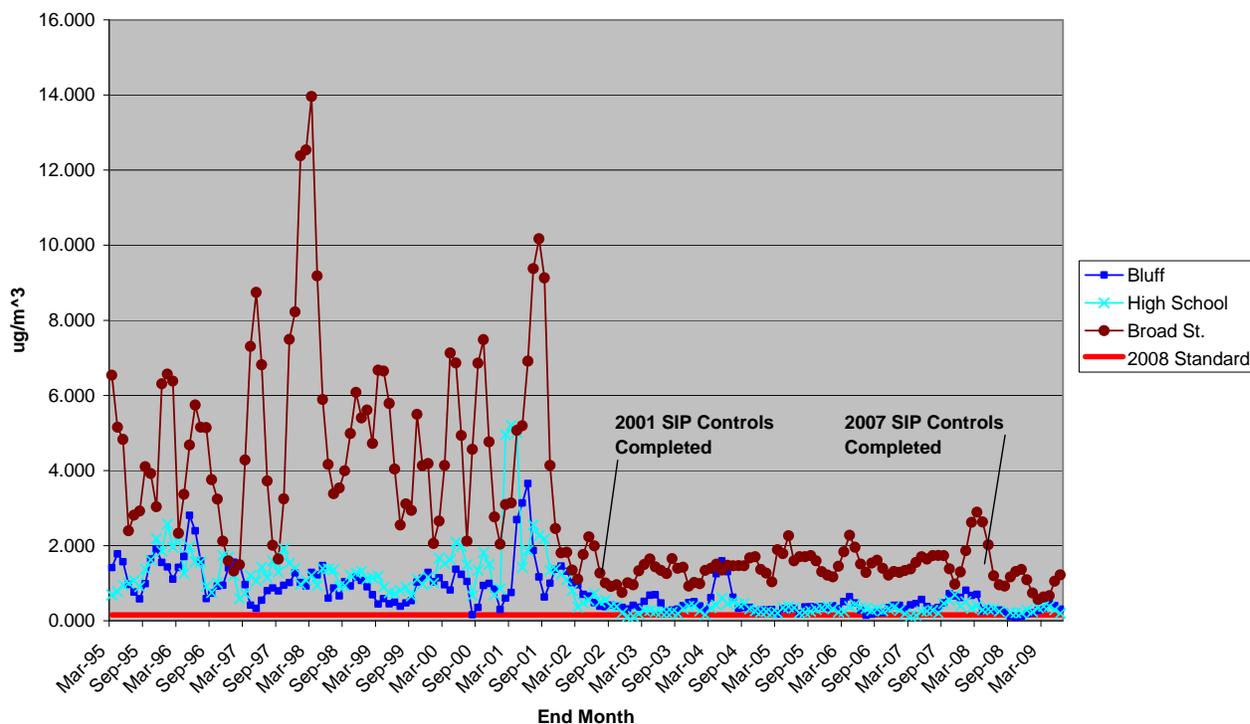


Figure 8: Herculaneum Airborne Lead Concentrations, 3-Month Rolling Averages (1995-2008)

The monitoring results provided in Figure 8 illustrate the substantial benefits of the controls implemented in the previous control plans. However, based on the data in Figure 7, no conclusion can be made with respect to the attainment status of the Golf Course or the Dow monitoring sites. While the overall concentrations continue to decrease at the proximate sites and this will also occur at the more distant sites, there is no definitive evidence that these sites will or will not comply with the standard under the current operating scenario at the Herculaneum facility. The far south site (Ursuline) has not monitored a violation of the 2008 standard since before the 2001 control plan. This data provides evidence that the area near the Ursuline site will not exceed the 2008 standard.

Per the EPA guidance on designation boundaries, there are three techniques that can be used to determine the extent of areas in violation of the relevant air quality standard: (1) qualitative analysis, (2) spatial interpolation of air quality monitoring information, and (3) air quality simulation by dispersion modeling. The following sections discuss the last objective techniques for the boundary recommendation.

Spatial Interpolation of Air Quality Monitoring Information

As discussed above, the geographic extent of the current monitoring network is not sufficient to identify areas of violation of the 2008 standard. Therefore, the Department utilized the ArcMAP program from ESRI to interpolate all available air quality monitoring data from two time

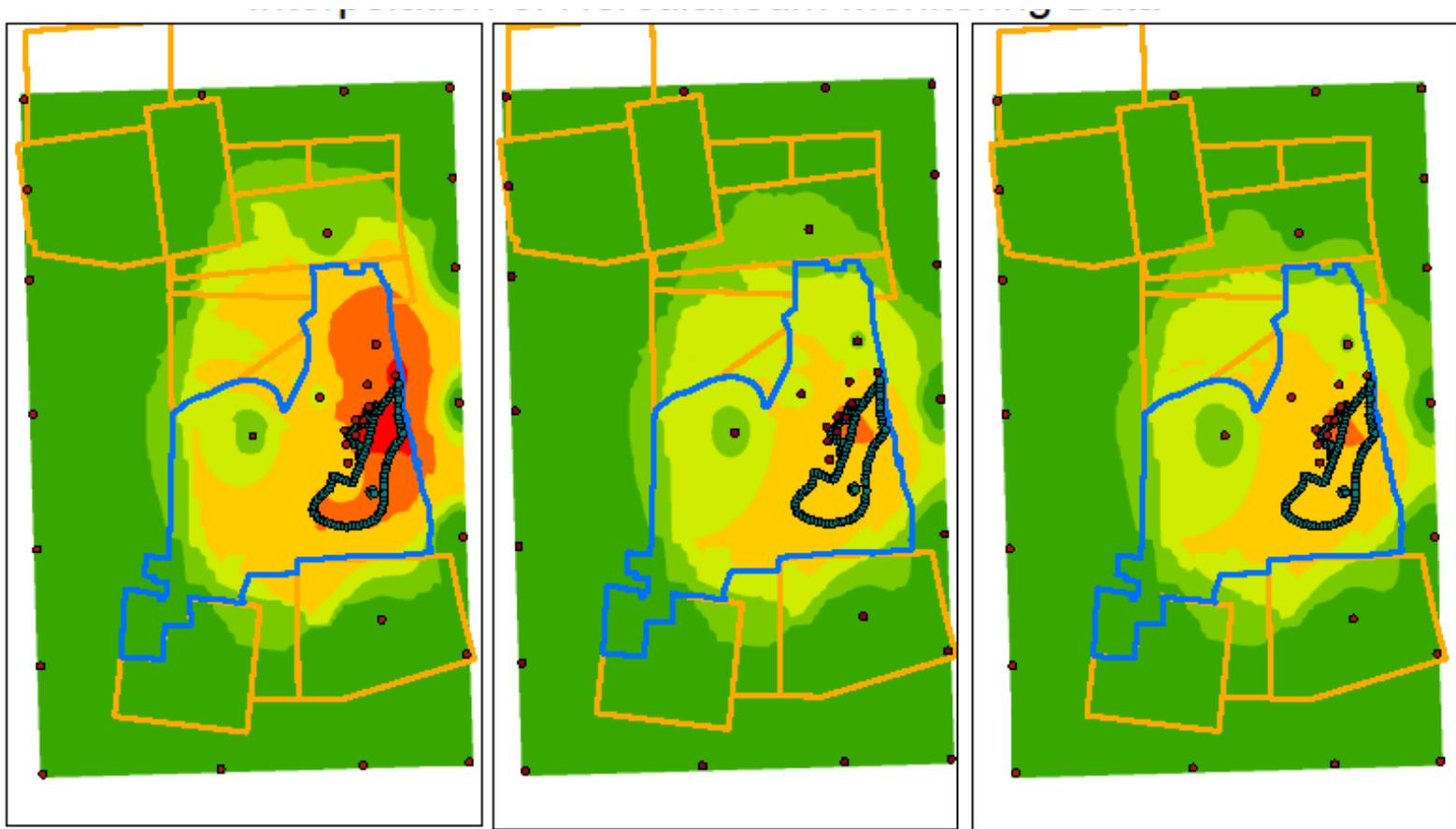
periods. The first time frame is after the 2001 SIP controls were in place (July 2002) up to the 2007 SIP control implementation (April 2008). The second is post-2007 SIP control implementation. For these interpolations, the maximum 3-month rolling average at each monitoring site during the time frame was utilized.

However, the lack of available monitoring data at the more distant sites does not provide sufficient geographic coverage to allow an interpolation for the second time frame. Therefore, the Department used two different sets of information for the more distant sites as part of the interpolation for the post-2007 SIP analyses. The first set of data from the more distant sites included the maximum concentrations measured after the 2001 SIP controls. This is conservative since it does not include any of the 2007 SIP emission reductions at the smelter. The second data set was derived from the relationship between the more distant sites and the High School monitor (the most distant of the sites with continuous data). The ratio of the monitoring data from the distant sites and the High School monitoring site was calculated for each 3-month rolling average since March 1995. These concentration ratios were analyzed to find the maximum, minimum, and average along with the standard deviation of the dataset. The Department chose to use the average ratio plus one standard deviation to provide additional conservatism to the analysis. The resultant ratio for each monitoring site was then multiplied by the maximum 3-month rolling average concentration at the High School after April 2008 (0.386 micrograms per cubic meter - $\mu\text{g}/\text{m}^3$). Table 1 provides the concentration data and the ratios utilized for this calculation.

