Health Consultation

An Evaluation of Pre- and Post- Hurricane Soil and Blood Lead Data from Orleans and St. Bernard Parishes

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
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An Evaluation of Pre- and Post- Hurricane Soil and Blood Lead Data from Orleans and St. Bernard Parishes

Prepared By:

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Office of Public Health
Section of Environmental Epidemiology and Toxicology
Under a Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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List of Acronyms

ABLES	Adult Blood Lead Epidemiology and Surveillance Program
ATSDR	Agency for Toxic Substances and Disease Registry
CBLSS	Childhood Blood Lead Surveillance System
CDC	Centers for Disease Control
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
HC	Health Consultation
HUD	U.S. Department of Housing and Urban Development
LDEQ	Louisiana Department of Environmental Quality
LDHH	Louisiana Department of Health and Hospitals
LHPS	Louisiana Health and Population Survey
mg/kg	milligrams per kilogram
mph	miles per hour
MRGO	Mississippi River Gulf Outlet
N	Number of samples
NIOSH	National Institute of Occupational Safety and Health
NOHD	New Orleans Health Department
OPH	Office of Public Health
ppm	parts per million
SEET	Section of Environmental Epidemiology and Toxicology
ug/dL	micrograms per deciliter

Summary and Statement of Issues

On August 29, 2005, Hurricane Katrina made landfall in Southeastern Louisiana. The storm surge that followed the landfall of this hurricane pushed water into the Mississippi River Gulf Outlet (MRGO), breaching and/or overtopping the Orleans Parish and St. Bernard Parish levee systems. After floodwaters receded, the United States Environmental Protection Agency (EPA), in coordination with the Louisiana Department of Environmental Quality (LDEQ), sampled sediments and soils throughout Orleans and St. Bernard parishes to determine whether these media contained any contaminants that would pose a health hazard to exposed individuals. Analysis of the soil samples identified levels of lead that were above environmental regulatory screening levels at various sampling sites throughout Orleans and St. Bernard parishes. However, detected soil lead levels appear to be consistent with historic levels reported prior to the hurricanes. Subsequent to this finding, as part of prudent public health practice, the Louisiana Department of Health and Hospitals/Office of Public Health/Section of Environmental Epidemiology and Toxicology (LDHH/OPH/SEET) performed a comparison of pre- and post-hurricane soil lead levels by census tract. This comparison was performed to determine if soil lead concentrations increased or migrated following the hurricane. Childhood blood lead levels were also determined in these census tracts. Neighborhood areas with risk factors making residents susceptible to lead exposures, such as relatively high poverty levels and homes built prior to 1978 were identified by census tract. Households below poverty level may be at increased risk to pre- or post- hurricane lead exposures due to the relationship of poverty and older, substandard housing and limited access to or knowledge of health resources. These evaluations were performed to identify the recommendations that would be most helpful in reducing future childhood lead exposure in the neighborhoods throughout Orleans and St. Bernard parishes as the area rebuilds and recovers.

Background

Site Description and History

Hurricane Katrina made landfall in Southeastern Louisiana on August 29, 2005 as a Category 3 hurricane with sustained winds of 125 mph. Later that day, breaches appeared in the levees surrounding the 17th Street Canal, the London Avenue Canal, and the Industrial Canal. A levee along the Intercoastal Waterway was overtopped by floodwaters in New Orleans East. Additionally, hurricane related storm surge was funneled into St. Bernard Parish through the MRGO, overtopping the levee system and flooding much of the parish. Breaches in floodwalls surrounding the Industrial Canal in neighboring Orleans Parish contributed to flooding in adjacent St. Bernard neighborhoods (appendix, map 1). The flooding that resulted left many houses in the parish under more than 10 feet of water for several days. Not long after the flooding subsided from Katrina, rising waters from Hurricane Rita poured through breaches in the patched Industrial Canal levee into the Ninth Ward before making landfall along the Texas - Louisiana coast as a Category 3 Hurricane on September 24, 2005.

Following the hurricanes, the EPA, in coordination with the LDEQ, sampled the sediments that were left behind once the floodwaters receded. The samples were analyzed for a range of compounds, including total metals, and total coliform bacteria. Due to the varying depths of the sediments left behind by floodwaters, some samples included historical sediment from nearby water bodies, soil from yards, road and construction debris, and other material. Analysis of these samples detected heavy metals, including lead. These findings raised questions about how the lead levels compared to previous levels measured in the Orleans and St. Bernard parishes and how these levels should be addressed. Concerns have also arisen about the effect that the continuing demolition and renovation of homes across the area will have on lead levels in soil.

Based on the Federal Emergency Management Agency's (FEMA) evaluation of census 2000 occupied units in Orleans Parish, over 154,000 of reported structures sustained some form of hurricane related damage in 2005 [1]. Given the reported figures, some 53,181 new residential permits were issued in the city of New Orleans between October 2005 and January 2007 [2]. Similarly, 2,971 homes have been demolished (Orleans Parish) from February 2006 through February 15, 2007 [2]. Data for St. Bernard Parish was not available.

New Orleans, Louisiana is an old city with architecturally distinguished wood houses that were mostly constructed pre-1950 when lead-based paints were in common use (appendix, map 2). As further demolition and extensive remodeling continues to take place in the Orleans and St. Bernard parishes, it is necessary to implement precautionary practices in order to minimize the dispersion of lead-based paints into the environment. Discussion of the regulatory oversight of lead abatement follows below. Households below poverty level may be at increased risk to pre- or post- hurricane lead exposures due to the relationship of poverty and older, substandard housing and limited access to or knowledge of health resources (appendix, map 3). Failures to utilize lead-safe remediation controls will likely result in addition of more lead to soils and substantial and sustained increases in home interior lead dust. These increases could add to the potential for adverse human health effects, especially in children.

Regulation of the Removal of Lead-Based Paint and Preliminary Interventions

The EPA regulates abatement procedures for industrial structures containing lead, and HUD regulates the abatement of leaded paint in HUD housing. Regulations are also in place to govern how lead-based wastes such as extra paint or paint chips should be disposed. In 1999, under the direction of the Toxic Substances Control Act, Congress directed the EPA to address the public's risk of exposure to lead-based paint hazards. The EPA subsequently put the Lead-Based Paint Pre-Renovation Education Rule into effect. This regulation affects renovators working for compensation, including general contractors and special trade contractors such as painters. Any of these individuals whose job requires the disturbance of more than two square feet of painted surface on a house built prior to 1978 must give the owner or tenant of the house a copy of the EPA's Protect Your Family From Lead In Your Home pamphlet [3]. Federal regulation does not, however, extend to the methods used to remove lead-based paint from private dwellings [4].

In September 2001, the New Orleans City Council passed an ordinance to regulate the power-sanding of exterior leaded paint. There was initial concern that the demand created by the ordinance for more stringent paint removal methods would pose an economic burden. However, it was determined that the cost associated with cleanup of lead in soil would greatly exceed the cost of preventing the deposition of lead from occurring. Using lead-safe work practices is ultimately more economical.

Demographics

Pre- hurricane Census 2000 results recorded a total population of 484,674 for Orleans Parish. The largest ethnic group in the parish at that time was African-American (67.3%), followed by Caucasian (28.1%), Hispanic or Latino (3.1%), Asian (2.3%), and Native American (0.2%). Approximately 75% of the population age 25 years or older in 2000 had earned at least a high school diploma. The median household income in 1999 was $27,133, with 27.9% of persons living below the poverty level [5].

St Bernard Parish, which hosts one of the largest and richest wetland ecosystems in North America, is located five miles east of downtown New Orleans. Approximately two-thirds of the parish is surrounded by water [6]. Pre- hurricane Census 2000 results recorded a total population of 67,229. The largest ethnic group in the parish at that time was Caucasian (88.3%), followed by African-American (7.6%), Hispanic or Latino (5.1%), Asian (1.3%), and Native American (0.5%). Approximately 73% of the population age 25 years or older in 2000 had earned at least a high school diploma. The median household income in 1999 was $35,939, with 13.1% of persons living below the poverty level [7].

Post- hurricane, the Louisiana Health and Population Survey (LHPS) was conducted from June to September 2006 by the Louisiana Public Health Institute to provide state and local authorities with accurate demographic, health and economic information for public health emergency preparedness and economic development planning for hurricane-affected parishes [6]. LHPS 2006 results recorded a total population of 187,525 for Orleans Parish, with 7,669 children under the age of 5 years old. The ethnic group percentages were estimated. The largest ethnic group in the parish is African-American (46.3%), followed by Caucasian (43.8%), Hispanic or Latino (8.8%), Asian (3.6%), Native Hawaiian (1.2%) and Native American (0.4%). Approximately 15% of the population in 2006 had earned at least a high school diploma [8].

For St Bernard Parish, the post- hurricane LHPS 2006 results recorded a total population of 25,016, with 998 children under the age of 5 years old. The ethnic group percentages were estimated. The largest ethnic group in the parish is Caucasian (87.8%), followed by African-American (7.3%), Hispanic or Latino (5.6%), Native Hawaiian (1.1%) and Native American (0.4%). Approximately 33% of the population in 2006 had earned at least a high school diploma [9].

Discussion

Problems Inherent in House Demolition or Remodeling

New Orleans has a unique housing stock. As presented in September 2004 by Dr. Kevin Stephens of the New Orleans Health Department (NOHD), there is an estimated 109,345 homes in Orleans Parish that were built prior to 1950. Approximately 83% of this housing stock has not been lead-abated. More specifically, there are over 1400 properties in Orleans Parish that were identified by NOHD as suspected sources for elevated blood lead levels. A reported 16% of said properties are located in public housing units and are therefore occupied by low-income families. If lead-safe renovation or demolition practices are not followed on these properties, the concentration of lead in homes and residential soils will likely increase [10].

Urban redevelopment of older neighborhoods with a high prevalence of houses painted with lead-based paint can mobilize a potentially large source of lead [11]. The potential release of lead by power-sanding in a typical New Orleans home during renovation has been estimated at 7.4 kg of lead, which would be released as dust directly into the environment [11]. This is a public health concern and a potential source of household exposure from residents tracking exterior dust into indoor areas. Once indoors, this dustfall can be ingested by young children during hand-to-mouth behaviors. This is a particularly important concern for low-income and minority communities, which may already be at high risk of lead poisoning due to poor housing conditions and the age of housing. Projections included in a 2000 report by the President's Task Force on Environmental Health Risks and Safety Risks to Children showed that without the abatement of lead during the demolition or renovation of older lead-painted houses, several million children would be adversely affected over the next several decades [4].

