

Health Consultation

Public Health Implications from Attending or Working
at Herculaneum Schools

HERCULANEUM LEAD SMELTER SITE

HERCULANEUM, JEFFERSON COUNTY, MISSOURI

EPA FACILITY ID: MOD006266373

JUNE 4, 2002

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR

or

Visit our Home Page at: <http://www.atsdr.cdc.gov>

Health Consultation

Public Health Implications From Attending or Working at Herculaneum Schools

Herculaneum Lead Smelter Site

Herculaneum, Jefferson County, Missouri

EPA Facility ID: MOD006266373

Prepared by

Missouri Department of Health and Senior Services
Section for Environmental Public Health
under cooperative agreement with the
Agency for Toxic Substances and Disease Registry

Statement of Issues and Background

Statement of Issues

The Missouri Department of Health and Senior Services (DHSS) and the Agency for Toxic Substances and Disease Registry (ATSDR) were asked by Herculaneum community members if the schools in Herculaneum, Missouri, were safe for students, faculty, and staff. This question was asked in response to community-wide lead contamination.

Background

The Herculaneum lead smelter is an active facility that has been in operation in this community since 1892. The Doe Run Company currently owns and operates the smelter. The facility is located at 881 Main Street in Herculaneum, Missouri, approximately 25 miles south of St. Louis, Missouri, on the Mississippi River. A lead ore concentrate, consisting of approximately 80% lead sulfide, is processed at the smelter. The ore is transported by truck from eight lead mines operated by the company near Viburnum, Missouri, approximately 75 miles south-southwest of Herculaneum. The 52-acre Herculaneum facility consists of a smelter plant, 24-acre waste slag storage pile, and an onsite sulfuric acid plant (1). Figures 1 and 2 display the location of the smelter and schools in the community (2).

Environmental sampling has shown lead contamination throughout the community and high prevalence rates of elevated blood lead levels in children less than 72 months of age (3).

Children living in Herculaneum are part of the Dunklin R-5 School District (District). This district consists of three schools in Herculaneum and one in nearby Pevely, Missouri. Schools in Herculaneum include: Roy E. Taylor Elementary School (4th and 5th grades), located at 400 Joachim Avenue, Herculaneum High School (9th - 12th grades), located at 500 Joachim Avenue, and Senn-Thomas Middle School (6th - 8th grades), located at 204 Main Street. The elementary and high schools are approximately 0.5 mile north-northwest of the stack at the Doe Run plant, the middle school is approximately one mile north-northwest of the stack. Finally, Pevely Primary School (kindergarten - 3rd grades) is located at 300 County Road in Pevely, Missouri, which is approximately two miles northwest of the stack.

Given the community-wide lead contamination, members of the community have been concerned about exposure to students, faculty, and staff at the schools in the district. Because of the proximity of the Doe Run Co. to the school buildings in Herculaneum, the District had a limited study performed in October 2001 to evaluate possible exposure to lead dust at the four district schools. The results of this limited sampling are summarized as follows:

- In all schools except the middle school, some of the interior and exterior painted surfaces were determined to have lead-based paint (none of the tested surfaces at the middle school were found to have lead-based paint);
- Lead was found in dust wipes taken from a variety of areas in all four schools. These wipes were analyzed for lead loading (i.e., amount of lead per unit of area) and not for lead concentration (weight of lead in dust per unit of total dust weight); and,
- Lead was found in surface soil samples (0.25 inch - 0.5 inch deep) at all the schools.
 - At the elementary school, soil lead levels in play areas ranged from 76.6 parts per million (ppm) to 1,011.4 ppm (one other sample was reported as having 3,584.5 ppm, but was qualified by the lab as having an insufficient quantity of sample to analyze).
 - Soil samples from the high school were taken from six locations on the football field and a hillside facing the football field. Results ranged from 363.1 ppm - 1,899.6 ppm on the football field and 955.2 on the hillside.
 - DHSS was not able to determine the exact location of soil samples taken from the middle school; however, based on their labels, the soil samples appear to have been taken on and around a baseball field. These soil lead levels ranged from 59.5 ppm - 444.6 ppm.
 - Soil samples taken from play areas at the primary school ranged from not detectable through 163.6 ppm (4).

