



MISSISSIPPI STATE DEPARTMENT OF HEALTH

November 30, 2010

Mr. Jerry Cain, Director
Office of Pollution Control
P. O. Box 2261
Jackson, MS 39225

Dear Mr. Banks:

Please find enclosed the results of the requested assessments of infant mortality concerns around the sites in Hattiesburg and Columbus. The same approach was used in both locations. In short, no differences were seen for those near the sites compared to those further away.

While infant mortality is of great concern to all, the rates average about 10 deaths per 1,000 live births. The best approach to reduce an infant's risk is to understand the many risk factors, some of which can range into the ten's of percent in pregnant females. Many of the more important risk factors are well understood and highly preventable with early care and intervention.

Should you need additional information, please do not hesitate to contact us.

Sincerely,

Bruce T. Brackin, MPH
Epidemiology

Richard Johnson, MPH
Public Health Statistics

CC:
Mr. Jerry Banks
Mr. Trey Hess
Mr. Ben Moore
Dr. Susan Neurath

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Dept of Environmental Quality
Office of Pollution Control

Investigation of a Community Concern of Perceived Elevated Infant Mortality - Columbus

Introduction and Background

Infant mortality is a great concern to all from the national to the local level. The Mississippi Department of Environmental Quality (MDEQ) has received such a concern from a group living in an area surrounding a waste site in the Columbus area. The MDEQ requested the assistance of the Mississippi State Department of Health in addressing this concern from citizens. Staff from both agencies met to discuss the issue and a proposal was made to investigate infant mortality in the area. It should be noted the MSDH has not received any questions or concerns expressed from the local medical establishment in the Hattiesburg area nor from the concerned community.

Infant mortality is a complex issue with many known and well-established risk factors including demographics, socioeconomic and medical care access and quality issues. Items such as a mother's age, ethnicity, education, marital status and the intentionality of the pregnancy can play an important role. Access to and utilization of health care, particular early in pregnancy, can influence the outcome. While great strides have been made in reducing infant mortality, more is needed. Sadly there has been and continues to be a disparity in the rates between the majority and minority races with up to nearly a two fold difference in the rates. To assist the MDEQ a proposal was developed that would ascertain if rates near the site were similar to an area further away and to the county and state as a whole. The proposed analyses should be race-specific. Given the racial disparities in infant mortality rates, differences in the racial distribution between areas will make statistical comparisons difficult.

Materials and Methods

The analytical design was to identify all births and infant deaths close to the site and an area further away and compare them to see if there was any difference. It is important to understand that if a difference is found, it does not imply a causal relationship but only that a statistical difference exists. Any interpretation beyond a simple statistical relationship is highly subject to the problem of ecological fallacy and should be avoided.

In consultation with MDEQ, two areas were developed for the primary comparisons. MDEQ furnished the vital records division of the MSDH the coordinates for the site. It was decided to construct areas in one and two mile concentric circles around the site. The area contained in the one-mile and one to two miles areas is 0.785 and 2.356 square miles respectively. The Vital Records Division could then geo-reference the address data of all births and infant deaths and determine which of the two zones they resided in. The defined areas for comparison were a) less than one mile and b) from one to two miles. Based on the findings the two areas could be compared and also referenced to the rate for the entirety of Lowndes County and Mississippi as a whole. In addition, the community expressed concern that local rates were higher than those for the nearby town of West Point and Clay County. Rates for these two areas are also included.

While still very problematic, infant mortality is a fairly rare event on the order of 10 deaths of infants less than a year of age for every 1,000 live births. Thus, in a given year, the number of infant deaths in a

county or smaller geographical area can be small and the year-to-year variability can be large. To overcome these problems, multiple years worth of data are called for to reduce the variability and attempt to stabilize the resulting rates. In this instance data from 1999 through 2008 was combined.

Address data from 1999-2008 birth and infant death certificates were geo-referenced using ArcView 9.3 from ESRI Software. The Census Bureau's TIGER files provided street data for this process. The births and deaths were restricted to Lowndes County residents and the addresses were subjected to additional levels of cleaning and standardization. It is rare that 100% of address data can be automatically geo-referenced and this additional cleaning ensured that the number of records that could not be matched to a location and, therefore, lost to follow-up would be minimal. After the additional clean up, 85% of the birth records and 99% of the infant death records were geo-referenced to street level.