Keeping pace with this issue, the NOHD has conducted blood lead screening of children since the late 1970s; however, the data the department collected was not routinely used for public health tracking prior to 2000 [12]. In the mid 1990s, researchers from Tulane University, working with LDHH, developed a database of lead screening results for children in New Orleans between 1993 and 1995. As a result, the Childhood Blood Lead Surveillance System (CBLSS) was developed by the state of Louisiana with funding from the Centers for Disease Control and Prevention (CDC). The CBLSS is a statewide system that collects results of all blood lead tests on Louisiana children [12]. As reported by the Louisiana Department of Health and Hospitals, approximately 14% of children in Orleans parish have elevated blood lead levels, compared to the national average of roughly two percent. Mielke et al. (2001), estimates 25-30% of New Orleans' children six years or younger exhibit blood lead levels of greater than or equal to 10ug/dL [13].

Data Evaluation

Pre- and Post- Hurricane Soil Data: Mielke, et. al.

SEET compared the soil lead results from two soil metal surveys (conducted by Xavier University researcher, Dr. Howard Mielke) [14]. The pre-hurricane survey sample collection (performed from 1998 - 2000) included a total of 5,467 samples stratified by 286 tracts from the 1990 census. From the dataset, SEET extracted samples collected in Orleans and St. Bernard parishes, and analyzed the median lead soil levels of the census tracts (N = 184) therein (appendix, map 4 and table 1).

The EPA soil lead screening level is 400 parts per million (ppm) for bare soil where children play [15]. The pre-hurricane soil survey included 69 soil lead medians above 400 ppm in the Orleans and St. Bernard parishes.

The post-hurricane survey sample collection (performed from April 2006 – June 2006) included a total of 874 samples stratified by 46 tracts from the 1990 Census. (Per post-hurricane study investigator Dr. Howard Mielke, survey results are currently in peer-review in preparation for publication.) From the total samples, SEET extracted and analyzed the median lead soil levels of the census tracts (N= 37) throughout the Orleans and St. Bernard parishes (appendix, map 5 and table 2). The post-hurricane soil survey had 6 soil lead medians above 400 ppm, with census tract 19 yielding the highest median level of 647 ppm.

Additionally, the median post-hurricane lead soil values decreased by 50% or greater in 13 of the 37 census tracts since Hurricanes Katrina and Rita, and slightly decreased (<50%) in an additional 13 census tracts. The median soil lead values in 3 of the census tracts exhibited an increase by 50% or greater, and slightly increased (<50%) in the remaining 8 census tracts of the Orleans and St. Bernard parishes.

Post-Hurricane EPA Data

SEET conducted a query of the EPA post-hurricane soil lead samples by accessing the online Katrina central warehouse on the EPA website [16]. The search included samples collected from August 2005 through December 2006, yielding a total of 1889 samples located in 116 census tracts in Orleans and St. Bernard parishes (appendix, map 8 and table 3). From the total samples, SEET extracted and analyzed the median lead soil levels for the census tracts (N= 23) for which post-hurricane soil data (Mielke, et.al.) was available.

As previously mentioned, the soil lead screening level is 400 parts per million (ppm) for bare soil where children play [15]. The EPA post-hurricane data had 2 census tracts with soil lead medians above 400 ppm.

The post-hurricane soil survey conducted by Mielke, et.al, had 6 soil lead medians above 400 ppm. As mentioned previously, survey results are currently in peer-review in preparation for publication.

Of the EPA post-hurricane data, one of the elevated soil lead medians is located in census tract number 40, one of the same tracts where Mielke detected soil lead medians above 400 ppm in the pre-hurricane data.

Pre- and Post-Hurricane Blood Lead Data

Blood lead data was obtained from LDHH's Louisiana Childhood Blood Lead Surveillance System (CBLSS). These data are transmitted weekly to the CBLSS database from various laboratories throughout the United States. A total of 8746 childhood blood lead samples were collected from January 2004 through August 2005 (prior to Hurricanes Katrina and Rita). From this sample pool, 3395 (39%) of these samples were matched by census tract within the study area (appendix, map 6 and table 4). The median childhood blood lead levels were analyzed by census tracts (n= 161 tracts) using the 2000 US Census data for the Orleans and St. Bernard parishes. Post-hurricanes (from September through December 2005), 46 blood lead samples were collected from 32 census tracts (appendix, map 7 and table 5). Because soil lead is such a strong factor in childhood lead exposure, we compared the association between the soil lead values (Mielke, et.al.) with the blood lead levels (micrograms per deciliter) in the same communities.

The Centers for Disease Control and Prevention (CDC) has set a blood lead level of concern at 10 micrograms per deciliter for children under the age of 6 [17]. Children with lead levels greater than or equal to 10 ug/dL are considered to have elevated blood lead levels and require appropriate follow-up, including confirmatory blood sampling and discussion of treatment options, if necessary. Of the pre-hurricane childhood blood lead samples identified by census tract, 616 samples (18%) were greater than or equal to 10 ug/dL. Furthermore, six tracts had median blood lead concentrations greater than or equal to 10 ug/dL. Each of the census tracts with elevated median blood lead concentrations was associated with median soil lead values greater than 400 ppm.

Of the post-hurricane blood lead samples collected from 32 tracts, two blood lead samples were greater than 10 ug/dL. (These two samples are located in census tracts where only one sample per tract was available; therefore, median values were not calculated.) However, neither was located in a census tract with a median soil lead value greater than 400 ppm.

Data Limitations

SEET obtained soil and blood lead data from three separate sources. SEET has extracted and analyzed the comparable data from each of the datasets for the purposes of this HC. There are degrees of variability between the datasets, including the following:

1. The number of pre- (n= 5,467) and post- (n= 874) hurricane soil samples collected per census tract varies considerably, with much smaller post – hurricane sample sizes [Mielke, et.al.].

2. The number of pre- (n= 8746) and post- (n= 46) hurricane childhood blood lead samples collected per census tract is extremely variable. Post- hurricane collection efforts have been difficult, as many families have relocated.

3. EPA soil data was available post- (n= 1889) hurricane only, therefore limiting comparative analysis of EPA soil data and soil data from Mielke, et.al, exclusively to post- hurricane data.

4. EPA data (collected August 2005 through December 2006) included media from several sampling events which contained both sediment and soil only, as well as a mixture of sediment with samples of underlying soil that existed prior to the hurricane. Approximately 16% of the 1889 samples are identified as soil samples, with the remaining 84% identified as sediment.

5. In some cases, specifically samples collected immediately after the hurricane, samples were collected from public right of ways only, and not from residential yards. Sampling from residential yards was conducted, though not until February 2006. Results from that sampling are

captured in this dataset.

6. With respect to soil lead sampling, the EPA and Howard Mielke data were collected based on individual project objectives, using different sampling methodology (for example grab/discrete versus composite), during separate events with staggered phases and from different census tracts. The number of samples per census tract and per sampling event varies considerably.

Exposure Pathways

SEET evaluated the environmental and human components that lead to exposure in order to determine whether a child or adult would be exposed to lead found in pre- and post- hurricane soils from the Orleans and St. Bernard parishes. This pathway analysis consists of five elements: a source of contamination, transport through an environmental medium, a point of exposure, a route of human exposure and a receptor population.

ATSDR categorizes an exposure pathway as a completed or potential exposure pathway if the exposure pathway cannot be eliminated. Completed pathways require that the five elements exist and indicate that exposure to a contaminant has occurred in the past, is currently occurring, or will occur in the future. Potential pathways, however, require that at least one of the five elements is missing, but could exist. Potential pathways indicate that exposure to a contaminant could have occurred in the past, could be occurring now, or could occur in the future. An exposure pathway can be eliminated if at least one of the five elements is missing and will never be present.

The Orleans and St. Bernard parishes contain many homes that were constructed before 1978; homes that were likely painted with lead paint. Mielke's pre- hurricane soil lead survey included 69 census tracts with medians above the 400 ppm screening level for bare residential soil. These results suggest that a potential exposure pathway via ingestion and / or inhalation of soil lead or lead-containing dust existed in the past for adults, children and workers. Individuals may have been exposed to lead-containing soil, paint chips or dust (from an indoor source and / or tracking in exterior dust from outdoor areas). Additionally, children who lived in substandard housing and individuals / professionals working on home renovations, especially paint sanding activities, may have experienced some level of exposure to lead via ingestion (hand to mouth behaviors) and / or inhalation of dust particles.

While there were noticeably fewer numbers of post- hurricane soil lead medians above the 400 ppm screening level for bare soil, a potential exposure pathway via ingestion and / or inhalation of soil lead remains in place for adults, children and workers in the present time and the future.

Lead Background and Toxicity

Lead is a heavy, low-melting, bluish-gray metal that occurs naturally in the Earth's crust [18]. It is rarely found as a natural metal; rather it is usually found combined with two or more other elements to form lead components [18]. It is commonly found in pipes, storage batteries, weights, ammunition, cable covers and sheets used to shield us from radiation. The largest use for lead is in storage batteries in vehicles. Until 1978, lead compounds were used in paints and dyes, as it was known to have excellent adhesion, drying, covering, and pigmentation properties.

Tetraethyl lead and tetramethyl lead were used in the United States as gasoline additives to increase octane rating until 1986, after a national ban for use in motor vehicles.

Lead occurs naturally in the environment. However, most of the high levels found throughout the environment come from human activities. Flaking paint, decades of leaded gasoline use, mining operations, smelter and industrial emissions, waste incineration and application of pesticides all contribute to the elevated releases of lead into the environment. Once lead gets into the atmosphere, it may travel long distances if the lead particles are very small. It is removed from the air by rain and by particles falling to land or surface water [18]. Once lead falls onto soil, it sticks strongly to soil particles and remains in the upper layer of soil. This is one of the reasons that past uses of lead are so important in the amount of lead found in soil today.

Health Effects of Lead

The health effects of lead are the same whether it enters the body through breathing or swallowing. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults to lead at work has resulted in decreased performance in some tests that measure functions of the nervous system. Lead may also cause weakness in fingers, wrists or ankles, and anemia. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older individuals. At high levels of exposure, lead can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production [18].

As mentioned, a potential exposure pathway exists in the past, present and future for adults, children and workers via ingestion of and / or inhalation of leaded soil or dust. However, due to significant data variability and scarcity of post-hurricane data, it can be concluded that an indeterminate public health hazard relative to soil lead contamination currently exists for those living in the Orleans and St. Bernard parishes. SEET plans to immediately partner with community groups and other stakeholders to develop interventions in areas where high soil lead levels were detected. Additionally, SEET will work with state and federal partners to evaluate future soil lead data when it becomes available and present the findings to the community.

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to lead. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child’s lower body weight and higher intake rate results in a greater dose of lead per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus, adults need as much information as possible to make informed decisions regarding their children’s health.

Children are more vulnerable to lead poisoning than adults. Children can be exposed to lead in the womb if their mothers have lead in their bodies, and babies can swallow lead when they breast feed, or eat other foods, or drink water that contains lead. Exposure in the womb, in infancy, or in early childhood may slow mental development and cause lower intelligence later in childhood. There is evidence that these effects may persist beyond childhood [18].