In December 2001, 15 paint chip samples were collected from the four schools. Results indicate the following:

- Samples from the high school ranged from .00173% through .5536% lead;
- Samples from the elementary school ranged from .0842% through 19.3%. The highest sample from the elementary school was taken from an overhead door jam into a counselor's office;
- Samples from the middle school ranged from .00769% through .0594%; and,
- Samples from the primary school ranged from .0926% through .618% (5).

On the basis of on all this information, the District took the following actions:

- Began wet wiping of all painted surfaces;
- Purchased HEPA vacuums for each school. The vacuums are now routinely used for vacuuming; and
- A sealant was applied to all door jams and other friction surfaces in December 2001 (6).

In October and November of 2001, DHSS staff made eight presentations to District teachers and custodial staff on lead poisoning prevention and Herculaneum site activities. Specifically, the following subjects were covered with the teachers: symptoms and health effects of lead exposure, sources of lead, blood lead testing, ways to reduce exposure and the body's uptake of lead (hand washing/hygiene, good nutrition), site activities, and resources for more information. These same subjects were covered

with the custodial staff. In addition, presentations that reviewed the results of the limited environmental study conducted in October 2001 were made to the custodial staff. The staff was briefed on where lead had been found (and not found), in which environmental media (dust, soil, paint, etc.) and in which schools. General cleaning suggestions and which areas of the buildings need more cleaning attention were reviewed, as well as the need to follow manufacturers' recommendations on changing filters in vacuums and to wet clean areas when dusting/cleaning floors. DHSS also answered questions from the custodial staff regarding health concerns, site activities, and specific cleaning concerns.

The Missouri Department of Natural Resources (MDNR) and the Environmental Protection Agency (EPA) have directed the Doe Run Company to expedite activities to clean up existing contamination and reduce/eliminate future contamination throughout Herculaneum. The company is currently attempting to address this contamination under an Administrative Order on Consent as well as other agreements with MDNR and EPA (7,8,9,10,11,12,13). Through these agreements, activities planned at the schools include the following:

- Soil removal on school property where lead levels are greater than 400 ppm. Contaminated soil will be removed to a depth of one foot and replaced with soil containing the normal background level of lead (50-150 ppm).
- Any soils found at elementary schools with lead levels greater than 10,000 ppm are to be cleaned within six months of the effective date of the EPA order.
- Soils at schools with lead levels of 2,500 ppm - 10,000 ppm are to be cleaned within 12 months of the effective date of the EPA order (school properties were divided into sections and randomly collected aliquots [sample portions] were combined into one composite sample from each section; for any section where the level of lead in the composite sample is greater than 400 ppm, the entire section will be replaced with clean soil) (14).

In February 2002, the District requested the Jefferson County Health Department (JCHD) provide blood lead testing for the students and staff of the District. From February 27, 2002 through March 5, 2002, JCHD collected 806 samples from students and adults at the schools (286 from the high school, 216 from the middle school, and 304 from the primary and elementary schools combined). In addition, 12 individuals associated with the school district were subsequently tested at the JCHD offices, bringing the total number of individuals tested to 818. The testing was voluntary. The testing was open to all students and adults at the schools (no particular age group was targeted for testing). No students < 72 months of age volunteered for testing. Results are presented in Table 1 (15). DHSS's review of this data found that levels in adults ranged from <5 to 17 micrograms per deciliter ($\mu\text{g}/\text{dL}$). None of these levels would be considered an elevated adult blood lead level. Three elementary students, one middle school, and one high school student had blood lead levels between 10 and 14 $\mu\text{g}/\text{dL}$. None of these students were less than 72 months of age. Table 2 lists blood lead results by ZIP code of residence (15).

Table 1. Blood lead results of Dunklin R-5 School District screening by blood lead level range, February - March 2002

	Less than 5 µg/dL	5 - 9 µg/dL	10 - 17 µg/dL
Number of individuals	759	52	7

Table 2. Blood lead results of Dunklin R-5 School District screening by residential ZIP code, February - March 2002

ZIP Code	Less than 5 µg/dL	5 - 9 µg/dL	10 - 17 µg/dL	Total
63012, Barnhart	41	1	0	42
63019, Crystal City	14	0	1	15
63020, DeSoto	5	0	0	5
63028, Festus	82	5	0	87
63048, Herculaneum	107	20	3	130
63050, Hillsboro	5	0	1	6
63052, Imperial	5	0	0	5
63070, Pevely	475	26	2	503
other ZIP codes	25	0	0	25
Total	759	52	7	818

Discussion

Pathways of exposure to lead in the schools in Herculaneum are ingestion and inhalation for the past and present, with the potential for similar exposure pathways in the future. Currently, people could become exposed to lead in the schools through ingestion or inhalation of lead particles from lead-based paint or contaminated soil and indoor dust.