Electronic information (ArcView shape files) on the former Kerr-Mcgee (Tronox) site in Columbus was originally supplied by the Mississippi Department of Environmental Quality and obtained from MARIS (Mississippi's Automated Resource Information System), a GIS clearinghouse for Mississippi. The geographic center of the site was located and two concentric circles of one and two mile radius were overlaid onto the data (see attached). Note that, when printed, the radius circles appear slightly elliptical due to the projection of a spherical map onto a flat surface. Births and infant deaths were classified by their distance (< 1 mile and 1-2 miles) from the geographic center of the site. The births and infant deaths were tabulated by geographic area and race using SAS 9.1.3 software from SAS Institute, Inc. These figures were used to calculate infant mortality rates, stratified by race, for the < 1 mile and 1-2 mile geographic areas. Rates for Lowndes County, the city of West Point, Clay County and Mississippi are included for comparison.

Figure 1.

Columbus Creosote Site Area

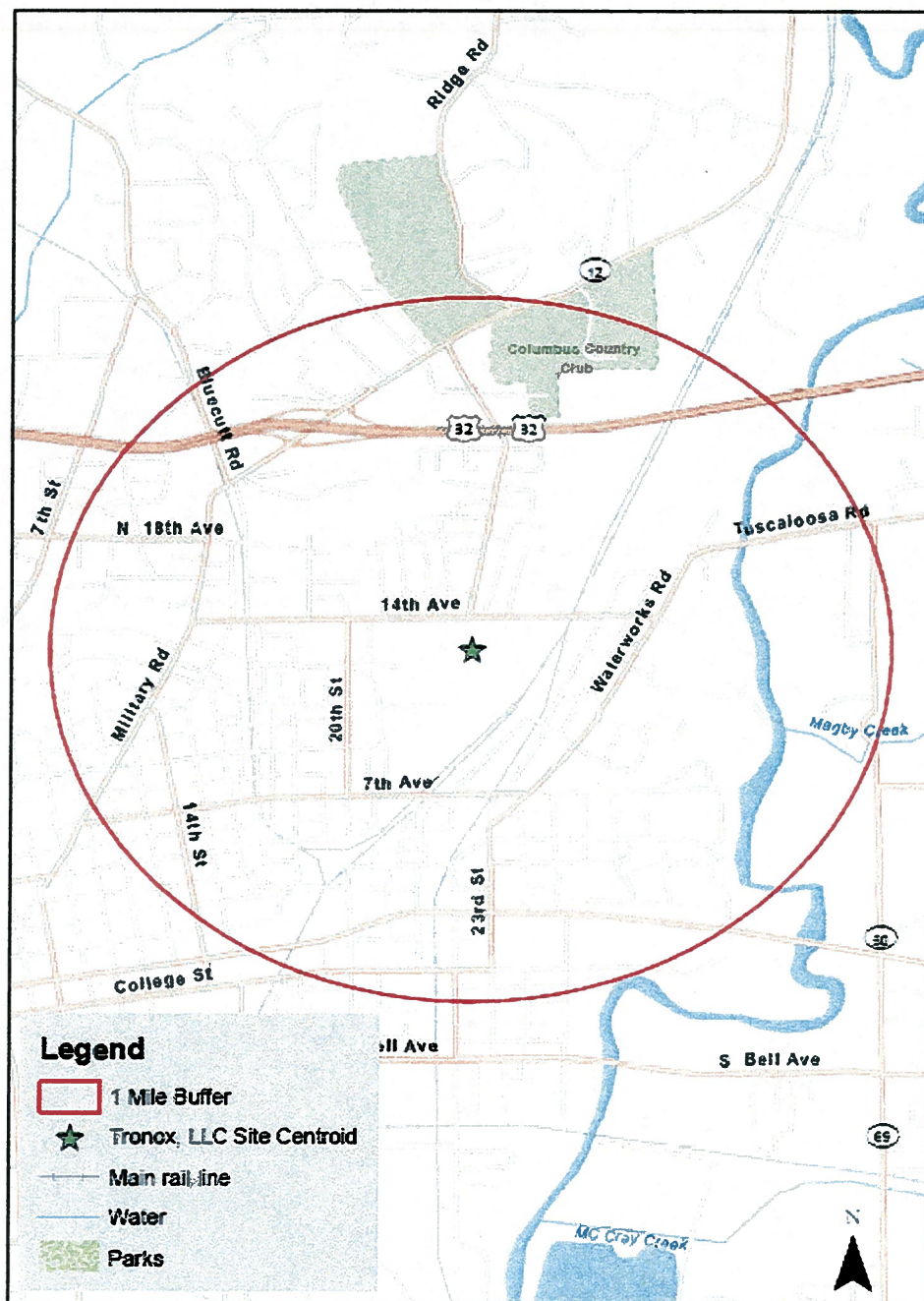
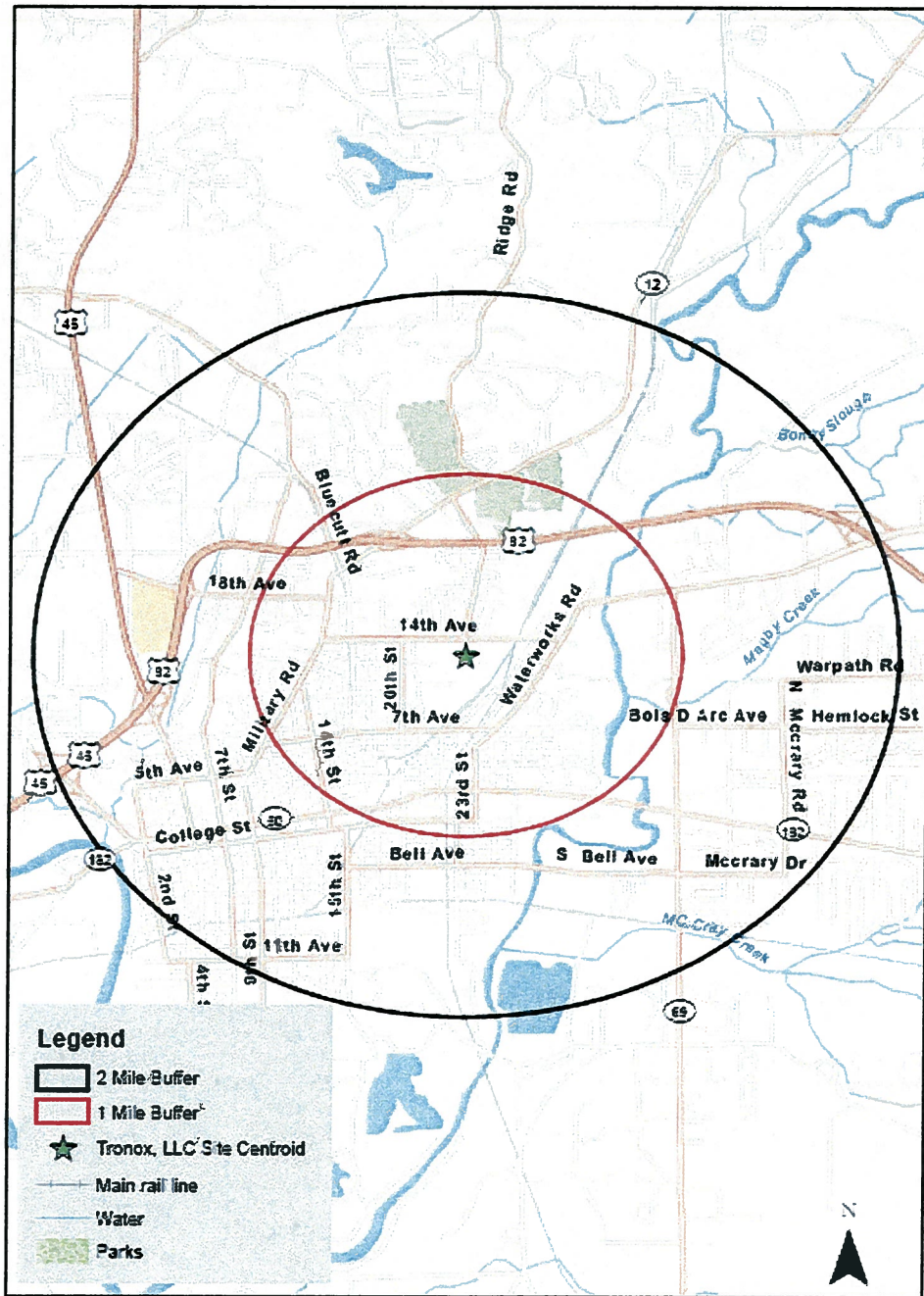


Figure 2.

Columbus Creosote Site Area



Results

Table 1 displays the numerical results of the resulting tabulations by racial group and distance from the center from the site. Figure 3 presents the data in a graphical format with the calculated confidence intervals. There were a total of 2,404 births and 25 infant deaths found within the two-mile area occurring between 1999 and 2008.