In some cases, children swallow nonfood items such as paint chips, which may contain very large amounts of lead, particularly in and around older houses containing lead-based paint. The paint in these houses often chips off and mixes with dust and dirt. Some old paint contains as much as 50% lead [18].

Compared with adults, a larger proportion of the amount of lead swallowed will enter the bloodstream in children. Lead affects children in different ways, depending upon the amount of lead swallowed. A child who swallows large amounts of lead may develop anemia, kidney damage, colic, muscle weakness and brain damage, which can ultimately be fatal. If a child swallows or breathes in smaller amounts of lead, such as dust containing lead from paint, much less severe but still important effects on blood, development and behavior may occur [18].

As reported by LDHH, 14% of children in Orleans Parish have elevated blood lead levels, compared with the national average of two percent. Because soil lead is such a strong factor in childhood lead exposure, SEET compared the association between the soil and blood lead levels in the same communities. SEET found that 616 (18%) of pre-hurricane childhood blood lead samples were greater than or equal to 10 ug/dL, with six census tracts associated with soil lead values greater than 400 ppm. However, post-hurricane blood lead samples collected from 32 tracts yielded only two blood lead results greater than 10 ug/dL, and neither was located in a census tract with a median soil lead value greater than 400 ppm. There are obvious degrees of variability in the amount of pre- and post-hurricane soil and blood lead data, of which the data limitations section discusses in greater detail. As a result of historical lead paint usage and its associated environmental contamination, there continues to be a public health hazard for children related to lead exposures in the Orleans and St. Bernard parishes. However, with respect to the data evaluations of current soil lead levels, the health hazard for children living in the Orleans and St. Bernard parishes must be categorized as an indeterminate public health hazard. Future analyses can be conducted as additional soil lead and blood lead data become available. SEET will work with CBLSS to provide targeted outreach to continue education efforts related to soil lead exposures in children. Details of the outreach follow in the public health action plan. Additionally, SEET will work with state and federal partners to evaluate future soil and blood lead data as it becomes available, and provide the findings to the community.

Conclusions

Evaluation of the current soil and blood lead data suggests that there is an indeterminate public health hazard related to lead exposure for those living in the Orleans and St. Bernard parishes. A potential past / present / future exposure pathway exists for adults, children, and workers via ingestion and / or inhalation of soil lead and / or lead-containing dusts. Furthermore, detected soil and blood lead levels appear to be consistent with historic levels reported prior to the hurricanes. Therefore, a public health hazard exists for those residing or working in Orleans and St. Bernard parishes as a result of historically related soil lead levels. The extent of this public health hazard will be determined as additional soil and blood lead samples become available. It can be concluded that the hurricanes did not impact the likelihood of exposure to lead sources in the parishes.

The area contains architecturally distinguished wood homes that were mostly constructed pre-1950 when lead-based paints were commonly used. As further demolition and extensive remodeling continues to take place throughout the parishes, individuals must be educated to utilize lead-safe practices in order to lower their exposure to lead sources in their homes. SEET is committed to providing the education resources to a variety of stakeholders, as well as continued partnership with state and federal agencies to evaluate future soil and blood lead data as it becomes available.

Recommendations

The most important way families can lower their exposure to lead is to know about the sources of lead in their homes and how to avoid exposures to these sources. The Orleans and St. Bernard parishes contain many homes that were constructed before 1978; homes that were likely painted with lead-based paint. This lead may still be on the walls, floors, ceilings, and window sills, or on the outside walls of the house. The paint may have been scraped off by a previous owner, but paint chips and lead-containing dust may still be in the yard soil.

Families from these parishes are faced with new sources of lead exposures: those related to the ongoing demolition and reconstruction of aged housing stock affected during the 2005 hurricane season. There are, however, lead-safe demolition and renovation practices that can be used to prevent/minimize lead exposures. Many cases of lead poisoning have resulted from do-it-yourself home renovations. Therefore, any renovations of pre-1978 constructed homes should be performed by a licensed contractor who will incorporate specific controls to minimize/eliminate lead exposures. The federal government requires that contractors who test for or remove lead must be certified by the EPA or an EPA-approved state program. The National Lead Abatement Council (P.O. Box 535; Olney, MD 20932; telephone 301-924-5490) can provide a list of certified contractors [18]. Some of the controls included in the New Orleans power-sanding ordinance, are: containing the work area, using a wet mist before and during sanding or scraping of paint, using a HEPA vacuum on any power tools to capture lead dust, and cleaning up thoroughly upon completion so that no dust or debris is present in the work area [19].

Since some individuals, in particular those residing in areas where there are high concentrations of historical houses that are blighted, may not be aware of the adverse health effects that have been observed in children with high blood lead levels, there is a need to educate tenants, landlords and homeowners about lead poisoning. There are many ways to raise public awareness regarding the hazards of lead exposure. Several states across the nation conduct various education events in cooperation with corporate partnerships. One example includes home improvement stores that display warnings of the dangers of lead paint and information regarding licensed lead-removal contractors in their area. Other efforts have included a community wide collaboration to visit schools, daycare centers, churches, private businesses such as contractors and apartment complexes to provide information about healthy homes and lead safety [20].

In coordination with ATSDR, CDC, NOHD and CBLSS, SEET recommends the following steps that individuals can take to limit potential exposure to lead in the home and in the surrounding soil of their neighborhoods [21].

In the home:

- Keep children away from peeling paint inside the home.
- When cleaning up around homes in affected neighborhoods, shower and change clothes after finishing work and before playing with your children.
- Place washable doormats or rugs at all entries of your home. Have everyone wipe their feet or leave their shoes at the door to ensure lead-containing dust will not be tracked into the house.
- Wash doormats, rugs, cleaning rags, and work clothes separately from other family laundry.
- Frequently wash a child's hands, especially after playing outside, before they eat, and at bedtime.
- Do not let children put dirty hands, toys or other items that might have dust on them in their mouths.
- When cleaning the home, wet-mop floors and damp-wipe surfaces.

Outside the home:

- Keep children from playing in bare dirt. Cover bare dirt with grass, bushes, or 4-6 inches of lead-free wood chips, mulch, soil or sand.
- Keep young children away from areas, such as old fences or houses, where paint is peeling, chipping, chalking, cracking or damaged.

Public Health Action Plan

The following public health action plan describes the actions to be taken by SEET in the Orleans and St. Bernard parishes. The purpose is to ensure that this health consultation not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. The public health actions which will be implemented by ATSDR/SEET are as follows:

Actions Planned

1. SEET will contact neighborhood and other community based organizations to obtain their input regarding developing an audience appropriate educational plan and to provide them with information on lead poisoning.
2. SEET will use information collected from the communities to deliver audience appropriate lead safety messages to residents either through the development of publications such as fact sheets and brochures, interactive presentations, public

availability sessions or other communication methods that are recommended by the communities and their stakeholders.

3. SEET will work with the LDHH Lead Prevention Program (surveillance program funded by CDC) to increase awareness of the dangers of lead exposure.

4. SEET will continue to develop and expand its adult blood lead surveillance activities, tracking lab results and adult lead poisoning as a reportable disease in Louisiana.

5. The information produced within this health consultation will be disseminated by SEET to the community members within Orleans and St. Bernard Parishes.

Actions Taken

1. SEET has attended meetings held by the City of New Orleans to discuss issues about lead safety during the recovery of the Greater New Orleans area.

2. SEET has designed a poster presentation which was presented at the 2006 National Environmental Public Health Association conference to communicate the pre- and post-hurricane status of soil and blood lead levels in the GNO area.

3. In 2006, SEET submitted a rule change to make adult lead poisoning reportable by all healthcare providers. In addition, laboratories are required to report all lead results to OPH. Over the last year, SEET has established electronic laboratory reporting for adult blood lead data from 10 reference laboratories. SEET will begin participating in the CDC/National Institute for Occupational Safety and Health's (NIOSH) Adult Blood Lead Epidemiology and Surveillance (ABLES) program in September of 2007 to track remediation workers in Orleans and St. Bernard Parishes.

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Certification

This document, An Evaluation of Pre- and Post- Hurricanes Soil and Blood Lead Data from Orleans and St. Bernard Parishes, was prepared by the Louisiana Department of Health and Hospitals under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures at the time the health consultation was begun. The editorial review was conducted by the Cooperative Agreement Partner.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Alan Paul for Alan Yarbrough

Alan W. Yarbrough
Cooperative Agreement Team Leader, DHAC, ATSDR

Appendix

TABLE 1. PRE HURRICANES KATRINA AND RITA SOIL LEAD VALUES (1998 – 2000), STRATIFIED BY THE 1990 U.S. CENSUS TRACTS FOR ORLEANS AND ST. BERNARD PARISHES (N = 184)
DATA SOURCE: DR. HOWARD MIELKE, XAVIER UNIVERSITY OF NEW ORLEANS, LOUISIANA

Census Tract	Soil Lead Range (mg/kg)	Soil Lead Median (mg/kg)	Sample Size
1	191.3 - 27140.0	704	19
2	114.4 - 4822.0	533	19
3	21.8 - 4610.0	291.5	19
4	112.7 - 686.0	198.2	19
6.01	9.8 - 279.2	37	19
6.02	9.7 - 7633.0	94	19
6.03	6.6 - 134.9	35.9	19
6.04	5.6 - 915.0	61.3	19
6.05	23.6 - 1918.0	77	19
6.06	10.8 - 267.6	67.8	19
6.07	13.6 - 289.1	82.5	19
6.08	6.4 - 306.1	45	19
6.11	10.4 - 202.5	40.3	19
6.12	4.6 - 136.4	15.4	19
6.13	4.7 - 598.0	35.8	19
6.14	6.7 - 516	14.5	19
7.01	34.9 - 2211	120.3	19
7.02	31.7 - 2966	197.3	19
8	12.9 - 12593.0	158.5	19
9.01	21.4 - 1155	98.8	19
9.02	14.3 - 6995.0	171.6	19
9.03	7.9 - 1198.0	133.2	19
9.04	36.4 - 2224.0	81.7	19
11	42.3 - 14562.0	451.3	19
12	222.9 - 11433.0	1789	19
13.01	86.1 - 7238.0	489.5	19
13.02	5.5 - 863.0	205.2	19
13.03	89.2 - 12222.0	526	19
13.04	153.6 - 2846	667	19
14.01	21.2 - 6126.0	244.9	19
14.02	93.4 - 2377.0	269.6	19
15	14.5 - 9812.0	503	19
16	20.1 - 727	83.7	19
17.01	28.5 - 443.7	76.5	19
17.02	7.4 - 277.9	98.5	19
17.03	23.1 - 742	196.6	19
17.06	8.6 - 923.0	73.5	19
17.21	2.5 - 215.1	31.4	19
17.22	8.6 - 1538.0	105.9	19
17.23	11.8 - 283.6	97.6	19
17.24	2.5 - 404.4	33.9	19
17.25	8.9 - 244.3	44.8	19
17.26	4.9 - 120.3	41	19