Lead-based paint has been found in every District school. In addition, lead has been found on dust wipes in every school; however, it is not possible to accurately assess the impact to public health with dust wipe samples which only give lead loading data (µg lead/ unit area) and not lead in dust concentration data (µg lead/g dust).

Lead has been found in surface soils in recreational areas at the schools. Removal/remedial plans include a provision for removing surface soils where concentrations exceed 400 ppm. Further, it is likely that students and staff would only be exposed to contaminated soils intermittently and for a limited amount of time. Because of these considerations, these soil lead concentrations are not expected to cause significant adverse health effects. Although exposures are not expected to result in health effects, it is advisable to continue prudent practices to reduce exposures (e.g., wash hands after using the school yards and before eating; refrain from eating while sitting on these soils, housekeeping practices at the schools, etc.).

Actions taken at the schools now and in the future will reduce exposure pathways as long as these actions are maintained. For instance, wet wiping of painted surfaces and use of HEPA vacuums will decrease dust in the buildings. In addition, stabilization of paint on friction surfaces will decrease exposure to lead-based paint.

The school blood lead screening indicates that lead exposures at levels of health concern are not occurring for the majority of individuals screened. The blood lead screening event held in the District schools indicates that no adults had blood lead levels that would be expected to cause adverse health effects. Other exposures to lead from sources off of the school properties may have contributed to the elevated blood lead levels found in the students.

Child Health Initiative and Susceptible Subpopulations

Childhood lead poisoning is a major, but preventable, environmental health problem. Children less than 72 months of age are a high risk group. They are generally assumed to be at an increased risk of exposure to chemicals in soil due to their more frequent soil contact and tendency to ingest soil, either intentionally or through normal hand-to-mouth behavior. Exposure to lead *in utero*, in infancy, and in early childhood can slow mental development and lower intelligence later in life. Further, children less than 72 months of age have developing body systems that can sustain permanent damage if toxic exposures occur during critical growth stages. Compared to adults, children absorb more of the lead they take into their bodies, retain more of the lead they do take in, and are more sensitive to its effects (16). The Centers for Disease Control and Prevention (CDC) recommends that BLLs remain below 10 µg/dL to decrease the likelihood of neurological and learning problems in children less than 72 months of age. None of the children included in the District screening were below 72 months of age.

For children six to seventeen years of age, the minimum blood lead level that might result in adverse health effects is unclear. There are conflicting studies regarding children in this age range (16) and there are behavioral practices that would result in decreased lead exposure, regardless of the source for these children. These activities include washing hands before eating, not eating food that has fallen on the ground, and consuming a diet high in calcium and low in fat. DHSS advises parents/guardians of these

children with blood lead levels greater than or equal to 10 µg/dl to seek medical advice from their personal medical care provider.

Conclusions

Based on the exposure-reducing activities being taken at the District schools and the results of the District blood lead screening, exposure to lead in Dunklin R-5 schools is not likely to lead to harmful effects. Remediation activities are underway or planned to address soil lead contamination.

Because some limited exposure is still possible, although not at levels expected to cause harm, conditions at these schools are categorized as a no apparent public health hazard. If significant new information about exposure or toxicity potential becomes available, DHSS will revisit this conclusion.

Recommendations

1. Continue lead exposure reduction activities at the District schools (e.g., wet wiping of painted surfaces, routine use of HEPA vacuums, monitoring of friction surfaces, washing hands after using the school yards and before eating; refraining from eating while sitting on these soils, etc.) until lead exposure sources are abated.
2. Parents/guardians of children six to seventeen years of age with blood lead levels of 10 µg/dL or greater should contact their private medical provider for medical advice.

Public Health Action Plan

The Public Health Action Plan (PHAP) for the Dunklin R-5 School District contains a description of actions to be taken by the Missouri Department of Health and Senior Services (DHSS), the Agency for Toxic Substances and Disease Registry (ATSDR), and other involved parties. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but provides an action plan to mitigate and prevent adverse human health effects resulting from past, present, and future exposures to contamination from the site. Included is a commitment from DHSS, ATSDR, or both to follow up on this plan to ensure that it is implemented.

