



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

ACTION MEMORANDUM

JAN 15 2008

SUBJECT: Request for a Removal Action and 12-month Exemption at the Jefferson County Lead Site OU 03 – Jefferson County, Missouri

FROM:

James O. Silver

On-Scene Coordinator

THRU:

Scott Hayes, Chief

Emergency Response & Removal Branch

TO:

Cecilia Tapia, Director

Superfund Division

CERCLIS ID#

Site ID#

Category of Removal

Nationally Significant/Precedent Setting:

MON000705443

A7D2

Time Critical

No

I. PURPOSE

The purpose of this Action Memorandum is to request and document approval of the proposed removal action and 12-month statutory limit exemption on removals for the Jefferson County Lead site OU 03 (site). This Action Memorandum will address the following scenarios. First, where contaminated drinking water at the tap is found to be above the removal action level (RAL) or other established site-specific level, an alternative drinking water source will be provided. Second, EPA will excavate and remove all soils and/or waste from properties where a composite sample exceeds a concentration of 400 milligrams per kilogram (mg/kg)/parts per million (ppm) for lead and the area is a high-use area for children 84 months of age or younger or the property is the residence of a child with an elevated blood lead level greater than 10 micrograms per deciliter. Third, EPA will excavate and remove soils and/or waste from properties where a composite sample exceeds a concentration of 1,200 ppm for lead.

The primary objective of this action is to eliminate or reduce potential ingestion exposure due to the presence of lead and other heavy metals in the drinking water and the soils. This 12-month exemption satisfies the criteria for removal actions under section 300.415(b)(2) of the National Contingency Plan (NCP). This request meets the emergency criteria for exemption of section 104(c)(1) of the Comprehensive Environmental Response, Compensation, and Liability

Act (CERCLA) 42 U.S.C. § 9604(c)(1) from the statutory limits of removal actions and is necessary because EPA needs to eliminate or reduce potential ingestion exposure due to the presence of lead and other heavy metals in the drinking water and the soils. It is anticipated that the alternate drinking water source will have to be supplied well past a 12-month period of time.

II. EXEMPTION FROM STATUTORY LIMITS

The response actions are immediately required to prevent, limit, or mitigate an emergency. This response action includes excavating contaminated soils in yards and providing alternative drinking water as described in the Action Memorandum, thereby reducing the potential for exposure to lead, cadmium, and arsenic. If funding is not provided, these threats will not be addressed, and residents will continue to be exposed to high lead, cadmium, or arsenic concentrations that could lead to adverse health effects.

Assistance will not otherwise be provided on a timely basis. Neither the state of Missouri, the county, nor local governments have the response authority and/or resources to implement the described actions. The high lead levels found in residential soils and drinking water in this area require an immediate response to address the health risks posed to the residents.

The above conditions satisfy the emergency exemption criteria for a 12-month exemption and should be granted in order to immediately provide emergency response actions.

III. SITE CONDITIONS AND BACKGROUND

A. Site Description

1. Removal Site Evaluation

The site consists of high concentrations of lead contamination from soil delivered by a trucking company from a contaminated farm field to numerous residences and businesses throughout Jefferson County.

The primary problem areas at this site that require action are lead-contaminated soils in yards and lead-contaminated dust in homes.

2. Physical Location and Site Characteristics

Jefferson County is located in southeastern Missouri (Appendix B, Figure 1). It is bordered on the north by St. Louis County and the Meramec River; on the east by the Mississippi River; on the south by St. Genevieve and St. Francis Counties; and on the west by Washington and Franklin Counties. The county encompasses 664 square miles. According to the 2000 census, the population of Jefferson County is 198,099 people. The county seat is located in Hillsboro, Missouri. Jefferson County was organized in 1818 and named in honor of former President Thomas Jefferson.

Mining activities in Jefferson County began in the early 1800s in southern Jefferson County, where the Cambrian dolomite source rock is concentrated along Big River and other

major streams. The first production operation was a lead shot tower erected in 1809 in the southern part of Herculanum (USDA 2000). Two mines were in operation as early as 1818: Gray's Mine was located on Big River and McKane's Mine was located on Dry Creek. Many other mines were opened in the 1830s and 1840s for the production of lead, zinc, and barium (tiff). By 1855, three smelters were operating in Jefferson County, including Valle Mines, Mammoth Mines, and Sandy Mines. Historical records indicate that over three million pounds of lead was shipped out of Jefferson County annually during this time period, making it one of the leading lead producers.