Table 1 continued			
Census Tract	**Soil Lead Range (mg/kg)**	**Soil Lead Median (mg/kg)**	**Sample Size**
17.27	6.0 - 63.1	18	19
17.28	11.1 - 405.6	56.5	19
17.32	4.0 - 117.4	14.5	19
17.98	32.3 - 172.2	82.8	19
18	52.4 - 7955.0	930	19
19	40.5 - 6610.2	1049.9	19
20	16.5 - 16814.7	494.9	19
21	2.5 - 3422.4	380.7	19
22	4.9 - 5434.1	293.5	19
23	23.1 - 2416.9	194.5	19
24.01	16.5 - 16814.7	494.9	19
24.02	66.6 - 2529.4	330.2	19
25.01	21.8 - 603.2	45.6	19
25.02	37.9 - 6681.4	242	19
25.03	10.0 - 2532.3	115.9	19
25.04	16.1 - 329.2	72	19
26	206.4 - 16107.0	1126	19
27	67.5 - 4297.6	1134.1	19
28	2.5 - 1292	528	19
29	79.5 - 1996.7	605.2	19
30	11.3 - 1485.9	400.4	19
31	25.4 - 7767.7	612	19
33.01	2.5 - 1055.1	20.6	19
33.02	3.2 - 270.6	25.1	19
33.03	18.7 - 426.8	122.3	19
33.04	3.4 - 10183.6	87.4	19
33.05	18.3 - 529.9	138.6	19
33.06	4.5 - 1535.8	281.2	19
33.07	19.5 - 1774.1	132	19
33.08	44.0 - 6259.1	170.8	19
35	26.5 - 6977.2	603	19
36	31.2 - 6862.0	507.5	19
37.01	2.9 - 6117.3	265.2	19
37.02	174.6 - 13199.5	540.6	19
38	31.1 - 45071.0	485.9	19
39	55.6 - 4637.7	613.5	19
40	76.6 - 12385.1	1134.8	19
41	57.3 - 3926.1	667.5	19
42	15.1 - 20209.6	214	19
44.01	3.2 - 1002.8	794.6	19
44.02	31.4 - 7703.2	179.9	19
45	17.1 - 2545	608.3	19
47	5.9 - 768	108.3	19
48	15.8 - 295.9	182.4	19
49	17.9 - 916	1164	19
50	11.2 - 52798	389.9	19
54	4.4 - 2039.2	301.5	19
55	5.5 - 454.8	138.5	19
56.01	3.1 - 546.9	42.2	19

Table 1 continued

Census Tract	Soil Lead Range (mg/kg)	Soil Lead Median (mg/kg)	Sample Size
56.02	9.4 - 394.7	40.1	19
56.03	10.7 - 725.8	60	19
56.04	9.8 - 917	73.4	19
57	3.7 - 182.4	34.6	19
58	35.4 - 14042	164.3	19
59	9.6 - 8204	203	19
60	8.2 - 4670.6	1182	19
63	2.5 - 15922.2	689.2	19
64	16.2 - 7275.5	408.1	19
65	52.2 -13126.7	250.9	19
67	223.4 - 3502	799	19
68	15.1 - 6382	401	19
69	16 - 2052	224	19
70	9.8 - 3996	208.6	19
71	16.5 - 7939.0	588	19
72	21.9 - 1242	293.7	19
75.01	30.3 - 3448	273.4	19
75.02	21 - 6084	200.5	19
76.03	2.5 - 694	44.5	19
76.04	5.0 - 308.4	52.3	19
76.05	14.3 - 1632	230.5	19
77	2.5 - 9249	577.5	19
78	162.7 - 10300.0	656	19
79	242.1 - 48894.0	987	19
80	13.5 - 6584.0	758	19
81.01	116.2 - 474.2	285.2	19
81.02	84.5 - 3058.0	573	19
82	88.3 - 10285.0	941	19
83	117.3 - 3957.0	1055	19
84	10.7 - 28910.0	882	19
85	19.9 - 5139.0	606	19
86	136.2 - 12648.0	809	19
87	23.1 - 4002.0	849	19
88	31.1 - 6175.0	968	19
89	38.5 - 9933.0	477.9	19
90	27.1 - 14271.0	661	19
91	140.8 - 2313.7	1013.7	19
92	88.7 - 8980.0	771.4	19
93.01	170.7 - 15679.0	1561.5	19
93.02	18.4-411.4	123.8	19
94	32.7 - 4107.0	390.7	19
96	132.5-5333.0	564	19
97	14.8-4570.0	394.8	19
99	13.3-6566.0	559	19
100	42.7-12075.0	515	19
101	148.4-3175.0	505	19
102	66.1-12058.0	404.6	19
103	27.8-7511.0	278.1	19
104	9.0-4126.0	47.7	19

Table 1 continued			
Census Tract	**Soil Lead Range (mg/kg)**	**Soil Lead Median (mg/kg)**	**Sample Size**
105	76.7-19671.0	597	19
106	29.4-5830.0	450.8	19
107	37.6-3437.0	491	19
108	97.2-22684.0	471.1	19
109	35.4-11658.0	521	19
111	54.0-8893.8	383.1	19
112	41.0-5869.3	274.4	19
114	50.3-10966.0	458.9	19
115	242.9-2479.0	765	19
116	188.1-2207.0	419.2	19
117	182.3-1414.0	465.1	19
119	18.9-3707.7	568.8	18
120	33.6-11253.0	285.9	19
121.01	129.9-12999.0	796	19
121.02	240.8-10342.0	661	19
122	25.3-2537.0	544	19
123	77.7-3125.3	295.3	19
124	62.8-5771.0	333.8	19
125	52.6-2266.0	312.1	19
126	8.6-1969.0	559	19
127	146.2-5431.0	431.4	19
128	135.0-13772.0	356.2	19
129	83.6-5205.0	213.7	19
130	169.9-7564.0	715	19
131	70.1-3551.0	450.8	19
132	266.3-10896.0	469.5	19
133.01	5.9-293.4	84.7	19
133.02	16.5-336.1	49.3	19

TABLE 2. POST HURRICANES KATRINA AND RITA SOIL LEAD VALUES (APRIL 2006 – JUNE 2006), STRATIFIED BY THE 1990 U.S. CENSUS TRACTS IN ORLEANS AND ST. BERNARD PARISHES (N = 37)
DATA SOURCE: DR. HOWARD MIELKE, XAVIER UNIVERSITY OF NEW ORLEANS, LOUISIANA

Census Tract	Soil Lead Range (mg/kg)	Soil Lead Median (mg/kg)	Sample Size
1	56.9-1473.0	307	19
6.01	25.5-455.3	51	19
6.02	13.0-485.2	79	19
7.01	28.0-557	77	19
7.02	17.2-1088	224	19
9.02	19.4-252.4	88	19
12	43.4-7332.0	513	19
13.02	63.9-2214.0	363	19
16	8.8-89.7	35	19
17.21	8.2-218.9	27	19
17.25	13.6-121.4	50	19
17.98	6.2-40.3	19	19
19	23.5-2566.0	647	19
25.02	34.4-387.6	84	19
33.02	10.5-288.9	37	19
37.02	158.7-4638.0	387	19
40	113.2-1399.0	506	19
44.01	16.2-3332.0	345	19
44.02	20.4-324.8	98	19
48	5.3-1369.0	85	19
56.01	22.4-287.3	59	19
59	25.5-1337.0	257	19
64	140.8-5734.0	646	19
68	111.2-1946.0	388	19
69	15.4-1174.0	160	19
80	55.4-3954.0	444	19
81.01	20.0-980.0	60	19
81.02	11.7-776.0	231	19
88	5.9-2412.0	372	19
89	43.0-2140.0	224	19
93.02	31.7-831.0	228	19
94	40.5-6823.0	368	19
103	98.8-3080.0	409	19
108	28.2-1227.0	314	19
115	52.0-1098.0	329	19
126	47.2-993.0	315	19
306.02	26.3 – 993.0	79	19

TABLE 3. EPA POST HURRICANES KATRINA AND RITA SOIL LEAD VALUES (AUGUST 2005 – DECEMBER 2006), WITHIN MIELKE TRACTS, STRATIFIED BY THE 1990 U.S. CENSUS TRACTS IN ORLEANS AND ST. BERNARD PARISHES (N = 23)

DATA SOURCE: UNITED STATES ENVIRONMENTAL PROTECTION AGENCY AND DR. HOWARD MIELKE, XAVIER UNIVERSITY OF NEW ORLEANS, LOUISIANA

Census Tract	Soil Lead Range (mg/kg)	Soil Lead Median (mg/kg)	Sample Size
7.01	18.5 – 91.2	33.85	44
7.02	55.5 - 938	177.5	18
9.02	20.4 - 396	34.4	65
13.02	109 - 163	136	2
16	22.7 – 45.9	23.35	4
17.21	7026 - 186	35.5	33
17.25	1.91 - 95	22.2	19
17.98	13.1 – 35.1	21.6	53
19	53.4 - 339	196.2	2
25.02	46.1 - 575	122	18
33.02	2.76 – 86.8	13.38	4
37.02	4.69 - 923	261	19
40	294 - 597	490	7
44.01	66.9*		1
56.01	52.3*		1
59	28.2*		1
64	9.95 - 316	49.8	14
68	225*		1
69	103*		1
94	5.46 – 1180	424	29
103	103– 162	132.5	2
126	113*		1
306.02	38.6 – 113	70.8	33

* denotes one sample

TABLE 4. PRE HURRICANES KATRINA AND RITA BLOOD LEAD VALUES (JANUARY 2004 – AUGUST 2005), STRATIFIED BY THE 2000 U.S. CENSUS TRACTS IN ORLEANS AND ST. BERNARD PARISHES (N = 3385)

DATA SOURCE: LOUISIANA CHILDHOOD BLOOD LEAD SURVEILLANCE OF THE LOUISIANA DEPARTMENT OF HEALTH AND HOSPITALS / OFFICE OF PUBLIC HEALTH