1. District school staff plan to continue lead exposure reduction activities such as wet wiping of painted surfaces and routine use of HEPA vacuums. Friction surfaces should be monitored for degradation of paint. If paint on these surfaces degrades, actions should be taken to assure no exposure to this paint occurs (paint is stabilized, abated, window replaced, etc.). District staff have indicated they will follow recommendations made in this document.

2. DHSS/ATSDR will continue to hold lead health education exposure reduction education presentations to District staff as needed (e.g., when new staff are hired). This will include guidance on not eating while sitting on soils at recreational areas around the schools.
3. DHSS/ATSDR/JCHD will provide guidance to District students, parents, staff, and faculty regarding lead exposure and interpreting blood lead levels. School-age children with blood lead levels greater than or equal to 10 $\mu\text{g}/\text{dL}$ will be referred to their private medical care provider for medical guidance regarding their lead exposure.

Report prepared by: Scott Clardy, Gale Carlson, Missouri Department of Health and Senior Services

Attachments: Figure 1 - Site Map
Figure 2 - Site Map

References

1. Missouri Department of Natural Resources. Preliminary Assessment: Herculaneum Lead Smelter Site, Jefferson County, Missouri. Jefferson City, Missouri: Missouri Department of Natural Resources; 1999 March 30.
2. Agency for Toxic Substances and Disease Registry. Health consultation for Herculaneum Lead Smelter Site. Atlanta: US Department of Health and Human Services; 2001 Jul 13.
3. Agency for Toxic Substances and Disease Registry. Health consultation on blood lead results for 2001 calendar year, Herculaneum Lead Smelter Site, Herculaneum, Missouri. Atlanta: US Department of Health and Human Services; 2002 Feb 26.
4. Inspections Construction Management Consulting Services. Lead dust limited inspection Dunklin R-5 School District. Florissant, Missouri: Inspections Construction Management Consulting Services; 2001.
5. Thomas Industrial Coatings. Letter to Ken Barker from Wayne Long concerning paint chip sampling and making recommendations for administrative measures and cleaning. Pevely, Missouri. December 17, 2001.
6. D.J. Goodwin. Personal communication between D.J. Goodwin (Dunklin R-5 School District) and Scott Clardy (Missouri Department of Health and Senior Services). April 3, 2002
7. US Environmental Protection Agency. Letter to Missouri Department of Health and Senior Services from Tony Petruska requesting a health consultation on the Herculaneum Lead Smelter Site, Herculaneum, Missouri, Kansas City, Kansas. January 4, 2002.
8. US Environmental Protection Agency. Letter to Dan Vornberg, Doe Run Company, from Dave Cozad concerning proposed remediation of lead contamination on transportation routes in Herculaneum, Missouri. Kansas City, Kansas. August 31, 2001.
9. US Environmental Protection Agency. Letter from Tony Petruska to Dan Vornberg, Doe Run Company, concerning the need for additional actions to address lead contamination on transportation routes in Herculaneum, Missouri. September 17, 2001.
10. US Environmental Protection Agency. Quality assurance project plan for a site characterization at the Herculaneum Lead Smelter, Herculaneum, Missouri. Kansas City, Kansas: US Environmental Protection Agency; 2001 Sep 10.

11. US Environmental Protection Agency. Letter to Jeffrey Zelms, Doe Run Company, from Michael Sanderson concerning notification of need for expedited soil and dust cleanup and actions to prevent releases from transportation and materials handling activities. December 14, 2001.
12. US Environmental Protection Agency. Administrative order on consent; docket no. RCRA-7-2000-0018. Washington DC: US Environmental Protection Agency; 2000 Sep 29.
13. US Environmental Protection Agency. Action memorandum, request for removal action at the Herculaneum Lead Smelter Site, Herculaneum, Jefferson County, Missouri. Washington DC: US Environmental Protection Agency; 2002 Jan 16.
14. T. Petruska. Personal communication between T. Petruska (US Environmental Protection Agency) and Gale Carlson (Missouri Department of Health and Senior Services). April 15, 2002.
15. Jefferson County Health Department. Lead testing report Dunklin R-5 School District Herculaneum, Missouri. Hillsboro, Missouri: Jefferson County Health Department; 2002 Mar 28.
16. Agency for Toxic Substances and Disease Registry. Toxicological profile for lead, (update). Atlanta: US Department of Health and Human Services; 1999 Jul.