The Inventory of Mines, Operations, and Prospects database lists 253 historical sites associated with mining and production operations in Jefferson County. Of these, 202 of the mining sites were designated for lead or lead and other commodities, particularly zinc and tiff. Most of the remaining sites were exclusively tiff mines. Past mining operators in Jefferson County included the St. Joe Lead Company (now Doe Run), the Valle Mining Company, the Big River Lead Company, Del Stocking, Magnolia Mining & Milling Company, Sandy Mining Company, National Lead Company, Bennett Lead & Zinc Company, Walther Mining Company, Ed Dixon, Big River L.M., M. Development Company, and Iva Schmitz-Rome & John. Of these operators, Doe Run is the only mining operator currently listed in Jefferson County. Doe Run's smelter was opened in 1892 by its predecessor St. Joe Lead Company. In 2003, the Doe Run smelter was producing over 100,000 tons of lead a year (Doe Run 2004 Annual Report). The Valle Mining company is also still in existence, but no longer mines for lead. According to historical records, the company operated the lead mine and smelting operation at Valle Mines from approximately 1824 through the 1930s. The ruins of several ore milling structures, a former smelter, chat piles, and mill wastes are still present in the vicinity of the town of Valles Mines.

In September 2006, EPA began an integrated site assessment, which included soil and groundwater sampling in the area. During this sampling event, EPA sampled the soil at 353 residences located on or near mining or mine-waste disposal areas. Based on this data, approximately 22% (55) of these residential properties had soils that exceeded 400 ppm for lead, and 6% (22) had soils that exceeded 1,200 ppm for lead. Beginning in September 2006, EPA also sampled approximately 304 private drinking water wells in Jefferson County. Of these 304 wells sampled, 36 (12%) were found with lead levels greater than 15 parts per billion (ppb) and/or cadmium levels greater than 5 ppb.

In September 2006, EPA sampled a farm field in anticipation of purchasing the soil for use as backfill following the excavation of lead-contaminated soil from residences in Washington County, Missouri. The soil was found to contain lead at levels greater than 1,200 ppm. EPA advised a hauling company in September 2006 that the soil was contaminated and the hauling company advised James Stewart, the property owner, that the soil was contaminated and that it could not be used for backfill. EPA sent a letter to Stewart in June of 2007 again advising him of the lead contamination and that "it is important that the contaminated soil from your property not be sold or transported off your property for use elsewhere."

On October 5, 2007, EPA sent a 104(e) letter to Stewart asking for "information and documents related to the delivery of contaminated soil, sand, gravel, and/or rock found in residential yards."

Stewart furnished the names of several trucking companies that had purchased soil from his property. In November 2007, EPA again sampled Stewart's property at three locations. Analysis of the soil by an XRF indicated lead levels from 1,000 ppm to nearly 4,000 ppm.

3. Release or Threatened Release into the Environment of a Hazardous Substance, or Pollutant or Contaminant

The primary contaminant of concern at this site is lead and lead compounds. EPA has documented that soil located in the field on Stewart's property where he was selling the topsoil is contaminated with lead at levels greater than 3,000 ppm. EPA has also documented soil delivered from Stewart's property to a separate residence was contaminated with lead at those same levels.

Lead, lead compounds, arsenic, and cadmium are hazardous substances (as defined by CERCLA section 101[14] and listed at 40 CFR § 302.4) and have been detected in the groundwater, soils, and mining wastes at the site.

4. National Priority List (NPL) Status

The site is not currently on or proposed for listing on the NPL. EPA has just completed a removal assessment to identify lead-contaminated residential yards and contaminated wells.

5. Maps, Pictures, and Other Graphic Representations

A map depicting the Jefferson County lead site is attached.

B. Other Actions to Date

There has been no known EPA or Missouri Department of Natural Resources (MDNR) response actions at this site to reduce the risks posed by lead contamination.

C. State and Local Authorities' Roles

EPA is closely coordinating with MDNR, the Missouri Department of Health and Senior Services, and the Jefferson County Health Department. These agencies, EPA, and the Agency for Toxic Substances and Disease Registry (ATSDR) hold monthly conference calls to stay updated and discuss various issues concerning the Jefferson County lead site.