For nonwhites the rates were lower infant mortality near the site (<1 mile) than further away (1-2 miles). While the rate for whites was higher near the site, one should be cautioned the rate is based on one infant death in 10 years. By applying confidence intervals to each area on a race-specific basis, there is no statistical difference in the rates. When stratifying for race, neither area was different than Lowndes County as a whole, West Point, Clay County or the state for the same time period. It should be noted that one infant death occurred in each of the two zones due to external causes and not from a medical cause. Thus, if infant deaths were restricted to medical causes, the rates would lower.

Infant deaths were additionally classified as neonatal deaths (occurring before the 28th day after birth) and postneonatal deaths (occurring on or after the 28th day after birth) and rates similarly prepared. Again, no differences were seen. The numbers are even smaller and rates may have additional variability when divided into neonatal and post neonatal groups. A complete table with the overall, neonatal and postneonatal numbers and rates is included as an appendix.

The underlying cause of the infant deaths for those within 1 and 1-2 miles of the site were examined. The pattern was similar to what is seen in any community. Conditions related to low birth weight and short gestational period were the predominate cause. As previously cited, two of the deaths were due to external causes. Due to small numbers and confidentiality, a complete list may not be presented.

The results suggest there is no difference between the compared areas. Nevertheless, education of potential mothers could benefit not only the area around the site but also the entire community. The MSDH would entertain suggestions to help educate the community on matters related to pregnancy and reducing the risk of infant mortality and address the more important risk factors that can be readily modified.

Table 1. Results of 1999-2008 births and infant deaths by race and zone around Columbus site. County and State rates are given for reference.

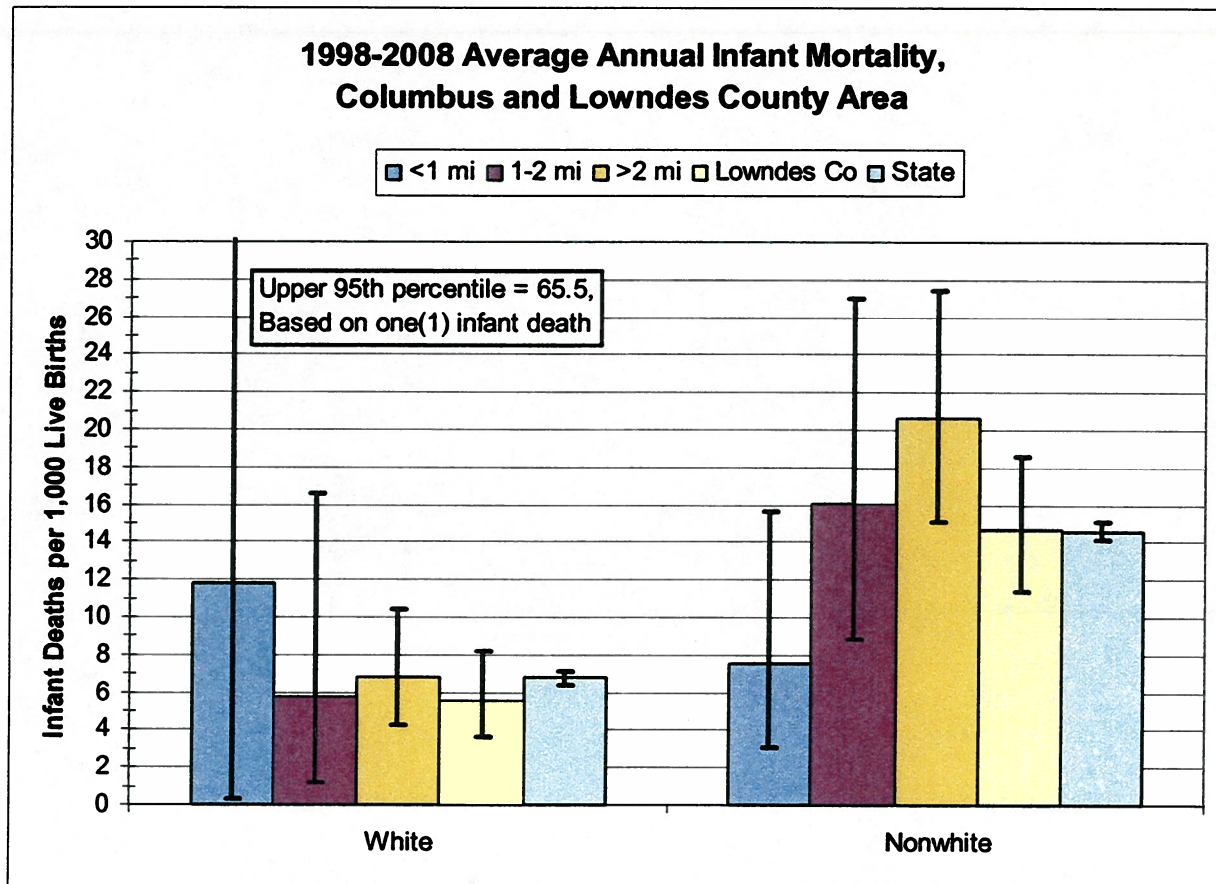
| | White | | | | Nonwhite | | | |
|----------------|---------|---------------|------|----------|----------|---------------|------|-----------|
| | Births | Infant deaths | Rate | 95% CI* | Births | Infant deaths | Rate | 95% CI* |
| < 1 mile | 85 | 1 | 11.8 | 0.3-65.5 | 922 | 7 | 7.6 | 3.1-15.6 |
| 1-2 miles | 527 | 3 | 5.7 | 1.2-16.6 | 879 | 14 | 16.1 | 8.8-27 |
| >2 miles | 3,078 | 21 | 6.8 | 4.2-10.4 | 2,279 | 47 | 20.6 | 15.2-27.4 |
| Lowndes County | 4,489 | 25 | 5.6 | 3.6-8.2 | 4,638 | 68 | 14.7 | 11.4-18.6 |
| West Point | 615 | 6 | 9.8 | 3.6-21.2 | 1,334 | 24 | 18.0 | 11.5-26.8 |
| Clay County | 1,040 | 7 | 6.7 | 2.7-13.9 | 2,109 | 39 | 18.5 | 13.1-25.3 |
| Mississippi | 234,474 | 1,588 | 6.8 | 6.4-7.1 | 200,929 | 2,935 | 14.6 | 14.1-15.1 |