Census Tract	Blood Lead Range (ug/dL)	Blood Lead Median (ug/dL)	Sample Size
1	1.0 - 11.0	8	7
2	1.8 - 44.5	9	17
3	2.0 - 10.6	4.1	20
4	0.9 - 13.5	5.9	28
6.01	0 - 25.1	4	27
6.02	0.9 - 11.2	4	28
6.03	0 - 13.4	3.15	36
6.04	0 - 21.1	3.6	49
6.05	1.0 - 15.0	5.4	5
6.06	2 - 5.2	3	8
6.07	0 - 4.8	2.4	7
6.08	1.0 - 17	3	33
6.11	0.9 - 17.6	2.95	46
6.12	3.0 - 4.0	3	3
6.13	0 - 21.8	4.1	40
6.14	0 - 14.3	3.8	21
7.01	1.2 - 10	4.2	28
7.02	2 - 22.2	6.7	26
8	0.5 - 12.9	5.4	20
9.01	2 - 7.4	3.9	14
9.02	1.0 - 9.0	4.5	12
9.03	1.0 - 9.0	3	15
9.04	3 - 29.2	6.3	24
11	3.0 - 4.0	3	3
12	3 - 18.9	13.5	10
13.01	0 - 20	4	56
13.02	3 - 15.6	6.5	16
13.03	1.3 - 9	5.5	10
13.04	5 - 21.1	14.5	8
14.01	0 - 27.9	4.8	50
14.02	1.1 - 13.3	5	30
15	0 - 28.1	10.8	42
16	0.7 - 10.9	3.4	23
17.01	1.0 - 4	2.5	4
17.02	1 - 9.2	3	37
17.03	0 - 21.2	4	64
17.20	1.0 - 10	3	66
17.22	1.0 - 14	4	59
17.23	0.9 - 8.9	3.9	32
17.24	0 - 9.9	3.5	30
17.25	0 - 17	3	63
17.26	3.5 - 5	4	3
17.28	1.0 - 26	3	65

Table 4 continued

Census Tract	Blood Lead Range (ug/dL)	Blood Lead Median (ug/dL)	Sample Size
17.32	0.9 - 16	3	45
17.35	1.8 - 4	3.5	8
17.36	1.9 - 6.3	2.8	10
17.37	0.9 - 6	3.5	8
17.38	1.5 - 10	4	21
17.39	2.8 - 8.6	3	9
17.40	1.9 - 4	3	4
18	3.0 - 9	3.8	3
19	2 - 46.5	7.4	57
20	1.6 - 26.7	7	47
21	1 - 32.5	6.3	22
22	2 - 21.1	5.4	26
23	0.9 - 16.9	5	38
24.01	2.7 - 7.5	4.8	70
24.02	1 - 18.2	4	31
25.01	3 - 6.1	4	13
25.02	2.0 - 7	4	21
25.03	1.1 - 8.3	4.7	11
25.04	3.6 - 14.2	6	7
26	5.9 - 14.1	6.5	3
27	0 - 25.9	5.3	37
28	1 - 13.1	5.8	24
29	0 - 19.9	6.1	56
30	0 - 13.4	5	24
31	1.5 -15.1	5	20
33.01	3.0 - 5	4	4
33.02	0.9 - 21.9	4	31
33.03	1 - 7.3	3.7	3
33.04	0 - 9.9	3.8	25
33.05	2 - 8.6	4	18
33.06	0 - 25.2	5.1	135
33.07	1 - 8.7	5	17
33.08	2 - 13.4	7	20
34	0 - 32.6	8	41
35	1 - 5.8	5.8	7
36	2 - 18.3	7.2	25
37.01	1 - 14.7	6	14
37.02	2 - 22.9	7	35
39	2.7 - 14	6	11
40	2.1 - 34	7	32
41	3.0 - 24	6.7	7
42	6*		1
44.01	2 - 22.8	6.7	23
44.02	1.1 - 22.9	5.5	51
45	1.8 - 32.1	7	43
46	1.9*		1
48	2 - 14.9	5	33
49	2.1 - 29.7	8	23
50	2.0 - 22	7	11

Table 4 continued			
Census Tract	**Blood Lead Range (ug/dL)**	**Blood Lead Median (ug/dL)**	**Sample Size**
54	2 - 18.1	7	7
55	1.7 - 23	5.7	6
56.01	4 - 6.3	5.3	3
56.02	0.9 -3.7	3.4	3
56.03	3.0 - 4	3.5	2
56.04	2 - 2.2	2.1	2
58	6.5*		1
59	3 - 13.5	9.4	3
60	1.3 - 13	5.9	6
63	4.6 - 22	9	15
64	2 - 24.5	5.8	30
65	0.9 - 19	6.5	12
68	(-0.2) - 15.9	3.9	16
69	0.9 - 29	5	90
70	3 - 22.2	5.2	10
71	3 - 18.4	8.4	8
72	0.6 - 25.7	6	43
75.01	1 - 16.3	5	24
75.02	0.9 - 17.6	5.1	43
76.03	0.9 - 3	2	4
7605	1 - 19.4	7.1	25
77	0 - 15.8	4.7	13
78	3 - 11.2	8	7
79	6.0 - 20	9.9	8
80	3 - 19.7	4	8
81.01	2 - 35.4	6	11
81.02	10.6 - 18.3	12.6	7
82	3.0 - 13	6	8
83	3 - 27.2	9.4	13
84	0 - 25.3	7.8	14
85	2 - 39.7	6.6	66
86	2.9 - 18	7	28
87	2.3 - 26	9.2	15
88	2.4 - 27.9	10.1	28
89	3 - 27.8	8.6	27
91	2.6 - 25.8	7	21
92	2 - 25.8	7.2	20
93.01	3 - 13.1	4.9	12
93.02	3.7 - 14.4	8.2	15
94	(-1.0) - 24.6	6.2	18
96	0 - 35.8	6.5	18
97	4.0 - 29	8	15
99	7 - 21.6	17.4	3
100	0 - 17.6	7	26
101	2 - 9.4	6.7	9
102	2.3 - 19.5	6.4	35
103	0.9 - 34	6	42
105	4 - 10.1	6	9
106	1.1 - 14.3	6	14

Table 4 continued

Census Tract	Blood Lead Range (ug/dL)	Blood Lead Median (ug/dL)	Sample Size
107	4.0 - 15	5.8	4
108	5*		1
109	3 - 26.2	4.9	8
111	3.0 - 23	8.1	18
112	3 - 8.4	4	5
116	3*		1
120	1.1	1.1	1
121.01	0 - 6.3	4.3	9
123	2.7 - 32.9	6	11
124	3 - 42.3	7.5	16
125	5.5 - 9	7.3	2
126	5.0 - 5.0	5	2
127	3.0 - 21	6.4	16
128	2.9 - 9.3	7	5
129	3 - 26.4	9.5	8
130	0 - 13.1	4.5	19
131	0.9 - 25.5	7	43
132	0.9 - 29.5	7.3	39
133.01	6*		1
133.02	5*		1
306.03	1*		1

* denotes one sample

TABLE 5. POST HURRICANES KATRINA AND RITA BLOOD LEAD VALUES (SEPTEMBER 2005 – DECEMBER 2005), STRATIFIED BY THE 2000 U.S. CENSUS TRACTS IN ORLEANS AND ST. BERNARD PARISHES (N = 32)

DATA SOURCE: LOUISIANA CHILDHOOD BLOOD LEAD SURVEILLANCE OF THE LOUISIANA DEPARTMENT OF HEALTH AND HOSPITALS / OFFICE OF PUBLIC HEALTH

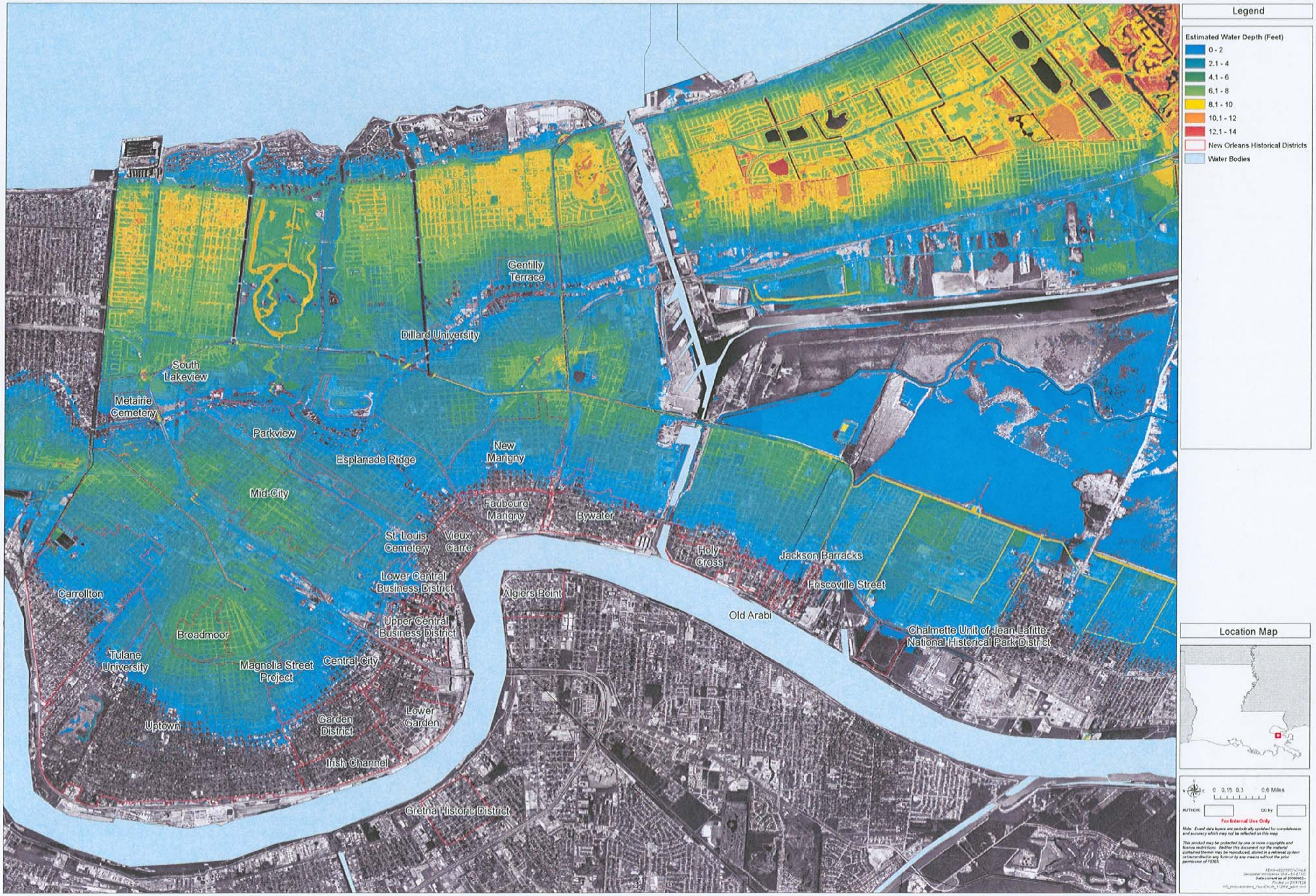
Census Tract	Blood Lead Range (ug/dL)	Blood Lead Median (ug/dL)	Sample Size
1	3*		1
2	5*		1
3	4*		1
4	3.7 – 4.0	3.85	2
6.02	3.0 – 3.0	3	2
6.03	4.0 – 4.0	4	2
6.04	3.0 – 3.0	3	2
6.05	6*		1
6.06	5.3*		1
6.08	3.0 – 5.0	4	2
6.11	3.0 – 11.0	3	4
6.14	3.0 – 4.0	3	3
7.01	3.0 – 3.0	3	2
13.01	5*		1
17.28	3*		1
20	12.7*		1
29	4.7*		1
33.02	2*		1
33.05	2.0 – 3.0	2.5	2
33.07	3*		1
37.02	11*		1
44.01	3*		1
45	4*		1
54	5.7*		1
75.01	8.1*		1
78	7*		1
89	2*		1
92	5*		1
93.01	4.5*		1
100	6.1*		1
111	3.0 – 5.6	4.1	3
132	3*		1