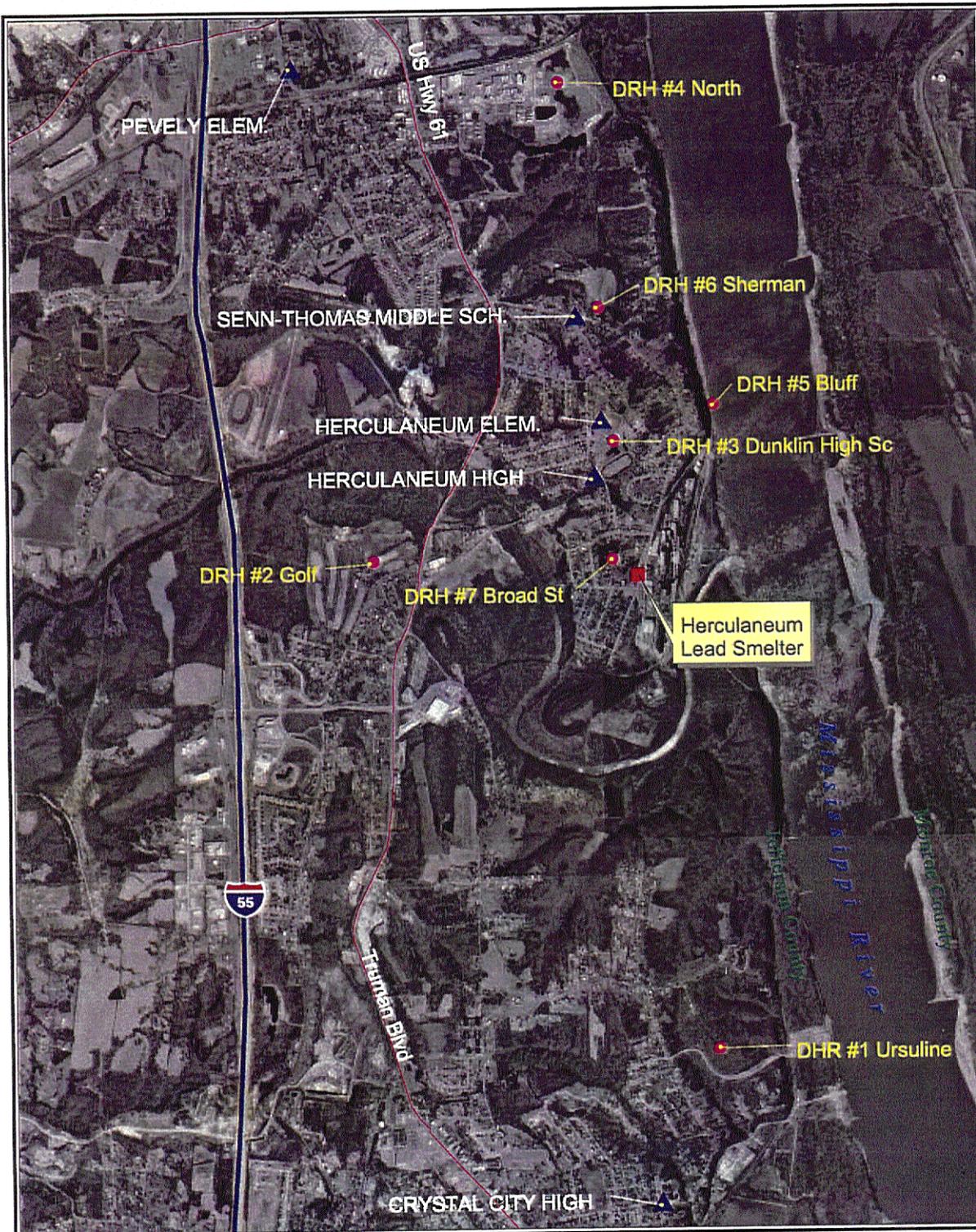
Certification

The Missouri Department of Health and Senior Services prepared this health consultation for the Herculaneum Lead Smelter Site, Public Health Implications From Attending or Working at Herculaneum Schools, under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved methodology and procedures at the time the health consultation was initiated.