***Except for the state, confidence limits were calculated based on Poisson distribution due to small areas and number of events.**

An additional approach may be employed to contrast the areas. One can apply the rates and confidence limits of the rates from a nearby larger area to compute the expected number of events in the smaller sub areas based on their number of live births. This would then represent the number of events along with 95 percent confidence range one would expect if the rates in the smaller areas were the same.

If rates for the area outside of the two mile radius, i.e., the remainder of Lowndes County, are used, one would expect 0.4-0.9 infant deaths in whites during the period compared to the 1 observed in the <1 mile radius area. For nonwhites, there were 7 observed infant deaths and 14 to 23 would be expected. Thus, this supports the observation based on the area rates and their confidence intervals for the area less than one mile from the site not being different or elevated.

Figure 3.



Investigation of a Community Concern of Perceived Elevated Infant Mortality - Hattiesburg

Introduction and Background

Infant mortality is a great concern to all from the national to the local level. The Mississippi Department of Environmental Quality (MDEQ) has received such a concern from a group living in an area surrounding a waste site in the Hattiesburg area. The MDEQ requested the assistance of the Mississippi State Department of Health in addressing this concern from citizens. Staff from both agencies met to discuss the issue and a proposal was made to investigate infant mortality in the area. It should be noted the MSDH has not received any questions or concerns expressed from the local medical establishment in the Hattiesburg area nor from the concerned community.

Infant mortality is a complex issue with many known and well-established risk factors including demographics, socioeconomic and medical care access and quality issues. Items such as a mother's age, ethnicity, education, marital status and the intentionality of the pregnancy can play an important role. Access to and utilization of health care, particular early in pregnancy, can influence the outcome. While great strides have been made in reducing infant mortality, more is needed. Sadly there has been and continues to be a disparity in the rates between the majority and minority races with up to nearly a two fold difference in the rates. To assist the MDEQ a proposal was developed that would ascertain if rates near the site were similar to an area further away and to the county and state as a whole. The proposed analyses should be race-specific. Given the racial disparities in infant mortality rates, differences in the racial distribution between areas will make statistical comparisons difficult.

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The analytical design was to identify all births and infant deaths close to the site and an area further away and compare them to see if there was any difference. It is important to understand that if a difference is found, it does not imply a causal relationship but only that a statistical difference exists. Any interpretation beyond a simple statistical relationship is highly subject to the problem of ecological fallacy and should be avoided.