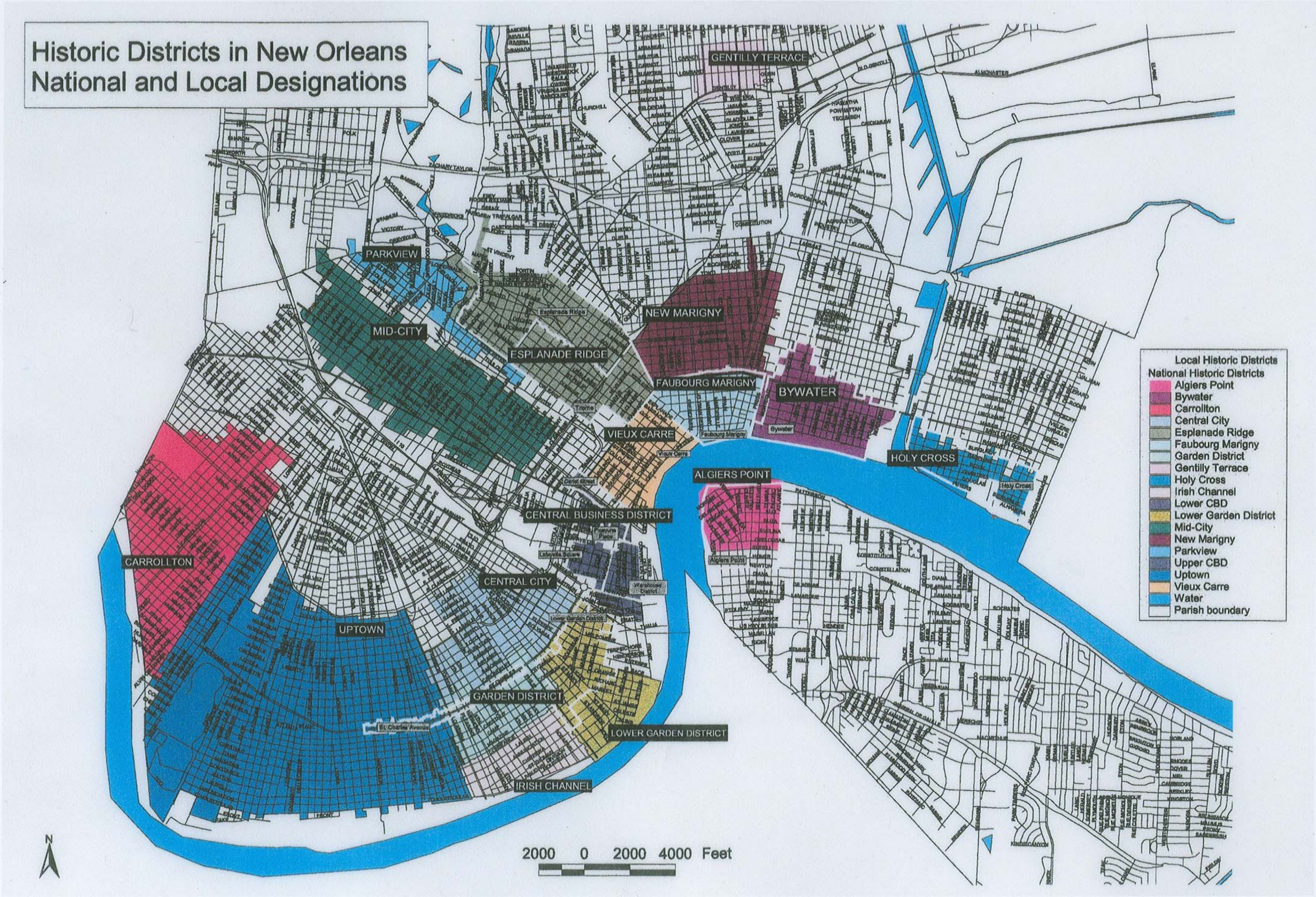
* denotes one sample

Map 1:New Orleans, LA Estimated Water Depth and Historic Districts

Hurricane Katrina, September 2, 2005

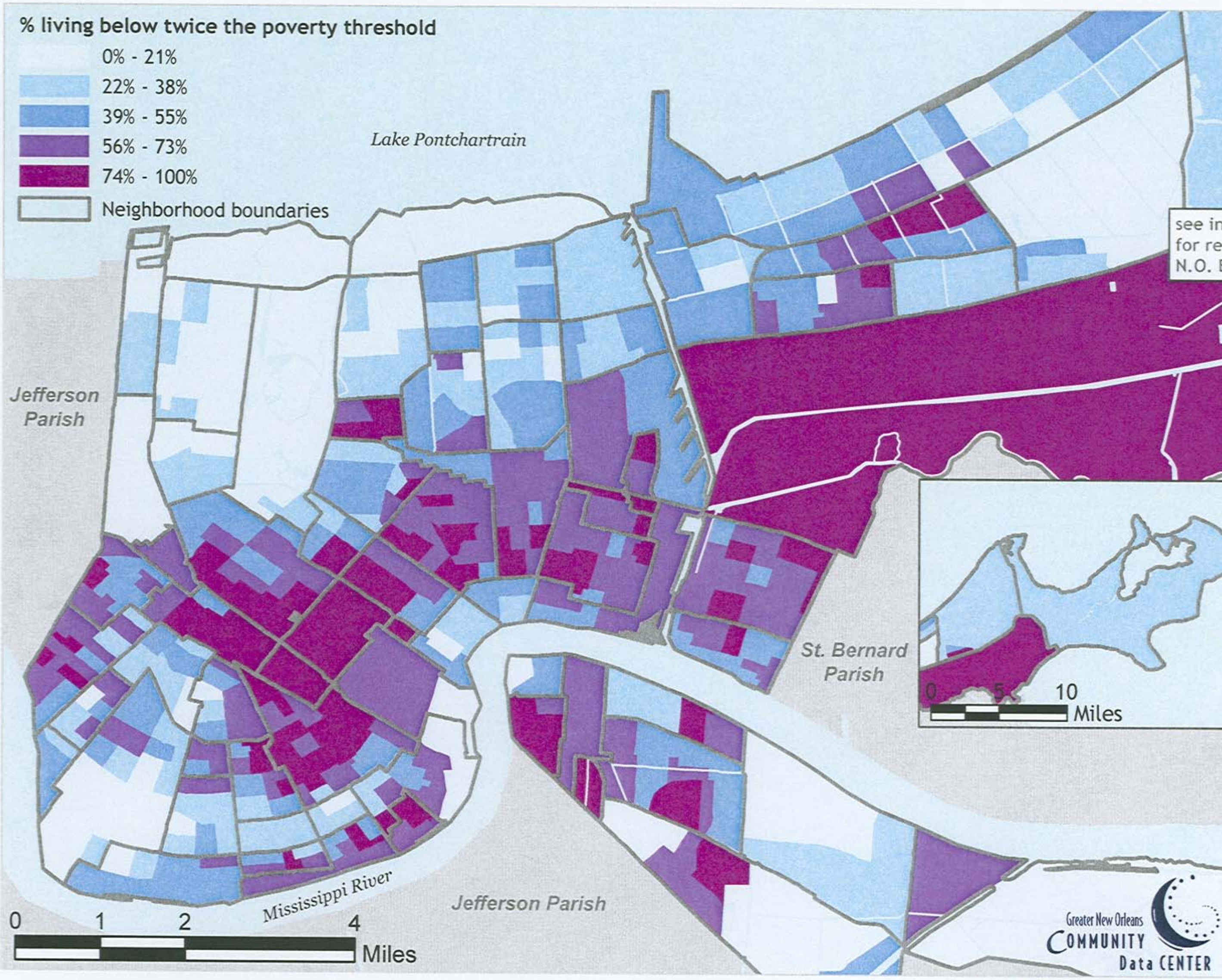
FEMA-1603-DR-LA
FEMA-1607-DR-LA




Historic Districts in New Orleans
National and Local Designations
GENTILLY TERRACE
PARKVIEW
MID-CITY
ESPLANADE RIDGE
NEW MARIGNY
FAUBOURG MARIGNY
BYWATER
VIEUX CARRE
HOLY CROSS
ALGIERS POINT
CENTRAL BUSINESS DISTRICT
CARROLLTON
CENTRAL CITY
UPTOWN
GARDEN DISTRICT
LOWER GARDEN DISTRICT
IRISH CHANNEL
Local Historic Districts
National Historic Districts
Algiers Point
Bywater
Carrollton
Central City
Esplanade Ridge
Faubourg Marigny
Garden District
Gentilly Terrace
Holy Cross
Irish Channel
Lower CBD
Lower Garden District
Mid-City
New Marigny
Parkview
Upper CBD
Uptown
Vieux Carre
Water
Parish boundary
2000 0 2000 4000 Feet
N

Map 2

Map 3: Percent of people living below twice the poverty threshold by Census block group in Orleans Parish



Feb 3, 2004 <www.gnocdc.org>

Data sources: Poverty rates (Census 2000), water & parish boundaries (Census Tiger files), neighborhood boundaries (adapted from City Planning Commission of New Orleans)

Note on poverty: People living below twice the poverty threshold includes all individuals whose family has income that is lower than twice the poverty threshold for that size family. Because poverty thresholds are generally considered to be flawed and have not been appropriately adjusted since they were created in 1964, twice the poverty threshold is commonly used as a rough proxy for a living wage.