Table 1: Distant Site and High School Monitoring Data Used for Interpolation

	Dow - Pevely	Golf Course	Ursuline	Thurwell
MAX RATIO	0.7342	1.1078	0.4503	1.4629
MIN RATIO	0.0524	0.0201	0.0185	0.2871
AVG RATIO	0.2268	0.2592	0.1290	0.8928
STDEV	0.1319	0.2102	0.0793	0.4370
AVG+1STD	0.3587	0.4693	0.2083	1.3298
Post-2007 High School MAX	0.386	0.386	0.386	0.386
Ratio Adjusted 2007 Concentrations	0.139	0.181	0.081	0.514
Maximum 3-month Rolling (Post – 2001)	0.192	0.232	0.084	0.330

The resultant interpolations are displayed in Figure 9 and illustrate the reduction in concentrations after the 2007 SIP controls using either distant site data set when compared to the post-2001 control timeframe. The overall interpolation requires the use of “ghost sites” to complete the interpolation. These sites seen at the edges of the interpolated zone were assumed to have a concentration of $0.005 \mu\text{g}/\text{m}^3$. The results using the post-2007 SIP monitoring data illustrate a pattern of concentrations over the standard outside the 1978 lead nonattainment area. However, there are still uncertainties with the use of either post-2007 monitoring dataset to ascertain the exact extent of the area that violates the 2008 lead air quality standard.



Maximum After 2001 Controls
w/ Actual Monitoring Data
for All Sites

Maximum After 2007 Controls
w/ pre-2007 Data to Inactive Sites

Maximum After 2007 Controls
w/ Ratio-Derived Data for
Inactive Sites


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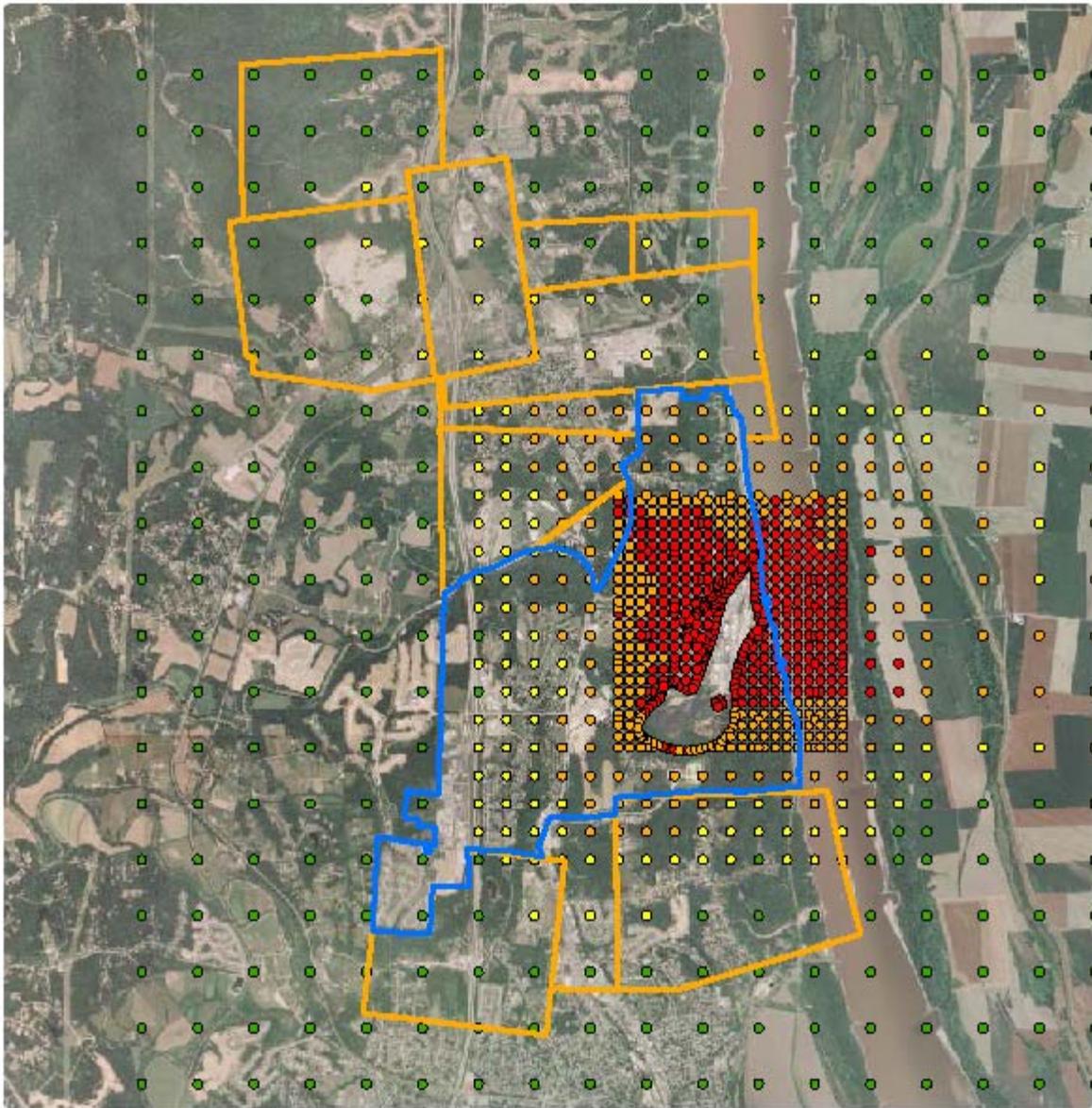
Figure 9: Interpolation of Herculaneum Monitoring Data

Modeling Results and Analysis

Given the uncertainty with respect to the area in violation of the 2008 standard, the Department completed dispersion modeling using the attainment demonstration modeling from the 2007 planning exercise. It is important to note that this modeling is not representative of the current production levels at the Herculaneum facility because it was designed to verify compliance with the quarterly $1.5 \mu\text{g}/\text{m}^3$ standard at specified maximum production levels. In addition, since the 2007 analysis was complete, the facility has redirected truck traffic to the plant to shorten the route from Interstate 55. This change has been incorporated into the analyses. Further, the surface meteorological data utilized was collected at the on-site meteorological station in Herculaneum and the upper air data was obtained from Lincoln, Illinois. The time period for the modeling was February 2007 to May 2009.

The Department utilized the current approved EPA modeling system (AERMOD) instead of the previous ISC-PRIME model used in the 2007 analysis. The new modeling system did not undergo the same level of model performance review as the previous modeling at Herculaneum and, therefore, has additional uncertainty. Nonetheless, the modeling does reflect the current building and operational configuration at Herculaneum and provides the best available tool to investigate impacts from the facility on the surrounding area. Figure 10 illustrates the maximum three-month rolling average concentrations for this analysis with the green dots indicating areas that are predicted to meet the 2008 lead standard. The maximum concentrations near the site are somewhat overestimated based on historical monitoring data comparisons. However, the extent of the area predicted to violate the 2008 standard is within reason and has been included as a portion of the evaluation to determine the nonattainment boundaries for the area.

Example input files for Herculaneum and the Viburnum Trend modeling analyses are included in Appendices A and B, respectively.



Recommended Non-Attainment Area - Herculaneum City Limits
 Recommended Unclassifiable Area

Lead NAAQS $\geq 0.155 \text{ ug/m}^3$


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Modeled Concentration
ug/m³

- 0.040 - 0.154
- 0.155 - 0.250
- 0.251 - 0.500
- >0.500



Figure 10 Herculaneum Modeled Concentration Values

Analysis of Factors to Change Presumptive Boundary

- 1) Emissions for the Herculaneum area are limited to operations within or that support the Doe Run primary smelter. The lead emissions from the smelter site were over 19 tons per year in 2008.
- 2) Based on the review of historic and current air quality monitoring data, the highest concentrations of airborne lead occur very near the smelter site. Over the last 10 years, concentrations over the 2008 standard have occurred at the geographic extent of the previous monitoring network. While concentrations in Herculaneum have decreased dramatically over the years, there are still several sites that monitor over the 2008 standard. Dispersion modeling was conducted using the latest SIP input files and the results were used along with the relevant monitoring data to characterize areas near the smelter that may be in violation of the standard. There is no monitoring or modeling data available that would support the inclusion of Jefferson County as a whole in the nonattainment area. Further, there is evidence that lead concentrations outside the sections immediately surrounding the smelter are in compliance with the 2008 lead NAAQS.
- 3) The sections surrounding the smelter do not contain higher population density and many of the areas are residential/light commercial and not industrial (Figure 11). There is no information related to this factor that provides rationale to change the concentration-based recommendation. The Department believes that all citizens should be protected from exposure to concentrations over the NAAQS. Further, there are no additional sources of lead in the area that contribute to elevated lead concentrations.
- 4) Growth of the community has no impact on the area designated because the permitting of lead sources in the state of Missouri is extremely rare without other pollutants. Any major source permit issued in Jefferson County would be a nonattainment permit and would require Lowest Achievable Emission Rate (LAER) technology and offsets. This is because Jefferson County is included in the St. Louis ozone and PM_{2.5} nonattainment area. Further, any population growth does not bring additional lead sources into the area because lead emissions are primarily from stationary sources. This is considerably different than ozone or PM sources/areas.
- 5) The meteorological conditions associated with the Herculaneum area typical of other areas along the Mississippi River. Wind flows have a tendency to follow the river valley, but the predominant wind direction in Missouri includes a strong southerly component. Further, the modeling analysis conducted to help determine the boundary includes on-site meteorological data from the Herculaneum smelter and supports the recommendation.
- 6) There are no significant geographic or topographic features that impact lead concentrations in the Herculaneum area.
- 7) The only existing jurisdictional boundary related to air quality management is the current and recommended nonattainment area that includes only the City of Herculaneum. The city boundaries for other communities in the area were noted as part of our review.
- 8) The only source of lead emissions in the area has been controlled dramatically as detailed in the regulatory history section above. These controls have reduced lead concentrations from over 10 µg/m³ to less than 1 µg/m³.