In consultation with MDEQ, two areas were developed for the primary comparisons. MDEQ furnished the vital records division of the MSDH the coordinates for the site. It was decided to construct areas in one and two mile concentric circles around the site. The area contained in the one-mile and one to two miles areas is 0.785 and 2.356 square miles respectively. The Vital Records Division could then geo-reference the address data of all births and infant deaths and determine which of the two zones they resided in. The defined areas for comparison were a) less than one mile and b) from one to two miles. Based on the findings the two areas could be compared and also referenced to the rate for the entirety of Forrest County and Mississippi as a whole.

While still very problematic, infant mortality is a fairly rare event on the order of 10 deaths of infants less than a year of age for every 1,000 live births. Thus, in a given year, the number of infant deaths in a county or smaller geographical area can be small and the year-to-year variability can be large. To

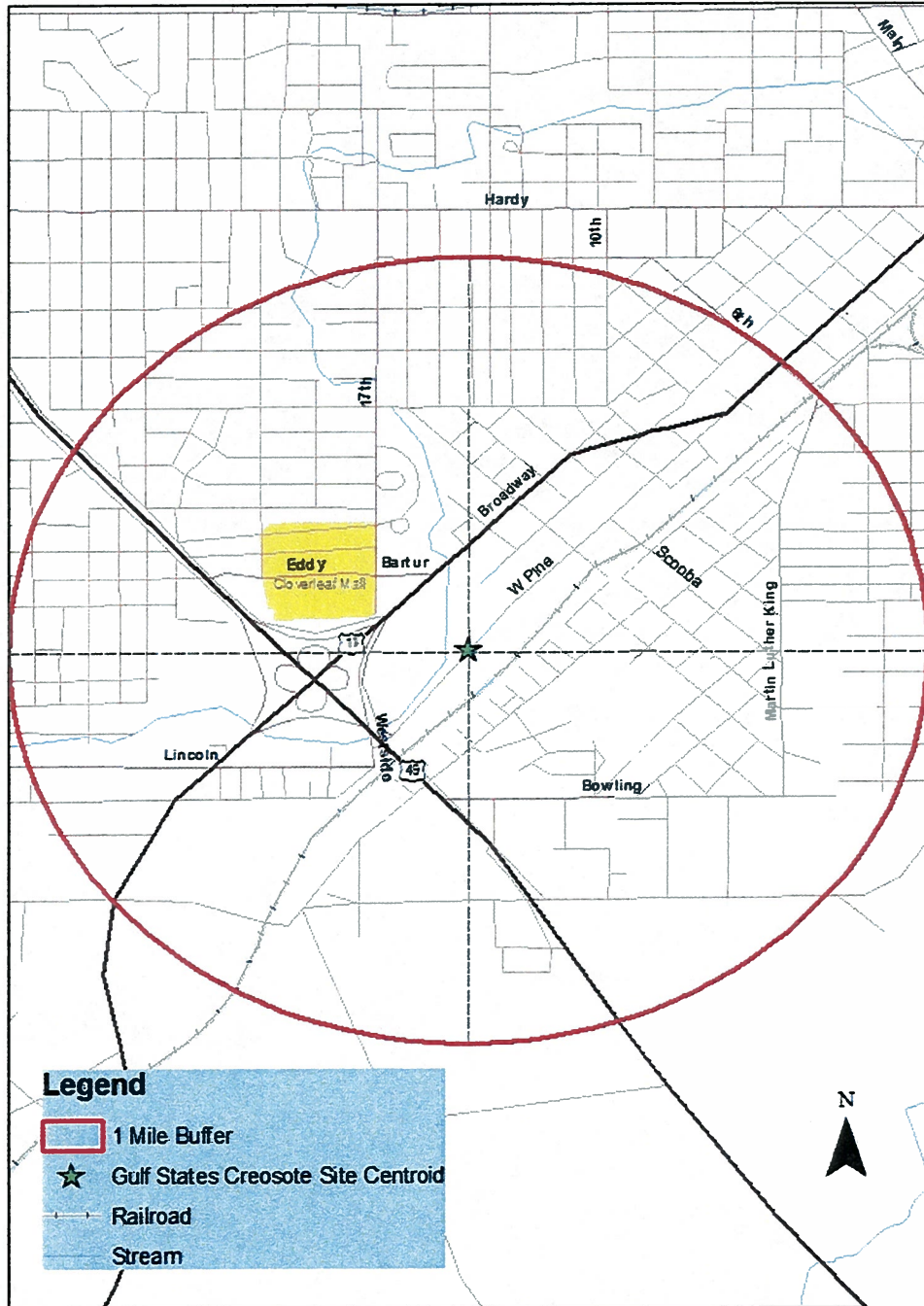
overcome these problems, multiple years worth of data are called for to reduce the variability and attempt to stabilize the resulting rates. In this instance data from 1999 through 2008 was combined.