Technical Project Officer, SPS, SSAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Section Chief, SPS/DHAC, ATSDR



Map Projection: UTM - 1983 ; Zone 15

Herculaneum Lead Smelter

Herculaneum, MO
 CERCLIS No. MOD006266373

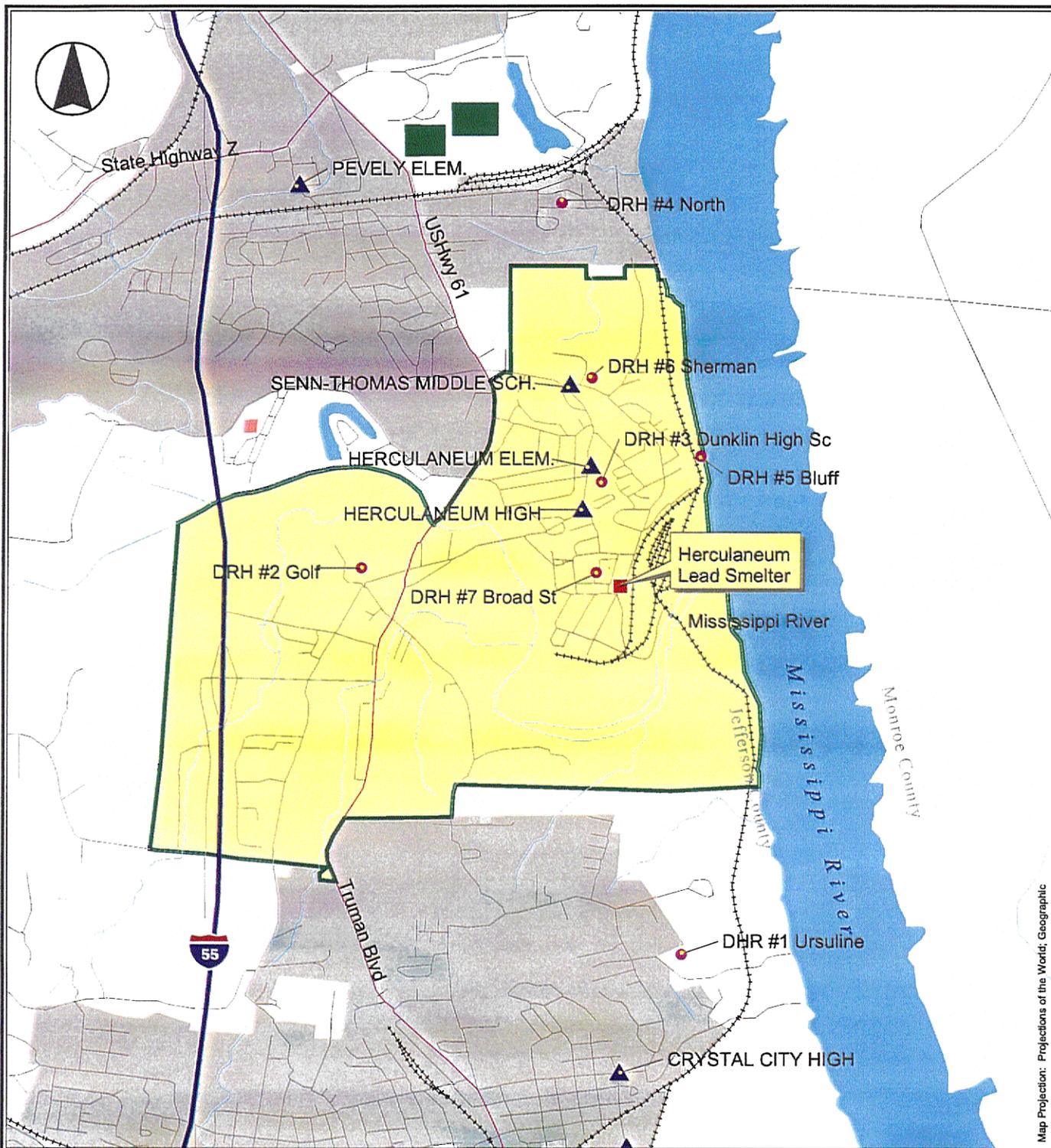
VICINITY MAP



Jefferson County, MO



ka1061201



Map Projection: Projections of the World; Geographic

Herculaneum Lead Smelter

Herculaneum, MO

CERCLIS No. MOD006266373

VICINITY MAP



Jefferson County, MO



ka1061201