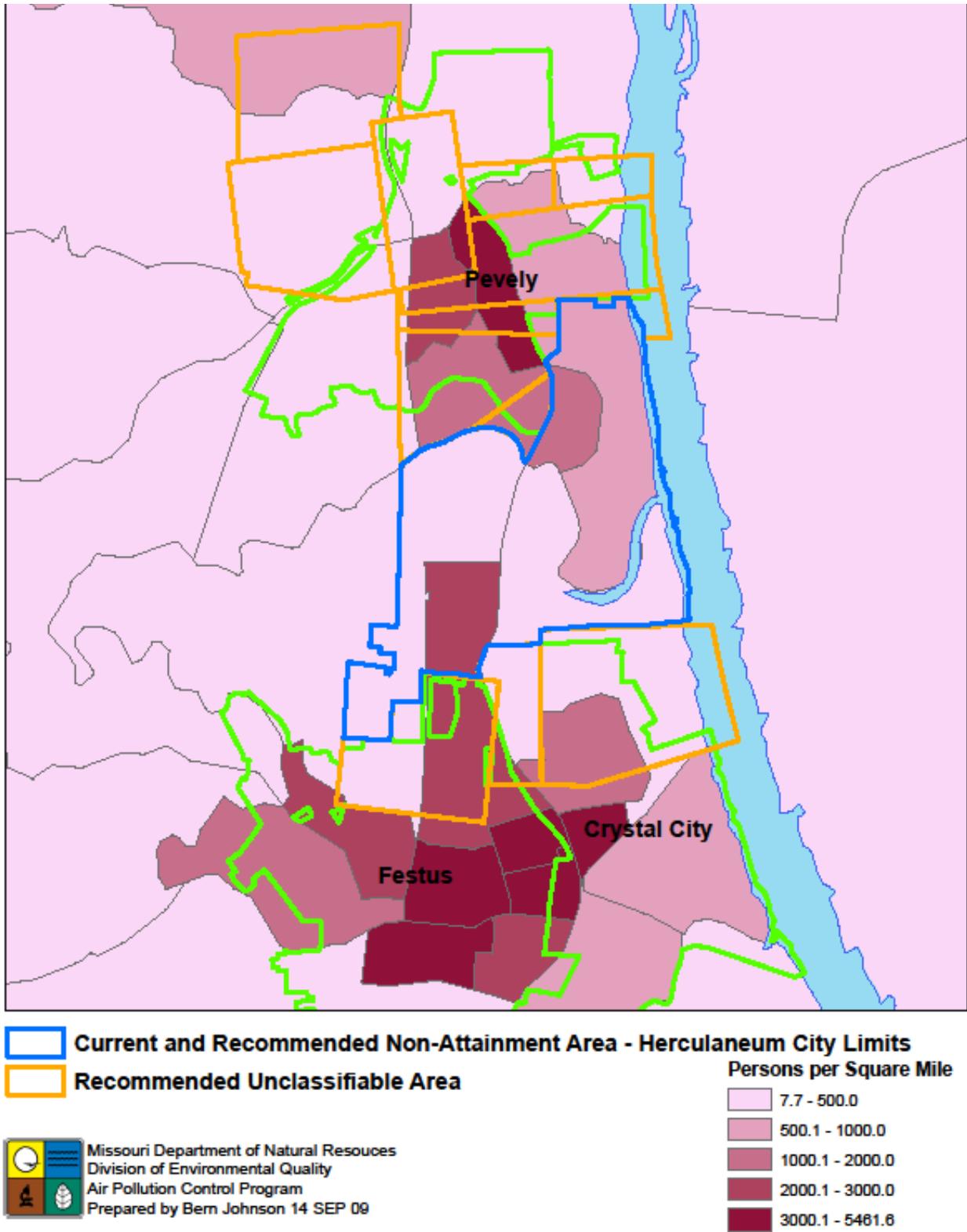


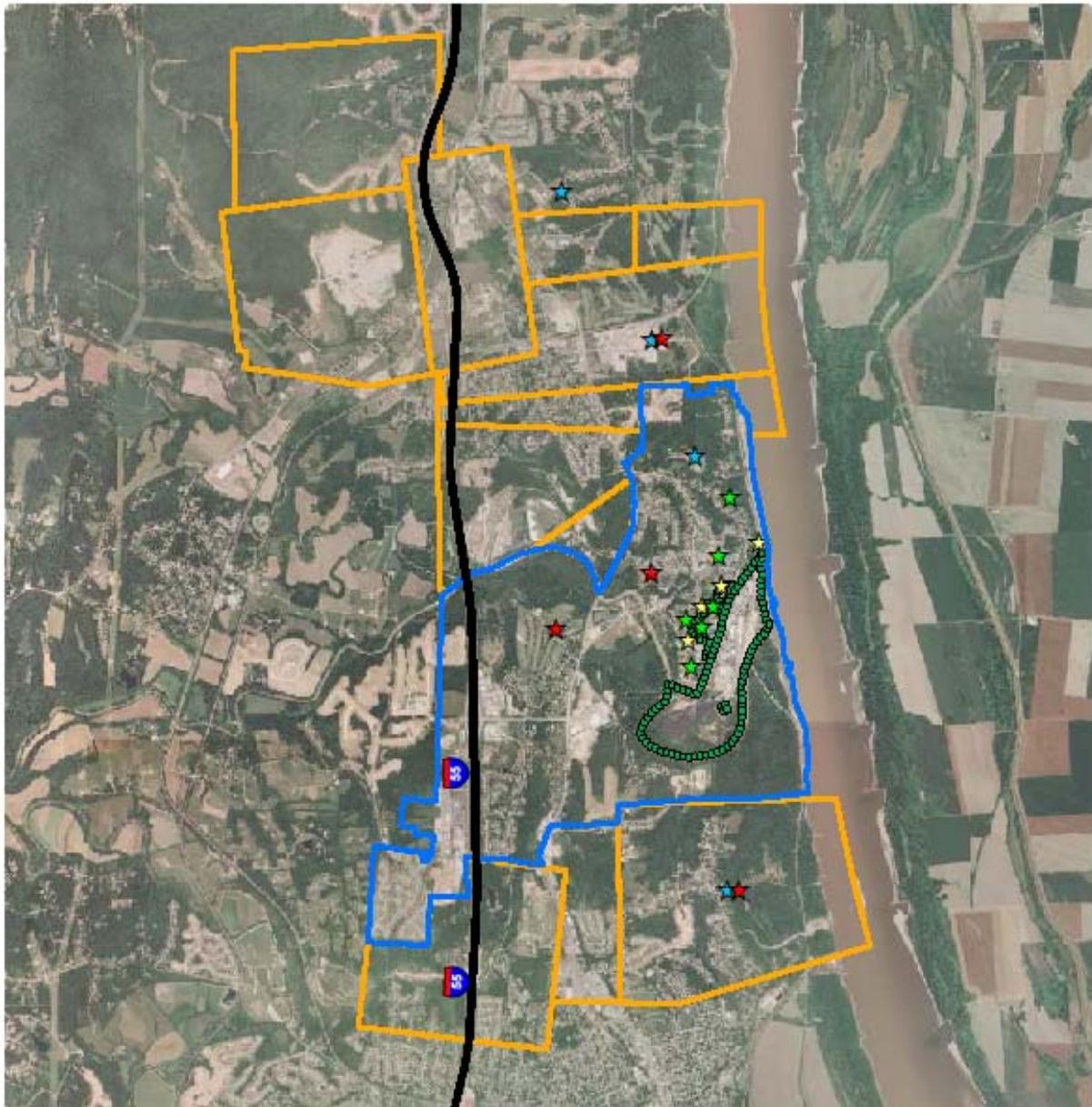
Figure 11: Herculaneum Population Density Map

Conclusion

The Herculaneum area is in violation of the 2008 lead NAAQS. This area is being impacted by the Doe Run primary lead smelter. There are no other significant sources of lead that contribute to the violations in the surrounding areas. Therefore, the Doe Run property has been included in the recommended nonattainment area. The modeling analysis illustrates an area over the standard that is much smaller than the presumptive county boundary. The “distant” monitoring site data suggest the area of violation is limited to much less than two miles from the installation. Further, there is still a lack of current monitoring data at distance from the smelter and there is a great deal of uncertainty associated with the EPA-recommended monitoring data interpolation and dispersion modeling techniques. This leads to the Department’s recommendation of the area denoted in Figure 12 as the Herculaneum nonattainment area. The recommendation for nonattainment is identical to the 1978 nonattainment boundary - the Herculaneum city limits. As seen in the figure, the Department is using the county-township-range-sections legal descriptions to define surrounding areas as unclassifiable with respect to the 2008 standard.