Address data from 1999-2008 birth and infant death certificates were geo-referenced using ArcView 9.3 from ESRI Software. The Census Bureau's TIGER files provided street data for this process. The births and deaths were restricted to Forrest County residents and the addresses were subjected to additional levels of cleaning and standardization. It is rare that 100% of address data can be automatically geo-referenced and this additional cleaning ensured that the number of records that could not be matched to a location and, therefore, lost to follow-up would be minimal. After the additional clean up, 94.5% of the birth records and 94.6% of the infant death records were geo-referenced to street level.

Electronic information (ArcView shape files) on the former Gulf States Creosoting (Tronox) site in Hattiesburg was originally supplied by the Mississippi Department of Environmental Quality and obtained from MARIS (Mississippi's Automated Resource Information System), a GIS clearinghouse for Mississippi. The geographic center of the site was located and two concentric circles of one and two mile radius were overlaid onto the data (see attached). Note that, when printed, the radius circles appear slightly elliptical due to the projection of a spherical map onto a flat surface. Births and infant deaths were classified by their distance (< 1 mile and 1-2 miles) from the geographic center of the site. The births and infant deaths were tabulated by geographic area and race using SAS 9.1.3 software from SAS Institute, Inc. These figures were used to calculate infant mortality rates, stratified by race, for the < 1 mile and 1-2 mile geographic areas. Rates for Forrest County and Mississippi are included for comparison.

Figure 1.