IV. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT AND STATUTORY AND REGULATORY AUTHORITIES

A. Threats to Public Health or Welfare

At any release, regardless of whether the site is included on the NPL where the lead agency makes the determination based on factors in 40 CFR part 300.415(b)(2) that there is a threat to public health or welfare or the environment, the lead agency may take any appropriate

removal action to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or threat of release. The factors in 40 CFR part 300.415 (b)(2) that apply to this site are:

300.415(b)(2)(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, or pollutants, or contaminants.

Elevated concentrations greater than 1,200 ppm of lead have been found throughout the site. Children playing in and around the contaminated areas have the highest potential to be negatively impacted by exposure. In addition, sampling has determined that numerous private drinking water wells have been contaminated with lead, arsenic, and cadmium.

Lead, arsenic, and cadmium are metals that are listed as hazardous waste (lead/D008, cadmium/D006 and arsenic/D004) in the regulations for RCRA. Lead is classified by the EPA as a probable human carcinogen and is a cumulative toxicant. Children are more vulnerable to lead poisoning than adults. The early effects of lead poisoning are nonspecific and difficult to distinguish from the symptoms of minor seasonal illnesses. For children, low levels of lead are harmful and are associated with decreased intelligence, impaired neurobehavioral development, decreased stature and growth, and even damage the central nervous system, kidneys, and reproductive system. At higher levels, it can cause comas, convulsions, and death.

In adults, the early effects of lead poisoning are nonspecific and difficult to distinguish from the symptoms of minor seasonal illnesses. Lead poisoning causes decreased physical fitness, fatigue, sleep disturbance, headache, aching bones and muscles, digestive symptoms (particularly constipation), abdominal cramping, nausea, vomiting, and decreased appetite. With increased exposure, symptoms include anemia, pallor, a "lead line" on the gums, and decreased handgrip strength. Alcohol and physical exertion may exacerbate these symptoms. The radial nerve is affected most severely causing weakness in the hands and wrists. Central nervous system effects include severe headaches, convulsions, coma, delirium, and possibly death. The kidneys can also be damaged after long periods of exposure to lead, with loss of kidney function and progressive azotemia. Reproductive effects in women include decreased fertility, increased rates of miscarriage and stillbirth, decreased birth weight, premature rupture of membrane, and/or pre-term delivery. Reproductive effects in men include erectile dysfunction, decreased sperm count, abnormal sperm shape and size, and reduced semen volume. Lead exposure is associated with increases in blood pressure and left ventricular hypertrophy. A significant amount of lead that enters the body is stored in the bone for many years and can be considered an irreversible health effect. Lead is classified as a probable human carcinogen.

300.415(b)(2)(ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems

EPA sample results showed numerous private drinking water wells were contaminated with lead and/or arsenic and cadmium above federal and state drinking water standards. The RAL for lead at this site is 15 ppb, and EPA has identified 36 wells exceeding the RAL. EPA has also identified two wells that exceed 5 ppb for cadmium.

300.415(b)(2)(iv) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate.

Lead has been detected in surface soils above the time-critical removal action level of 1,200 ppm. Lead-contaminated soils may migrate via airborne dusts, surface runoff, percolation into groundwater, construction activity, children transporting soils/dusts into their homes after playing in the affected areas, and other foot traffic into residences.

V. ENDANGERMENT DETERMINATION

The actual release of a hazardous substance at this site, if not addressed by implementing the response action selected in this Action Memorandum, presents an imminent and substantial endangerment to the health of the public that comes in contact with the site and to public welfare and the environment.

VI. PROPOSED ACTIONS AND ESTIMATED COST

A. Proposed Actions

1. Proposed Action Description

PROVISION OF ALTERNATIVE DRINKING WATER

An EPA site-specific analysis by the Regional Toxicologist (attached) has determined that the Jefferson County Mining District represents an area of wide-spread lead contamination where young children are exposed to multiple sources of lead. In areas where this determination has been made and EPA suspects that the contaminated drinking water is the result of contaminated groundwater, the drinking water Time-Critical RALs for lead, cadmium, and arsenic are 15 ppb, 5 ppb, and 10 ppb, respectively. Any residence where purged unfiltered tap water data exceeds the RALs, an alternate source of drinking water should be provided as long as the sampling results indicate that the contamination is not from plumbing (CERCLA section 104[a][3][C]) or natural sources (CERCLA section 104 [a][3][A]). Both first-run and purged unfiltered tap water and groundwater should be sampled and analyzed in making the determination (Superfund Lead-Contaminated Residential Sites Handbook, Office of Solid Waste and Emergency Response [OSWER] 9285.7-50, August 2003). Should the results demonstrate that the groundwater is potentially contaminated but the tap water is below the RALs, the EPA will notify the local health officials or other appropriate authority for further monitoring and action in accordance with section 300.415(e)(9) of the NCP.