Given the local communities’ adverse comments to being nonattainment designation for the 2008 lead standard and the lack of any current monitoring data to support a nonattainment designation at this time, the Department is recommending unclassifiable designations for areas to the north and south of the Herculaneum city limits. The rationale for this recommendation includes the spatially interpolated monitoring data that exhibits areas outside the city limits exceeding the 2008 standard. Also, the dispersion modeling data predicted a violation of the standard in areas outside the city limits. Any of these areas were recommended as unclassifiable due to potential violations of the air quality standard. The Department has committed to re-examine these areas after 2010 (sampling begins at new Herculaneum sites in January 2010) to propose a recommendation of attainment or nonattainment for the areas recommended as unclassifiable.

It is important to note the size of the sections/land grants does not allow for the exact area of violation to be included, but does provide a justifiable extent of the violating area that may include areas that do not violate the standard (e.g. Ursuline).



 Current & Recommended Non-Attainment Area - Herculaneum City Limits

 Recommended Unclassifiable Area **Status**

Lead NAAQS $\geq 0.155 \text{ ug/m}^3$

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-  Active
-  Discontinued
-  proposed
-  to be discontinued



Figure 12: Recommended Herculaneum Lead Nonattainment Area

Note: The green dotted line represents the Doe Run property boundary and the stars indicate monitoring sites.

Buick Smelter and the Viburnum Trend

The Buick Smelter, located near Boss and Bixby, Missouri in Iron County is a secondary smelter used for recycling lead primarily from lead-acid storage batteries. It is operated by the Doe Run Company's Resource Recycling Division. This area has monitored attainment of the 1.5 $\mu\text{g}/\text{m}^3$ standard for many years until the 4th quarter of 2008. Since the facility has been in attainment of the standard, there have not been the same air quality improvement projects at the Buick facility when compared to the Herculaneum facility. Doe Run owns and operates several lead mine/mill sites in the area around the Buick Smelter. These sites are located along the Viburnum Trend and are shown, along with the Buick smelter, in Figure 12. The active mine/mill sites include (from the north to the south): Buick, Brushy Creek, Fletcher, and Sweetwater.

Existing Lead Monitoring Network and Past Monitoring Results

The monitoring results for the currently operating monitoring sites near the Buick smelting facility (north and south) demonstrate that the area is in violation of the 2008 lead standard. Also, data from two additional sites to the west and northwest of the smelter operated in the past also demonstrate violations. Figure 12 illustrates the locations of these sites around the Buick facility. Figure 13 provides the three-month rolling average concentration data from 1995-2008. The geographic extent of the network is not broad and the average concentrations at the two current sites are well above the 2008 standard. Therefore, based on the monitoring data only, it is difficult to determine the area that is in violation of the standard. In addition to the ongoing compliance monitoring at Doe Run – Buick, Doe Run undertook a temporary sampling program in non-ambient air near the Brushy Creek mine/mill (about 0.3 miles from the active mine/mill site to the north/northeast). This sampling was conducted between April – July 2009 as is shown in Table 2 and is illustrated in Figure 11. For completeness, all the relevant sampling data is included in Appendix C.

Table 2: Non-Ambient Sampling Results Near Brushy Creek Mine

Month	Average Concentration ($\mu\text{g}/\text{m}^3$)
April 2009	0.14
May 2009	0.29
June 2009	0.22
August 2009	0.14

Since this data is non-ambient (i.e. public access is precluded to the site), it cannot be used to determine compliance with the 2008 lead standard. However, this sampling gives the indication that concentrations above the standard could occur very near the mine/mill locations. Therefore, the Department determined that the areas near Brushy Creek and Fletcher mine/mill facilities should be designated unclassifiable until ambient sampling has been conducted.