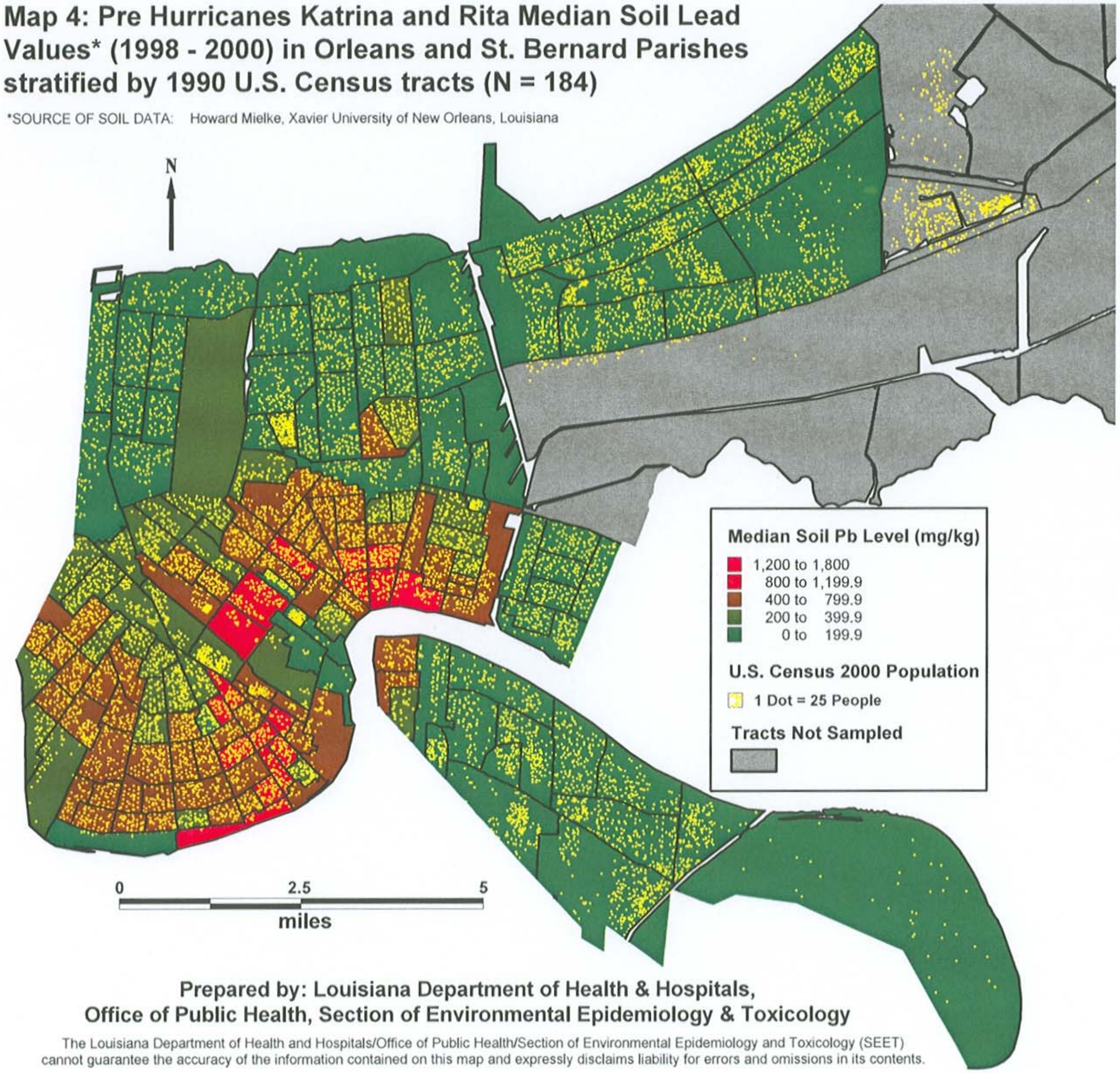
Note on percentage groups: Groupings of percents were selected using the "natural-breaks" method. This statistical method minimizes the within-grouping variation and maximizes the between-grouping variation using an iterative series of calculations.

Note on HANO developments: This poverty data is from 2000 and does not reflect changes in Housing Authority of New Orleans housing developments.

Note on population density: Because parts of New Orleans East are sparsely populated and have larger block groups, percentages may be misleading as they represent only a small number of people.

Map 4: Pre Hurricanes Katrina and Rita Median Soil Lead Values* (1998 - 2000) in Orleans and St. Bernard Parishes stratified by 1990 U.S. Census tracts (N = 184)

*SOURCE OF SOIL DATA: Howard Mielke, Xavier University of New Orleans, Louisiana



Prepared by: Louisiana Department of Health & Hospitals, Office of Public Health, Section of Environmental Epidemiology & Toxicology

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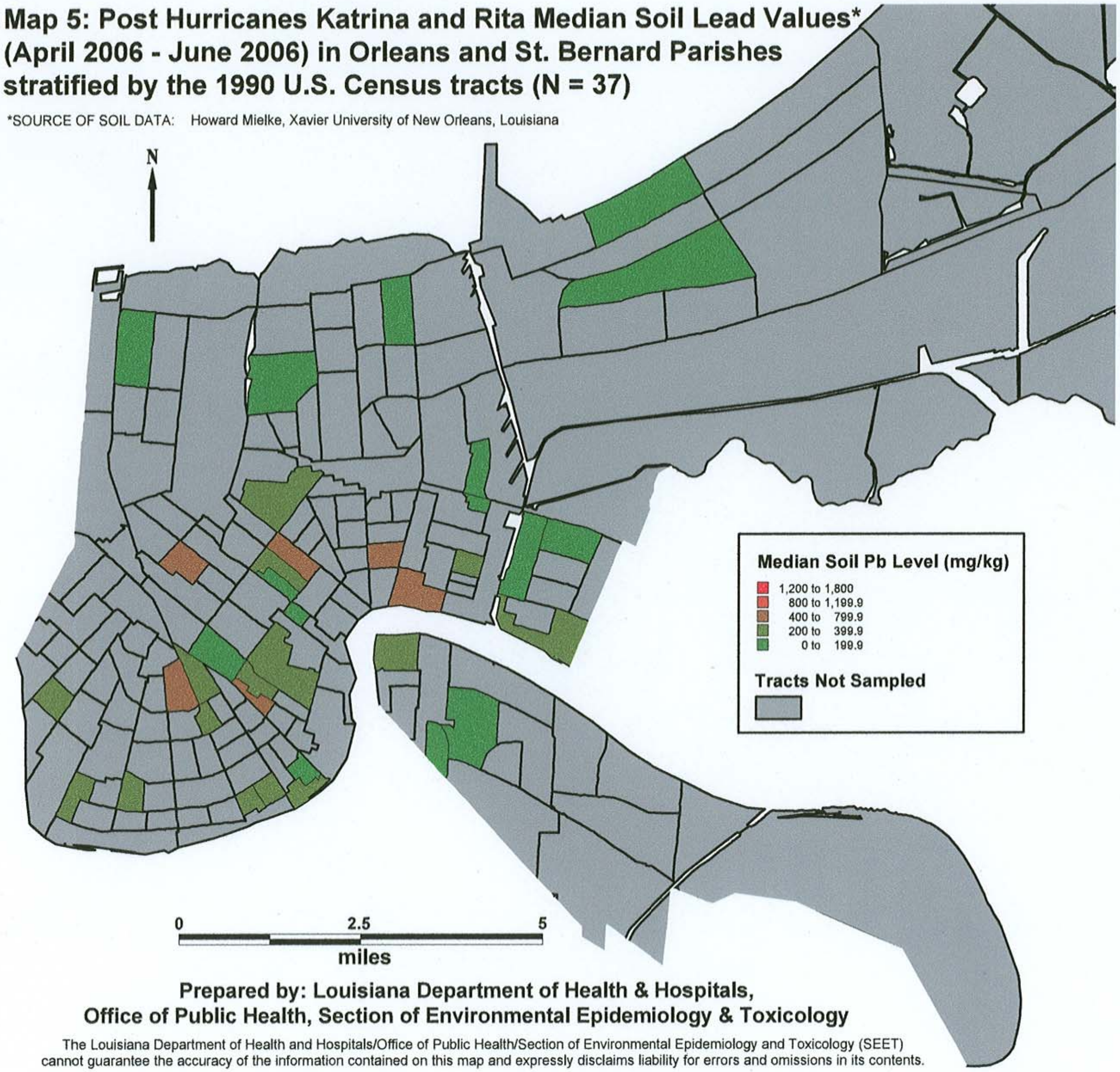
Map 5: Post Hurricanes Katrina and Rita Median Soil Lead Values* (April 2006 - June 2006) in Orleans and St. Bernard Parishes stratified by the 1990 U.S. Census tracts (N = 37)

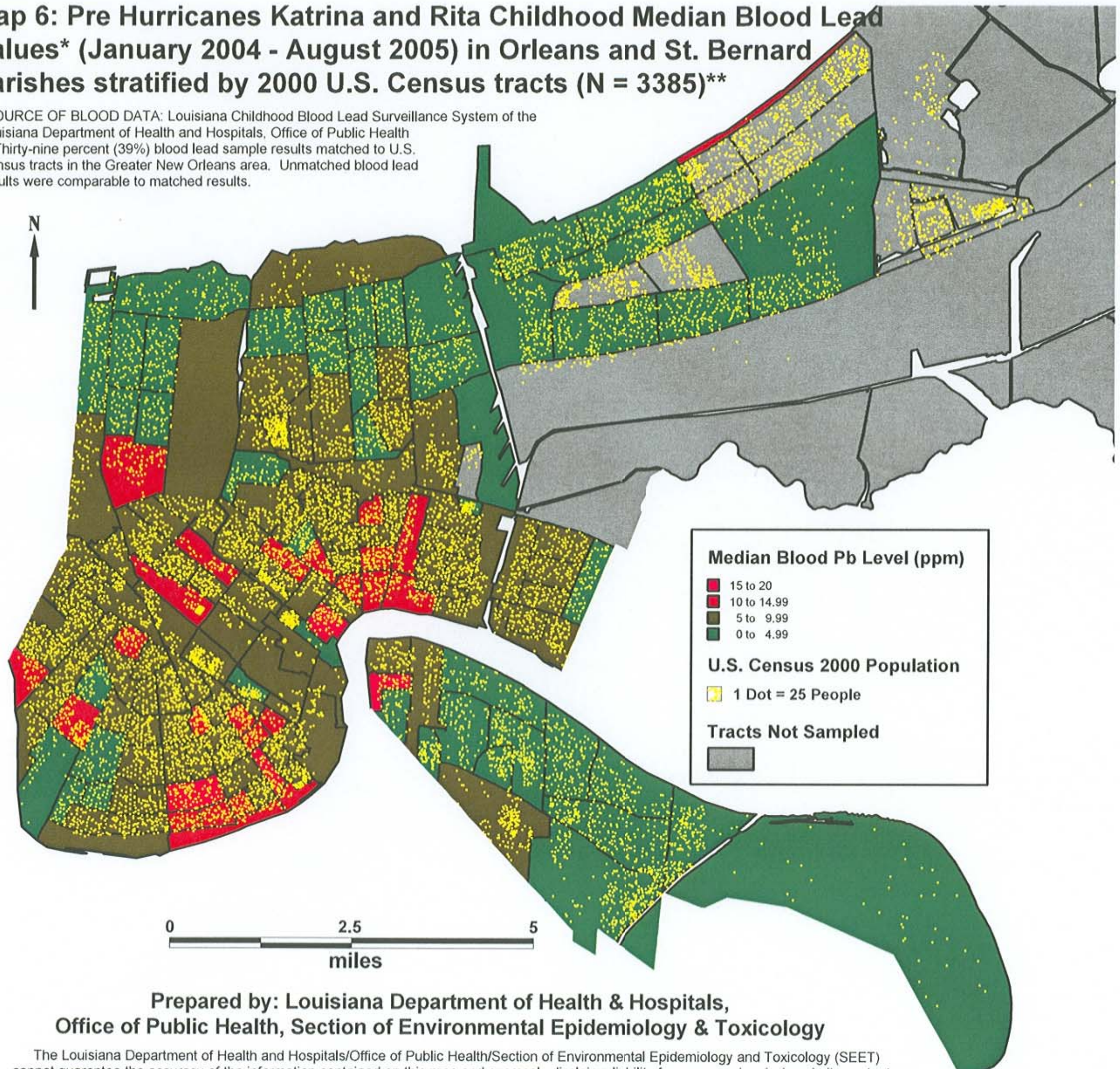
*SOURCE OF SOIL DATA: Howard Mielke, Xavier University of New Orleans, Louisiana