SOIL/WASTE EXCAVATION, REMOVAL, AND REPLACEMENT

EPA will not intentionally address naturally occurring lead ores in their undisturbed state as part of this action. Although the site has been heavily mined in the past, it may be possible to encounter naturally occurring lead ores during residential property excavation. Section 104 (a)(3)(A) of CERCLA states that removal or remedial actions shall not be provided in response to a release or threat of release of a naturally occurring substance in its unaltered form or altered solely through natural processes in a location where it is naturally found. Naturally occurring lead ores could be found at the bedrock interface and in undisturbed

clay soils near the surface. Another indicator of the presence of naturally occurring lead ores could be a high density of galena crystals in soils or unusually high concentrations of lead in excavated soils. When these conditions are encountered, they will be documented, excavation will stop, and backfill will be initiated.

EPA will excavate and remove all soils and/or wastes from properties where a composite sample exceeds a concentration of 400 ppm lead and the area is a high-use area for children 84 months of age or younger or the property is a residence of a child with an elevated blood lead greater than 10 micrograms per deciliter ($\mu\text{g/dl}$).

Properties with soil concentrations of lead exceeding the action level of 1,200 ppm will be excavated, in site predetermined lifts until levels are below 400 ppm or until 12 inches of soil has been excavated. At 12 inches and if levels are not below 1,200 ppm, a barrier may be put down to alert homeowners of the existence of high levels of lead. In the case of a garden area, excavation shall continue until 24 inches if it can be determined that levels below 1,200 ppm can be achieved. If EPA determines that excavation to 24 inches will not achieve this goal, then excavation will stop at 12 inches with a warning barrier being put up and the property owner being advised of this situation.

After removing the soils from the affected area or areas and placing the warning barriers where required, the excavated soils will be replaced with clean soils. Clean soils are soils that have been analyzed for lead and other heavy metals and results indicate that the lead concentration is below 240 ppm and all other hazardous substances, pollutants, or contaminants are below residential soil screening levels determined by EPA or by referring to the Region 9 Preliminary Remediation Goal tables found at <http://www.epa.gov/Region9/waste/sfund/prg/index.htm>.

SOIL TREATMENT AND DISPOSAL

EPA shall collect soil samples from the excavated soils to conduct the Toxicity Characteristic Leaching Procedure (TCLP) analysis according to the requirements of SW-846-Chapter 9 (representative sampling for waste piles). Soils that exceed TCLP limits for lead and other metals must be properly treated with an appropriate lead stabilization chemical and re-sampled until the levels are below TCLP limits for lead. Treatment of soils will not be conducted at the residence.

Transportation, treatment, storage, and disposal of the excavated material shall be in accordance with all applicable local, state, or federal requirements.

POST REMOVAL SITE CONTROL

It is EPA policy that Post Removal Site Control (PRSC) shall be the responsibility of the state, potentially responsible party, or the remedial program. At this time it is uncertain what, if any, PRSC will be needed. When that determination is made, the OSC, working through regional management, will attempt to obtain PRSC agreements as appropriate.

2. Contribution to Remedial Performance

The fund-lead actions proposed in this Action Memorandum should not impede any future remedial plans or other response. This is consistent with any long-term remedy in that it fully addresses the direct contact threat posed by lead contamination at this site.

3. Action/Cleanup Level

Yards with soils contaminated with lead above 1,200 ppm will be excavated, treated if TCLP analysis fails, and disposed of at an acceptable soil repository. Another suitable option is to dispose of excavated soils that meet the definition of a hazardous waste in a RCRA Subtitle C disposal facility. These levels are consistent with the revised interim guidance for lead-contaminated Superfund sites, OSWER Directive 9355.4-12, and have been concurred by ATSDR.

All site-sampling activities for comparison to the action levels will be conducted in accordance with the approved Quality Assurance Project Plan.

For those residences that exceed the proposed levels for drinking water in VI.A.1. above, an alternative drinking water source will be provided that may include bottled water, a filtration system, or other alternatives. It is anticipated that this action will exceed 12 months.