Viburnum Trend Facility Boundaries and Proposed Monitoring Sites

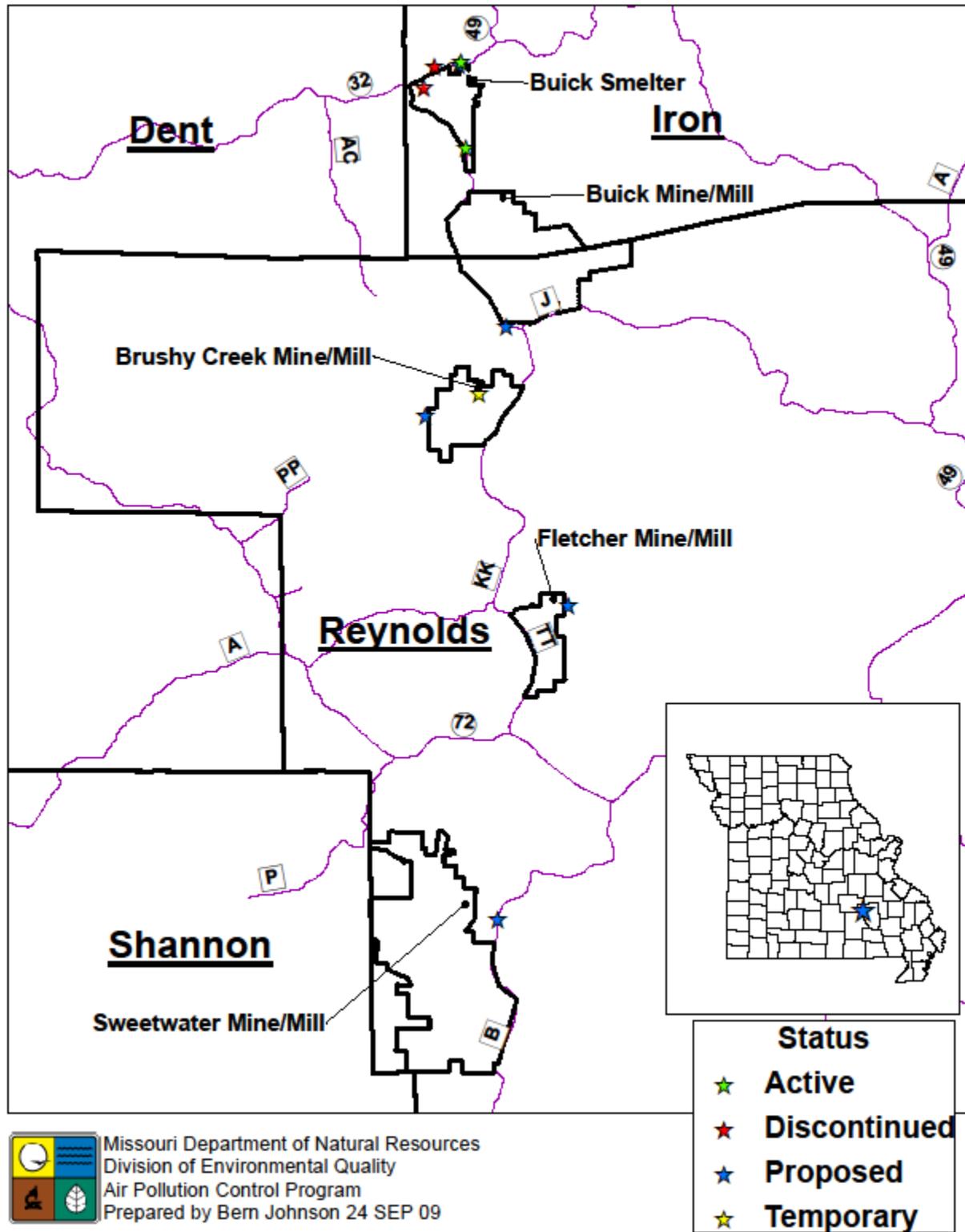


Figure 13: Viburnum Trend Facilities and Monitoring Sites

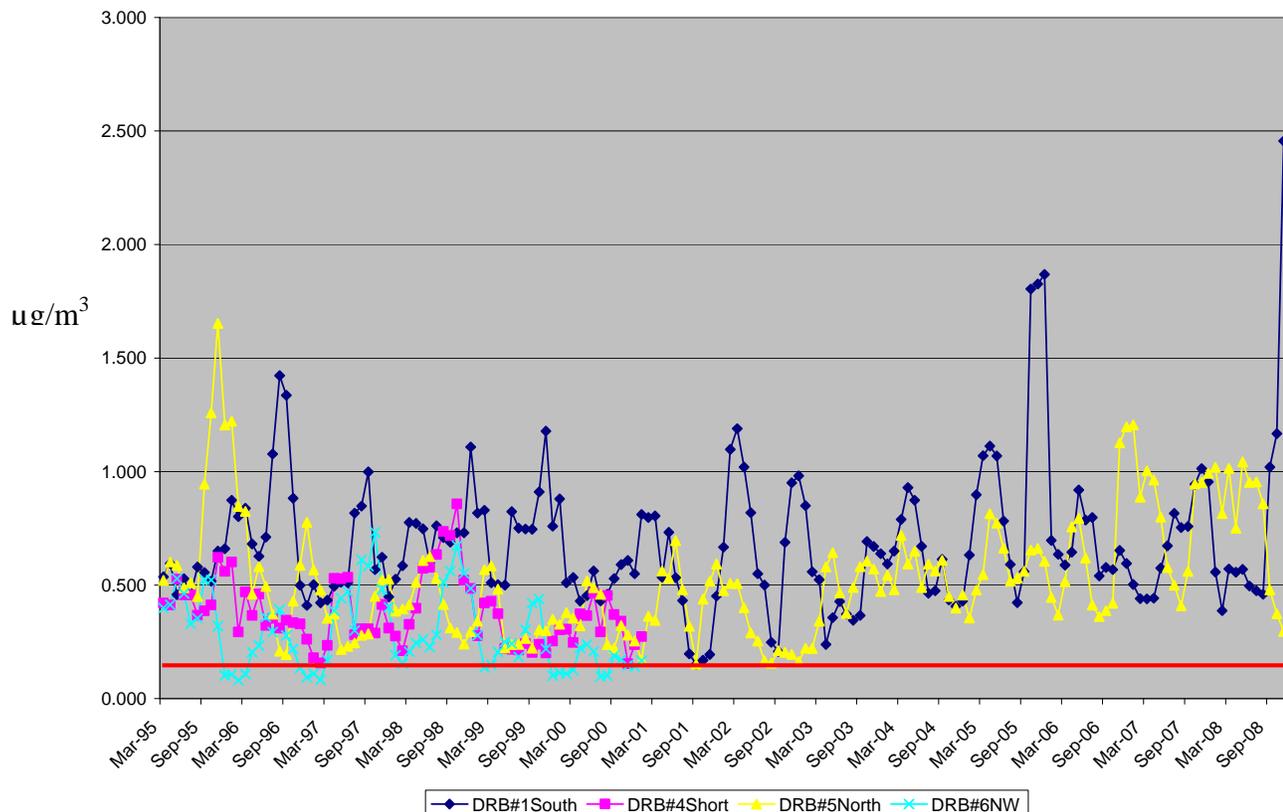
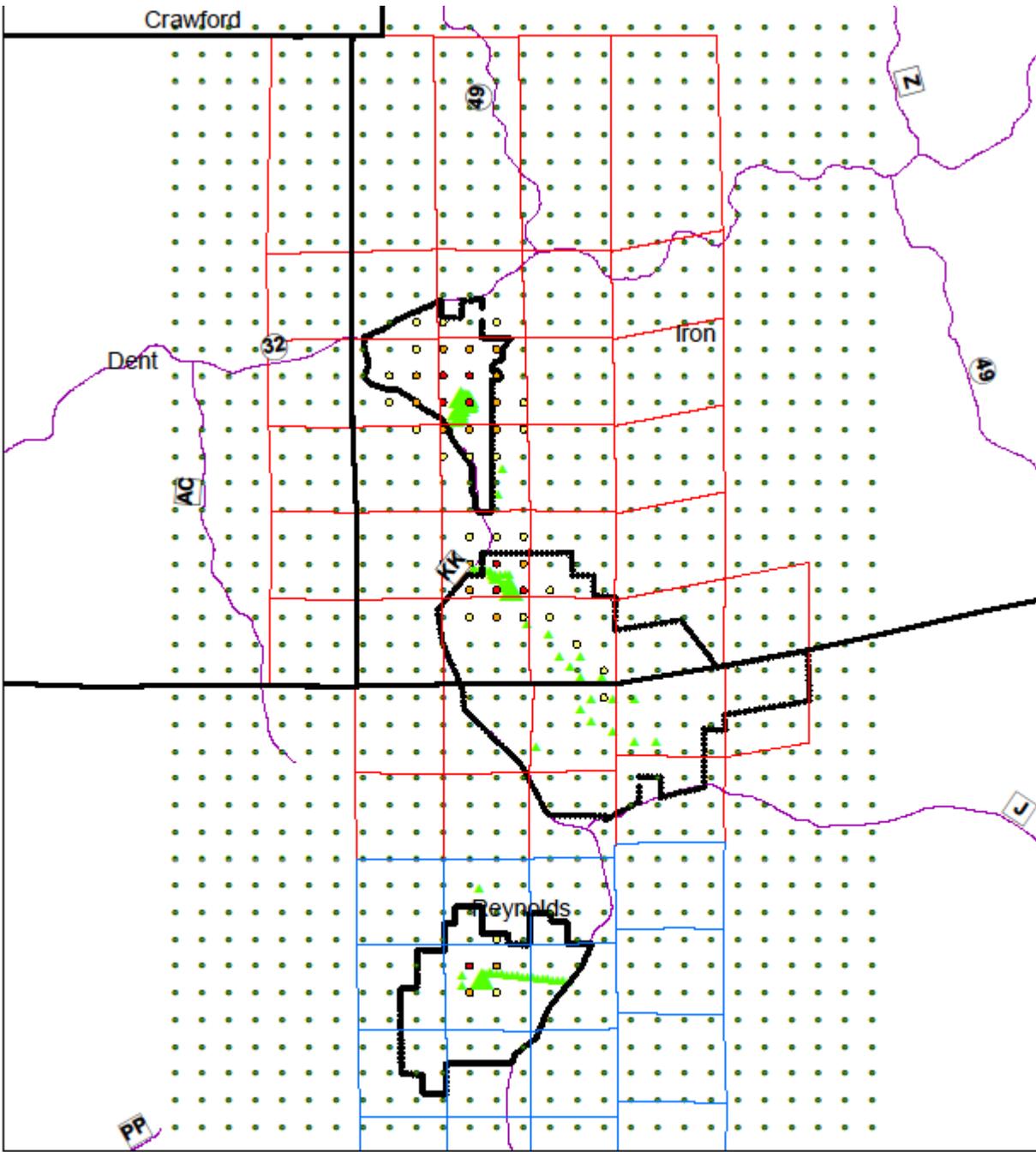


Figure 14: Buick Airborne Lead Concentrations, 3-Month Rolling Averages (1995-2008)

Modeling Results and Analysis

In addition to the monitoring data review, the Department conducted a dispersion modeling analysis for all the active sources in the area including the Buick smelter and all the mine/mill operations. As with the Herculaneum area, the results indicate potential violations near the large stationary sources. However, in the case of the Viburnum Trend, several sources are located along the trend within a few miles of each other. The modeling analyses demonstrate that each operational source has limited influence on the receptors near the other operational sources. This is true except for the Buick smelter and Buick mine/mill, which have considerable overlap between predicted violations near the property boundaries for each site.

The overall modeling exercise utilized the latest emissions for each group of sources including “stack” testing conducted at one of the mine vent shafts to better characterize the emissions from these sources. The Buick smelter emissions were from the latest approved permit action (not the latest requested permit from Doe Run). The modeling utilized surface meteorological data from Fort Leonard Wood for 2004-2007. The results are depicted in Figures 14 and 15 with the source locations for each facility and potential area of ambient violations highlighted. As with the Herculaneum analysis, the AERMOD modeling system was used without the benefit of a model performance evaluation. The areas of predicted ambient violations are limited very closely to the property boundary for several of the sources along the trend.



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Figure 15: Viburnum Trend Modeled Concentration Values of Northern Area
 Note: Doe Run facilities outlined in black are, from north to south, Buick Smelter, Buick Mine/Mill, and Brushy Creek Mine/Mill