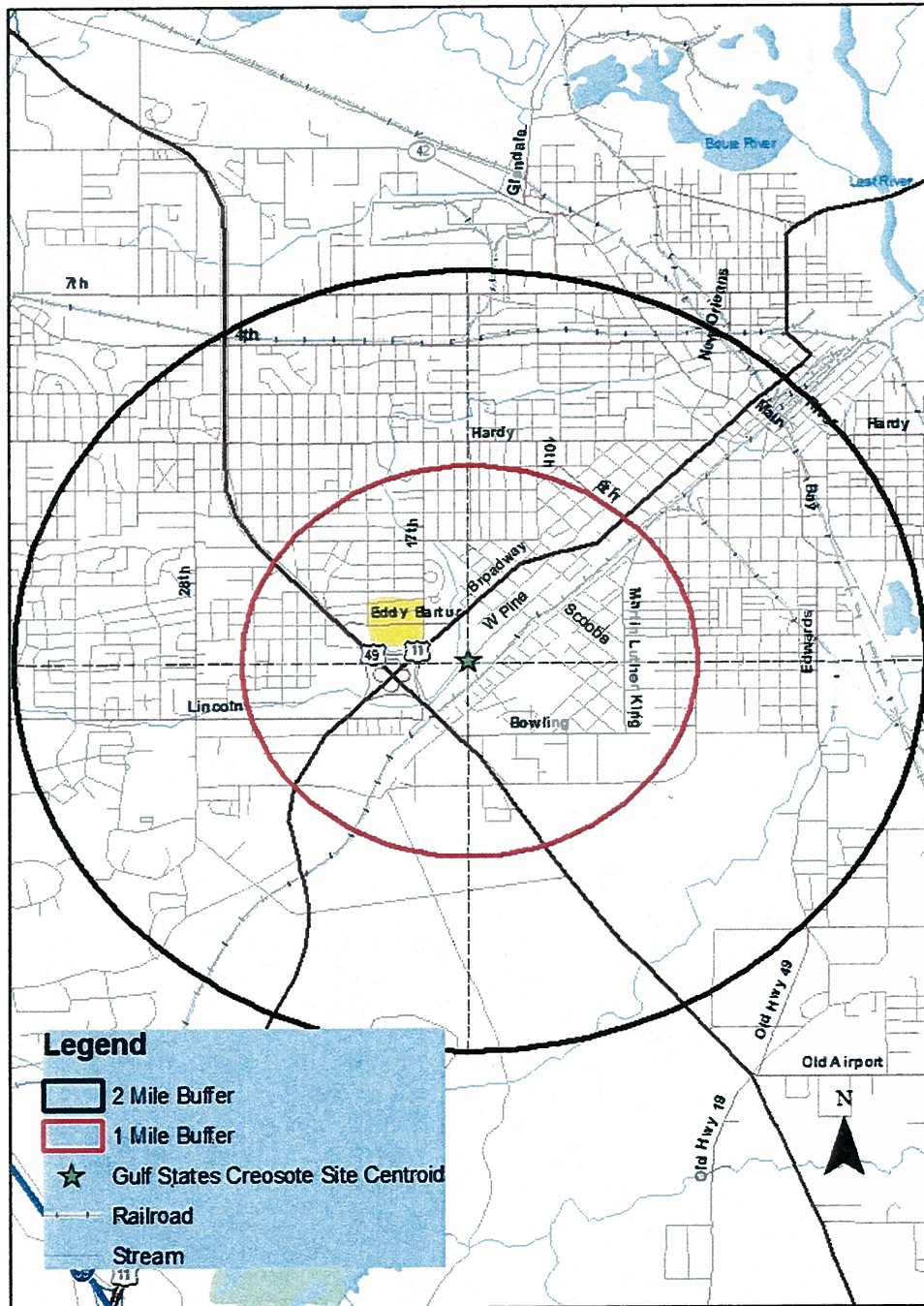
Hattiesburg Creosote Site Area



Mississippi Department of Health

Figure 2.

Hattiesburg Creosote Site Area



Mississippi Department of Health

Results

Table 1 displays the numerical results of the resulting tabulations by racial group and distance from the center from the site. Figure 3 presents the data in a graphical format with the calculated confidence intervals. There were a total of 3,653 births and 51 infant deaths found within the two-mile area occurring between 1999 and 2008. In referring to the map in Figure 2, it is seen that the majority of the residential area of both zones lies north of an east to west line through the site and is sparser to the south.

For both the white and nonwhite groups there were slightly lower infant mortality rates found closer to the site (<1 mile) than further away (1-2 miles). By applying confidence intervals to each area on a race-specific basis, there is no statistical difference in the rates. When stratifying for race, neither area was different than the county as a whole or the state for the same time period.

Infant deaths were additionally classified as neonatal deaths (occurring before the 28th day after birth) and postneonatal deaths (occurring on or after the 28th day after birth) and rates similarly prepared. Again, no differences were seen. The numbers are even smaller and rates may have additional variability when divided into neonatal and post neonatal groups. A complete table with the overall, neonatal and postneonatal numbers and rates is included as an appendix.

The underlying cause of the infant deaths for those within 1 and 1-2 miles of the site were examined. The pattern was similar to what is seen in any community. Conditions related to low birth weight and short gestational period were the predominate cause. Due to the small numbers and confidentiality, a complete list may not be presented.

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Table 1. Results of 1999-2008 births and infant deaths by race and zone around site. County and State rates are given for reference.

| | White | | | | Nonwhite | | | |
|----------------|---------|---------------|------|----------|----------|---------------|------|-----------|
| | Births | Infant deaths | Rate | 95% CI* | Births | Infant deaths | Rate | 95% CI* |
| < 1 mile | 326 | 2 | 6.1 | 0.7-22.2 | 801 | 14 | 17.5 | 9.6-29.3 |
| 1-2 miles | 964 | 7 | 7.3 | 2.9-15.0 | 1,562 | 28 | 17.9 | 11.9-25.9 |
| > 2 miles | 5,030 | 38 | 7.6 | 5.3-10.4 | 2,762 | 42 | 15.2 | 11.0-20.6 |
| Forrest County | 6,320 | 47 | 7.4 | 5.5-9.9 | 5,125 | 84 | 16.4 | 13.1-20.3 |
| Mississippi | 234,474 | 1,588 | 6.8 | 6.4-7.1 | 200,929 | 2,935 | 14.6 | 14.1-15.1 |

* Except for the state, confidence limits were calculated based on Poisson distribution due to small areas and number of events.

An additional approach may be employed to contrast the areas. One can apply the rates and confidence limits of the rates from a nearby larger area to compute the expected number of events in the smaller sub areas based on their number of live births. This would then represent the number of events along with 95 percent confidence range one would expect if the rates in the smaller areas were the same.

If rates for the area outside of the two mile radius, i.e., the remainder of Forrest County, are used, one would expect 1.7 to 3.4 infant deaths in whites during the period compared to the observed 2 in the <1 mile radius area. For nonwhites, there were 14 observed infant deaths and 8.8 to 16.5 would be expected. Thus, this supports the initial observation based on the area rates and their confidence intervals for the area less than one mile from the site not being different or elevated.

Figure 3.