Prepared by: Louisiana Department of Health & Hospitals, Office of Public Health, Section of Environmental Epidemiology & Toxicology

Map 6: Pre Hurricanes Katrina and Rita Childhood Median Blood Lead Values* (January 2004 - August 2005) in Orleans and St. Bernard Parishes stratified by 2000 U.S. Census tracts (N = 3385)**

*SOURCE OF BLOOD DATA: Louisiana Childhood Blood Lead Surveillance System of the Louisiana Department of Health and Hospitals, Office of Public Health
** Thirty-nine percent (39%) blood lead sample results matched to U.S. Census tracts in the Greater New Orleans area. Unmatched blood lead results were comparable to matched results.



Prepared by: Louisiana Department of Health & Hospitals, Office of Public Health, Section of Environmental Epidemiology & Toxicology

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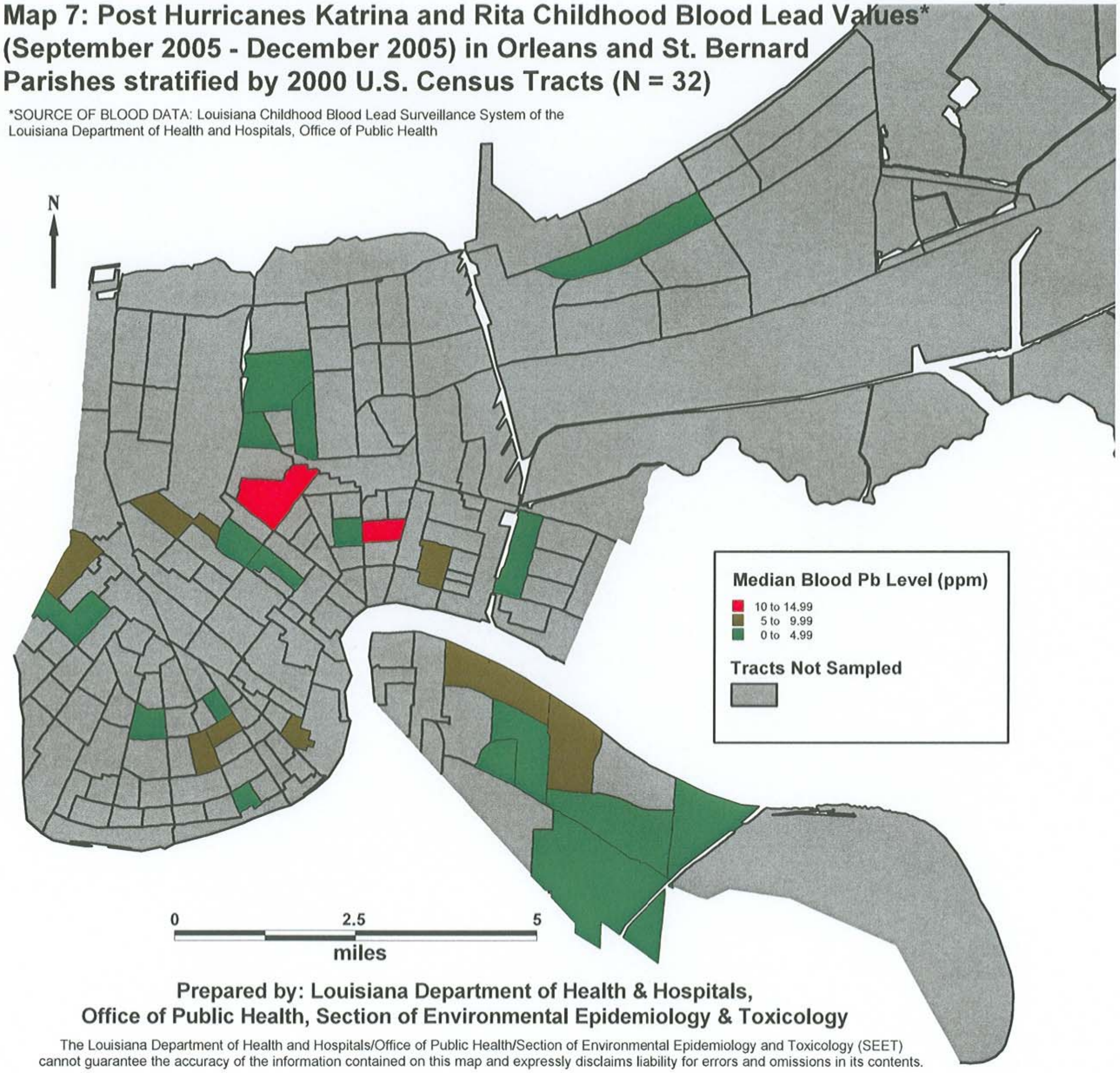
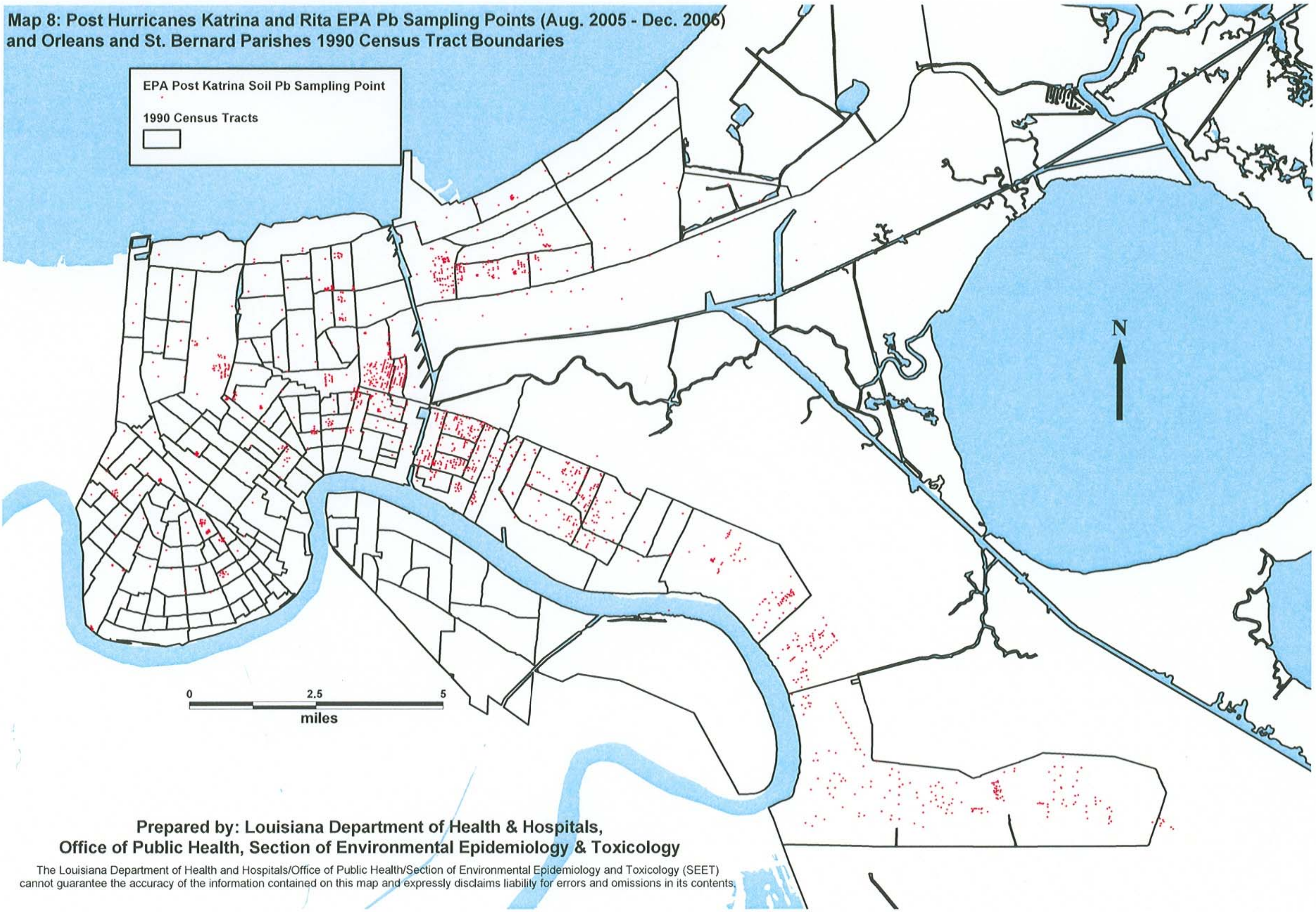
Map 7: Post Hurricanes Katrina and Rita Childhood Blood Lead Values* (September 2005 - December 2005) in Orleans and St. Bernard Parishes stratified by 2000 U.S. Census Tracts (N = 32)

*SOURCE OF BLOOD DATA: Louisiana Childhood Blood Lead Surveillance System of the Louisiana Department of Health and Hospitals, Office of Public Health



Prepared by: Louisiana Department of Health & Hospitals, Office of Public Health, Section of Environmental Epidemiology & Toxicology

Map 8: Post Hurricanes Katrina and Rita EPA Pb Sampling Points (Aug. 2005 - Dec. 2006) and Orleans and St. Bernard Parishes 1990 Census Tract Boundaries



Prepared by: Louisiana Department of Health & Hospitals,
Office of Public Health, Section of Environmental Epidemiology & Toxicology