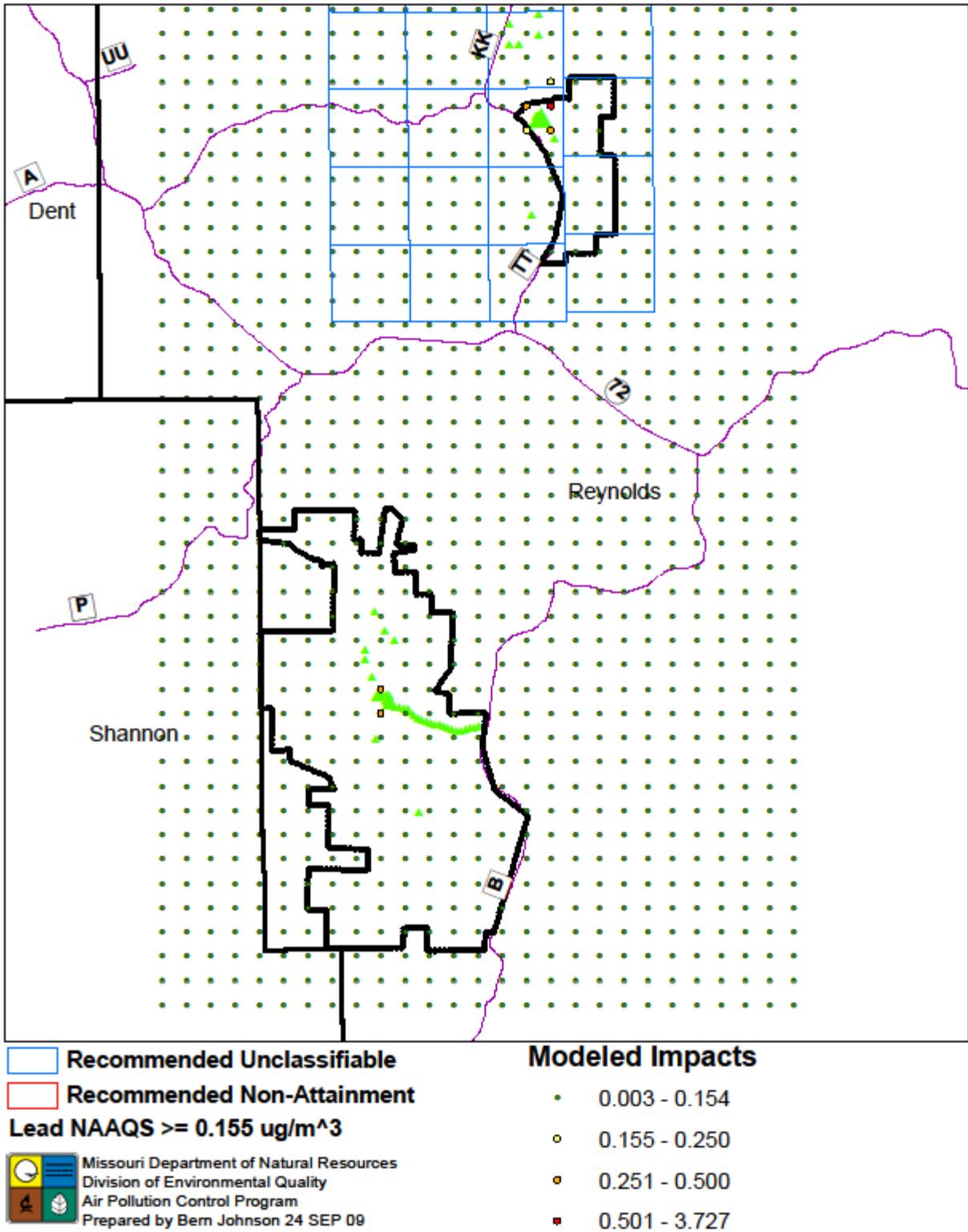


Figure 16: Viburnum Trend Modeled Concentration Values of Southern Area
 Note: Doe Run facilities outlined in black are, from north to south, West Fork and Fletcher (outlined as one property boundary), and Sweetwater

The overall analysis was supplemented with a facility-specific evaluation using the same receptor network as detailed above. This evaluation was utilized to understand the impact from each facility on other violating receptors inside the Viburnum Trend. Specifically, all the receptors predicted over the standard near the Buick smelter and mine/mill showed over a 99 percent impact from sources at the Buick smelter and mine/mill for all violating 3-month rolling averages (first 15 receptors in Table 3). The remaining receptors with predicted concentrations over the standard near the Fletcher mine/mill facility (last 2 receptors in Table 3) illustrate a maximum of 3 percent from the other sources and the remainder from the Fletcher sources (over 96 percent). This data indicates that the Buick smelter and mine/mill facility do not contribute significantly to the exceeding values around the other mine/mill complexes. Also, the mine/mill complexes (other than Buick) do not contribute to the predicted exceedance values of the recommended nonattainment area.

Table 3: Modeling Results of Buick/Viburnum Trend Impacts

UTM-X	UTM-Y	Buick Min.	Buick Max.	Fletcher Min.	Fletcher Max.	Brushy Min.	Brushy Max.	Sweetwater Min.	Sweetwater Max.	Overall Max
663500	4167000	99.2%	99.6%	0.1%	0.2%	0.3%	0.5%	0.0%	0.1%	0.183
664000	4166500	99.1%	99.4%	0.2%	0.3%	0.4%	0.6%	0.0%	0.0%	0.178
664000	4167000	99.5%	99.8%	0.1%	0.1%	0.1%	0.3%	0.0%	0.0%	0.311
664500	4164000	99.3%	99.5%	0.1%	0.2%	0.3%	0.5%	0.0%	0.0%	0.174
664500	4166000	99.4%	99.6%	0.1%	0.2%	0.2%	0.3%	0.0%	0.0%	0.174
664500	4166500	99.5%	99.9%	0.0%	0.1%	0.1%	0.4%	0.0%	0.0%	0.335
665000	4164000	99.2%	99.7%	0.1%	0.1%	0.2%	0.6%	0.0%	0.0%	0.309
665000	4164500	99.6%	99.6%	0.1%	0.1%	0.3%	0.3%	0.0%	0.0%	0.215
665500	4166000	99.7%	99.7%	0.1%	0.1%	0.2%	0.2%	0.0%	0.0%	0.166
665500	4166500	99.4%	99.9%	0.0%	0.2%	0.1%	0.4%	0.0%	0.0%	0.309
665500	4167000	99.6%	99.9%	0.0%	0.2%	0.1%	0.3%	0.0%	0.0%	0.446
665500	4168500	99.5%	99.5%	0.1%	0.1%	0.3%	0.4%	0.0%	0.0%	0.165
666000	4164500	99.2%	99.2%	0.2%	0.2%	0.5%	0.5%	0.0%	0.0%	0.156
666000	4166500	99.7%	99.7%	0.1%	0.1%	0.2%	0.2%	0.0%	0.0%	0.183
666000	4167000	99.7%	99.7%	0.1%	0.1%	0.2%	0.2%	0.0%	0.0%	0.187
667500	4148500	0.5%	1.6%	97.6%	99.1%	0.2%	0.7%	0.0%	0.2%	0.518
667500	4149000	2.0%	2.5%	96.4%	97.1%	0.7%	0.9%	0.2%	0.3%	0.181

Analysis of Factors to Change Presumptive Boundary

- 1) Emissions in the Viburnum Trend are dominated by the Doe Run secondary smelter. The lead emissions from the smelter site were nearly 13 tons per year in 2008. The Buick mine/mill has the next highest emissions with 3 tons per year in 2008. The Fletcher and Brushy Creek mines emitted 2.9 and 1.9 tons per year respectively. The Sweetwater mine only emitted 0.6 tons per year in 2008.
- 2) Based on the review of historic and current air quality monitoring data, the highest concentrations of airborne lead occur very near the smelter site. The network around the Buick smelter is not as geographically diverse as the Herculaneum area. Currently, there is one site located north of the smelter and one site in between the smelter and the Buick

mine. Both the current sites show concentrations well above the standard in the last few years. Dispersion modeling was conducted using the latest permit input files for the smelter and updated emissions from the mine/mill sources. The results were used along with the relevant monitoring data to characterize areas that may be in violation of the 2008 standard along the Viburnum Trend.

- 3) The population density of the Trend is very small due to the very rural nature of the area. Further, there is no information related to this factor that provides rationale to change the concentration-based recommendation. The Department believes that all citizens should be protected from exposure to concentrations over the NAAQS.
- 4) Growth rates within the area are very small and are primarily related to production increases/decreases at the Doe Run facilities. Further, any population growth does not bring additional lead sources into the area because lead emissions are primarily from stationary sources.
- 5) The meteorological conditions associated with the Viburnum Trend are typical of other areas in Missouri. The predominant wind direction in Missouri includes a strong southerly component. Further, the modeling analyses conducted to help determine the boundary includes meteorological data from nearby Fort Leonard Wood supports the recommendation.
- 6) There are no significant geographic or topographic features that impact lead concentrations in the Viburnum Trend area.
- 7) The only existing jurisdictional boundary related to air quality management is the current maintenance area that includes Dent Township in Iron County. These boundaries were noted as part of our review, but the primary rationale for inclusion of sections in the boundary was related to concentrations over the standard and the inclusion of sources that contribute to those potential violations.
- 8) All the sources of lead in the Trend have been issued construction and/or operating permits. The Doe Run Buick smelter has been controlled in the past to come into compliance with the 1978 NAAQS.

Conclusion

The Buick area is in violation of the 2008 lead NAAQS. The monitored violating area is being impacted by the Doe Run secondary lead smelter and the nearby Doe Run Buick mine/mill operation. Therefore, these two Doe Run properties have been included in the recommended nonattainment area. The monitored violations of the standard are inside sections that are part of the Doe Run property. The modeling analysis illustrates an area over the standard that includes small portions of three counties (Iron, Reynolds, and Dent) that are much smaller than the presumptive county boundary. The previous lead maintenance area includes Dent Township in Iron County. In the same manner as Herculaneum, the Department is recommending that the sections containing the violating monitor and contributing sources be included in the nonattainment area. These sections are depicted in Figure 16. Due to the high levels of lead concentrations at the monitors, the Department is including a buffer zone around the monitoring sites and Doe Run properties that includes sections with no previous monitoring data, but predicted violations in the dispersion modeling exercise.

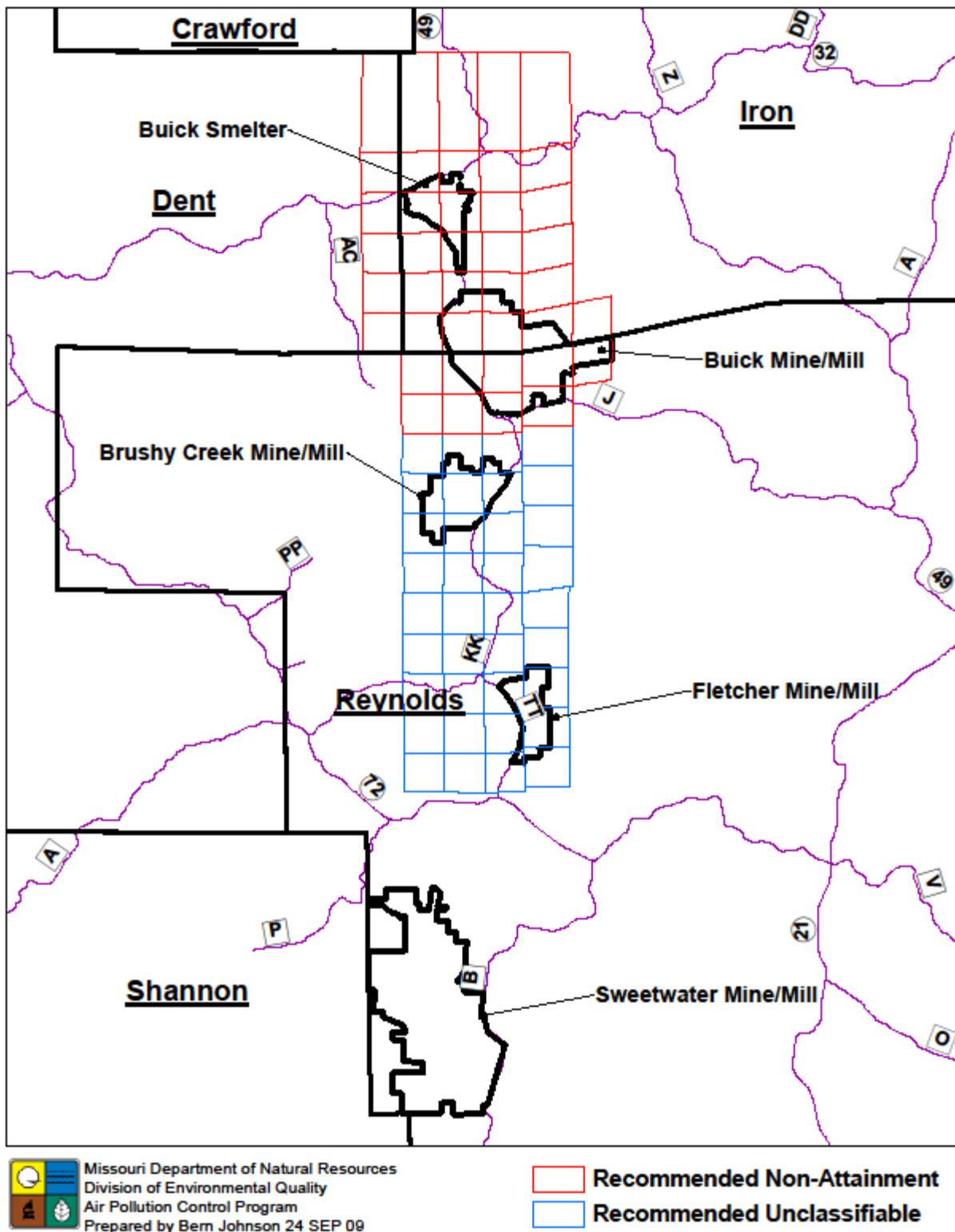


Figure 17: Recommended Buick Lead Nonattainment Area

Further, the Department is recommending two of the nearby Doe Run operational sites (Brushy Creek and Fletcher mine/mill) as unclassifiable due to the temporary monitoring data at the Brushy Creek site and the potential violations predicted by the modeling exercises. However, the individual culpability analyses do not support inclusion of these sections in the recommended Buick nonattainment area. The basis for this finding is the impact from the Buick sources on the predicted violations and the impact of these more distant sources on the Buick predicted violations. Since monitoring data will be available near these two operational sites in the near future, an indication of the attainment status will be made upon review of that data.

In addition, the Department's dispersion modeling analyses for each area show less than one percent contribution to violating monitoring locations from the more distant mine/mill sources in the Viburnum trend. Also, the impact of the Buick sources on the more distant mine/mill predicted violations is 2.5 percent of the standard with the remainder originating from the source in close proximity to the violation.

Other Areas with Lead Sources

Secondary Smelter

Exide Technologies

In addition to the Doe Run facilities, another lead source in the state is a facility in Holt County owned by Exide Technologies (formerly known as Schuylkill Metals) located in Canon Hollow. This facility is a secondary smelter for recycling of lead, primarily from lead acid storage batteries. The Department examined data from an air monitoring sampler that was located near the facility from 1992 to 2000. The facility violated the 1.5 $\mu\text{g}/\text{m}^3$ standard in the third quarter of 1994 and concentrations that were a significant fraction of the standard in other quarters. That monitoring site was subsequently acquired by Exide Technologies, so it was no longer considered ambient. Department staff evaluated current emission estimates for the facility and visited the facility in January 2009. The facility has added substantial emission controls since the time of the monitoring described above, and lead emissions are estimated to be about 0.01 tons per year. Source test results confirm that emissions have been reduced, indicating a 96 percent reduction since monitoring was discontinued. Therefore, it is extremely unlikely that ambient lead concentrations exceed the 2008 NAAQS at this location and the area is being recommended as attainment/unclassifiable.

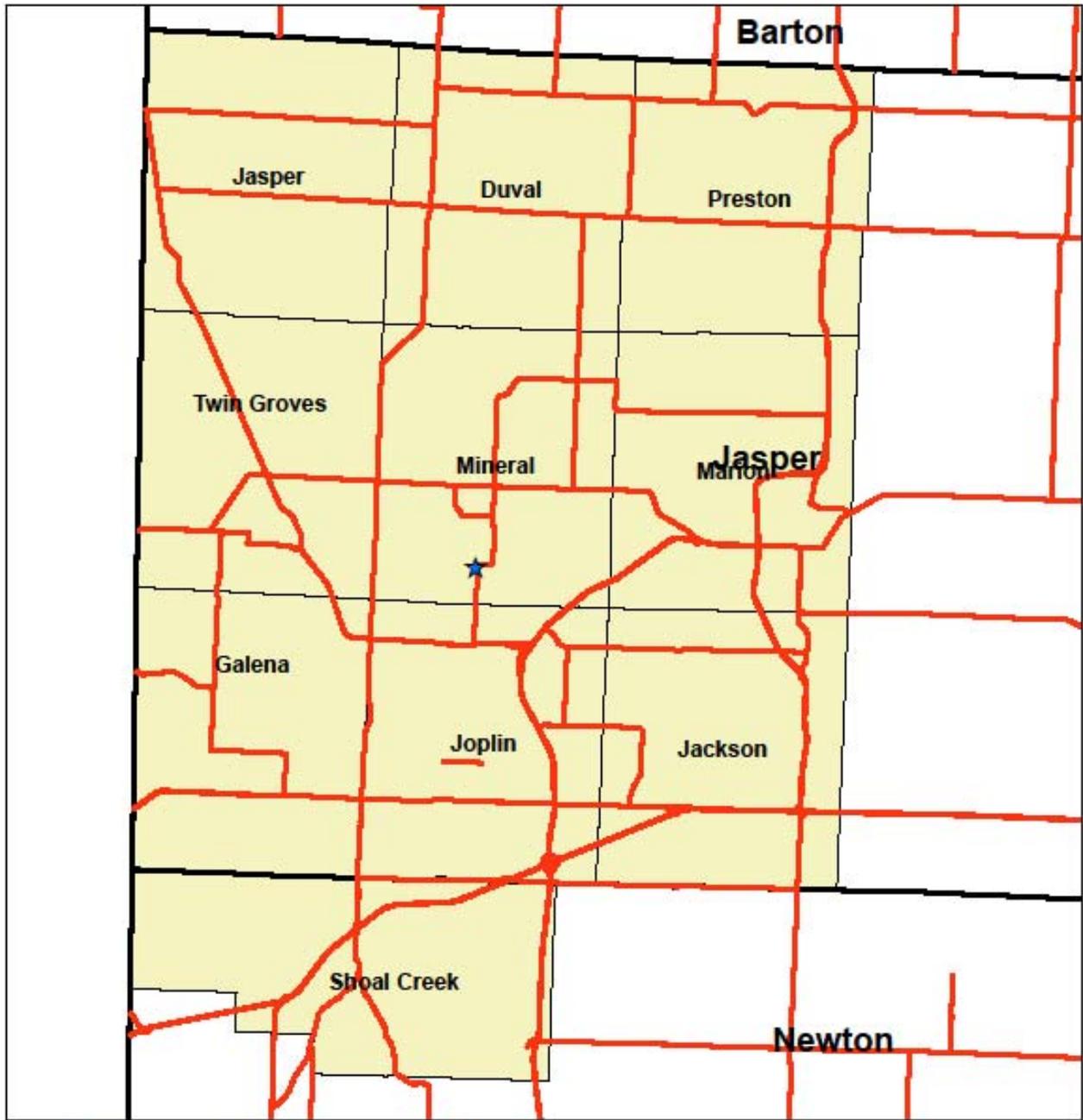
Inactive Lead Mine Areas

Two specific lead mine tailings cleanup areas in Missouri that were given consideration as potential lead problem areas. The first is an area near Joplin, Missouri (known as the Tri-State Area). Lead and zinc were mined in the tri-state area (southwestern Missouri, southeastern Kansas, and northeastern Oklahoma) between about 1830 and the 1970s. Chat and tailings from the mining and milling have remained in the area following cessation of mining activity.

Tri-State Area

Within Missouri, mining in the Tri-State Area occurred within Jasper and Newton Counties. Eleven separate areas within Jasper and Newton Counties were listed on the National Priorities or Superfund list in 1990. These areas are known collectively as the Oronogo-Duenweg Mining Belt Superfund Site, also sometimes called the Jasper County Site. Figure 17 shows the locations of these areas. Remediation activities are categorized under five operable units (OU). Remediation activities within OU 2 and 3, Residential Yard Soils, included cleanup activities completed in 2002 and institutional controls established in 2005. Activities within OU 4, Groundwater, were completed in 2004 with the installation of public water supply systems. OU 5 relates to the Spring River basin and is currently under study. OU 1 is mine and mill waste. Remediation activities within OU 1 have recently begun and will continue for several years. The remediation includes removal of contaminated material with contaminant concentrations above established thresholds and disposing of it in mining pits and in repository areas that will be capped and vegetated.

Some very limited airborne lead measurements were collected in this area and largely do not suggest violations of the 2008 lead NAAQS (see *Missouri Lead Monitoring Network Plan*). However, these measurements were not made during remediation or earthmoving activity, but primarily measure windblown dust in the area near the sampler. Therefore, in the lead monitoring plan, the Department has recommended airborne lead monitoring at a location within ambient air as close as practicable to remediation activity such as earthmoving and generally downwind of the activity. At this time, the Department has no strong indication of concentrations over the 2008 standard, but will designate the areas containing each of the remediation sites with the Oronogo-Duenweg Mining Belt Superfund Site as unclassifiable. The recommended Tri-State unclassifiable area includes Duval, Galena, Jackson, Jasper, Joplin, Marion, Mineral, Preston, and Twin Groves Townships in Jasper County and Shoal Creek Township in Newton County.



★ Proposed Monitoring Site

Recommended Unclassifiable Area
in Jasper and Newton Counties



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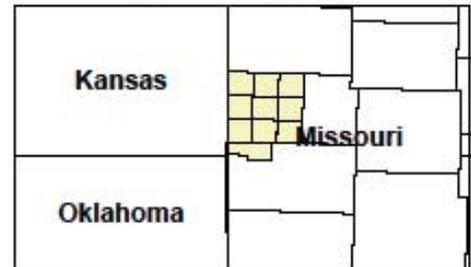


Figure 18: Recommended Tri-State Unclassifiable Area

Old Lead Belt Area

The second area is the Old Lead Belt area in St. Francois County. Even though mining has been discontinued in the old lead belt area, chat and tailings disposal areas remain from the mining activity. The larger chat and/or tailings disposal areas include: Bonne Terre, Desloge or Big River, National, Elvins or Rivermines, Leadwood, and Federal, all in St. Francois County. Locations of these areas are shown on Figure 18. Remediation activities are currently underway at the National chat pile in Park Hills, Missouri.

St. Joe State Park is also located in the old lead belt area near Park Hills, Missouri. The area of the park was donated to the state by the St. Joe Minerals Corporation in 1976 after lead mining in the old lead belt area ceased. The park is over 8,000 acres and includes approximately 2,000 acres that are set aside for off-road vehicle (ORV) riding. Of these 2,000 acres, 800 acres contain crushed dolomite remaining from past milling of lead ore (tailings). This area within the park is known as the Federal tailings pile. Lead emissions from areas in the park have never been quantified in emissions inventories. However, windblown dust and/or dust raised by ORV activities are a potential source of airborne lead in and near the park.

Some limited airborne lead measurements were collected in this area and suggest some limited concern that violations of the 2008 lead NAAQS could be occurring in these areas (see *Missouri Lead Monitoring Network Plan*). Therefore, in the lead monitoring plan, the Department has recommended airborne lead monitoring at a location within St. Joe State Park and in ambient air as close as practicable to remediation activity at the National chat pile. At this time, the Department has no strong indication of concentrations over the 2008 standard, but will designate the areas containing each of the remediation sites within the Old Lead Belt as unclassifiable. The recommended Old Lead Belt unclassifiable area includes Perry, Randolph, and St. Francois Townships in St. Francois County.

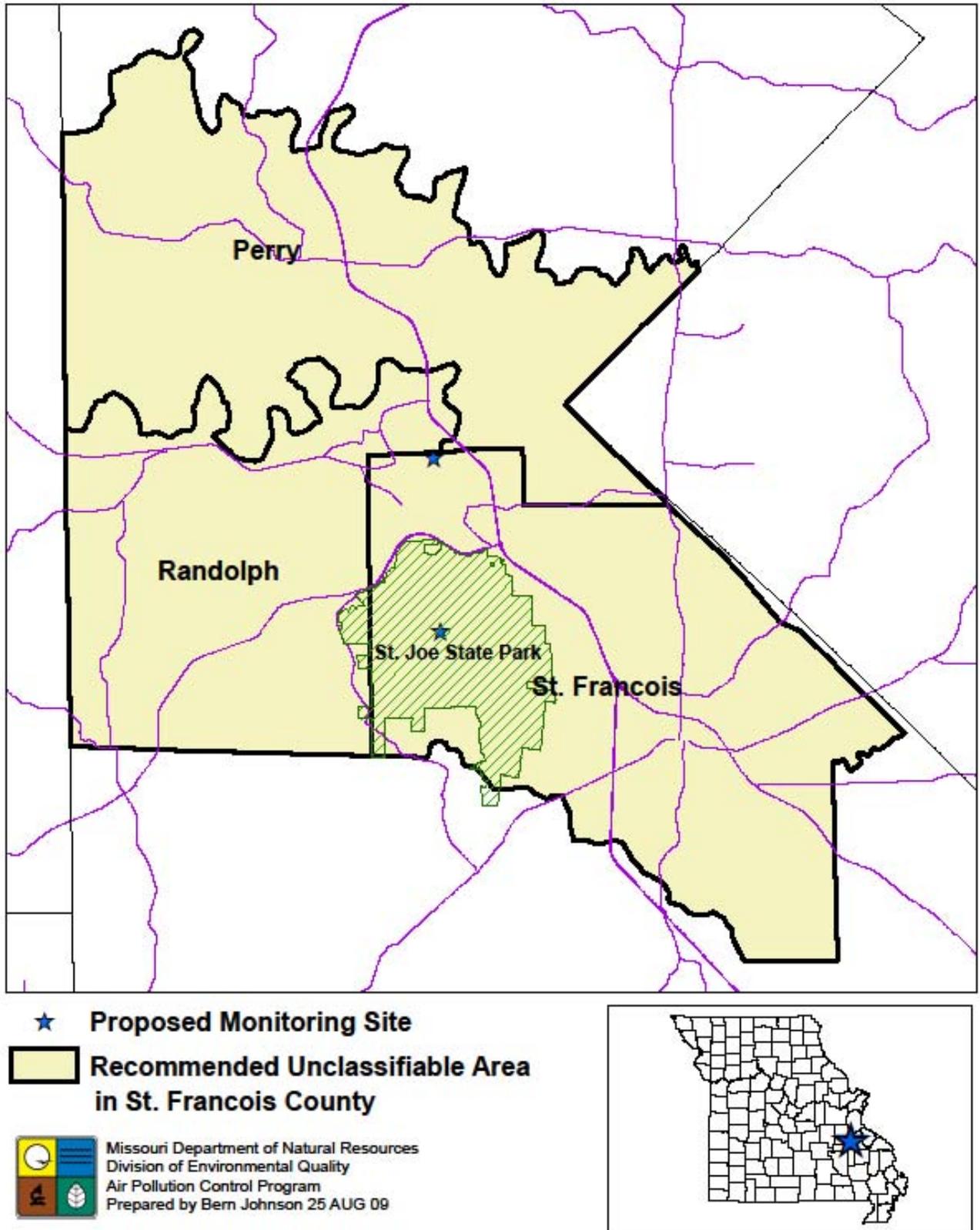


Figure 19: Recommended Old Lead Belt Unclassifiable Area

Summary

The Department is recommending for nonattainment designation areas around the active Doe Run smelting operations at Herculaneum and Buick, Missouri. This designation also includes the Buick mine/mill property to the south of the smelter. These recommended areas are smaller than the presumptive county boundaries proposed by EPA due to the very localized nature of the impacts from these large lead sources. The impact of these sources is isolated to ambient air in close proximity to these operations. The inclusion of other areas not impacted by these sources would not assist these areas in attaining the 2008 lead NAAQS.

Around the Herculaneum and Buick smelter locations, there are areas with unknown air quality at this time. These areas have been designated unclassifiable due to predicted concentrations above the standard with no supporting monitoring data and/or non-ambient sampling that identifies levels near the standard near other lead sources in the area. Also, the Department is recommending for unclassifiable designation areas that are near remediation sites for lead mine tailings cleanup. Some sites within the Oronogo-Duenweg Mining Belt in Jasper County (also known as the Tri-State Area) and the Old Lead Belt in St. Francois County) have been recommended for the unclassifiable designation.

List of Appendices

<i>Appendix A</i>	Herculaneum Modeling Input Files
<i>Appendix B</i>	Viburnum Modeling Input Files
<i>Appendix C</i>	Brushy Creek Mine Sampling Data
<i>Appendix D</i>	Herculaneum Monitoring Data
<i>Appendix E</i>	Comments Received on the Proposed Lead Boundary Recommendation
<i>Appendix F</i>	Responses to Comments on the Proposed Lead Boundary Recommendation