This Action Memorandum also allows for continued soil sampling of residences in this area.

4. Applicable Relevant and Appropriate Requirements (ARARs)

Section 300.415(j) of the NCP provides that fund-financed removal actions under section 104 of CERCLA and removal actions pursuant to CERCLA section 106 shall, to the extent practicable considering the exigencies of the situation, attain ARARs under federal environmental or state environmental facility siting laws. The following specific ARARs have been identified for this action:

- Subtitle D of RCRA, section 1008, section 4001, et seq.; 42 U.S.C. §6941, et seq.; State or Regional Solid Waste Plans and implementing federal and state regulations.
- Occupational Safety and Health Act, 29 CFR part 1910 will be applicable to all actions.
- Subtitle C of RCRA, 42 U.S.C. section 6901, et seq.; 40 CFR part 260, et seq. and implementing federal and state regulations for contaminated soils that exhibit the characteristic of toxicity and are considered RCRA hazardous waste.

Subtitle C of RCRA is potentially applicable for the removal of soils contaminated with heavy metals from spills of lead concentrate, particularly if these soils exceed the TCLP regulatory threshold. However, soils contaminated with heavy metals from extraction, beneficiation or processing of ores are exempt from the requirements of RCRA, Subtitle C

pursuant to the Bevill amendment, section 3001(b)(3)(A) of RCRA, 42 U.S.C. section 6921(b)(3)(A), and implementing regulations, 40 CFR section 261.4(b)(7).

- 40 CFR part 122, section 122.26, National Pollution Discharge Elimination System storm water discharge regulations may be relevant and appropriate for management of storm water runoff from the repository.
- 49 CFR parts 107, 171-177, Department of Transportation hazardous material transportation regulations may be relevant and appropriate for transportation of the contaminated soils to the repository.

EPA requested potential state ARARs for this site. When received, these ARARs will be evaluated per EPA guidance on consideration of ARARs during removal actions.

Any lead-bearing wastes exceeding the TCLP regulatory threshold will undergo treatment in accordance with the requirements of the RCRA.

5. Project Schedule

Response activities are anticipated to begin within 30 days of the signing of this Action Memorandum. It is expected that soil excavation will take several months to complete.

Soil sampling will continue in selected locations throughout this area for an undetermined period of time to address other potentially impacted residences.

B. Estimated Costs

The costs associated with this removal action are estimated as follows:

Extramural Costs:

Removal Costs	\$ 1,256,768
20% Contingency	<u>\$ 251,353</u>
Removal Ceiling	\$ 1,508,121

The EPA direct and indirect costs, although cost recoverable, do not count toward the total removal project ceiling for this removal action.

VII. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

Delayed action will continue to potentially expose residents, particularly children, to the contaminated soils exceeding the federal action levels.

VIII. OUTSTANDING POLICY ISSUES

None.

IX. ENFORCEMENT

See attached Confidential Enforcement Addendum for this Site. For NCP consistency purposes, it is not a part of this Action Memorandum.

The total EPA costs for this removal based on full cost-accounting practices are estimated to be \$2,359,181.

Direct Extramural Costs	\$1,508,121
Direct Intramural Costs	40,000
EPA Indirect (52.39% of all costs)	<u>811,060</u>
 Total Project Costs	 \$2,359,181

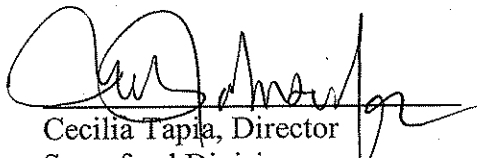
Direct costs include direct extramural and direct intramural costs. Indirect costs are calculated based on an estimated indirect cost rate expressed as a percentage of site-specific direct costs, consistent with the full cost-accounting methodology effective October 2, 2000. These estimates do not include prejudgment interest, do not take into account other enforcement costs, including Department of Justice costs, and may be adjusted during the course of a removal action. The estimates are for illustrative purposes only and their use is not intended to create any rights for responsible parties. Neither the lack of a total cost estimate nor deviation of actual total costs from this estimate will affect the United States' right to cost recovery.

X. RECOMMENDATION

This decision document represents the selected removal action for the contaminated soils and drinking water at the site. The removal action was developed in accordance with CERCLA, as amended, and is not inconsistent with the NCP. This decision is based on the Administrative Record for the site.

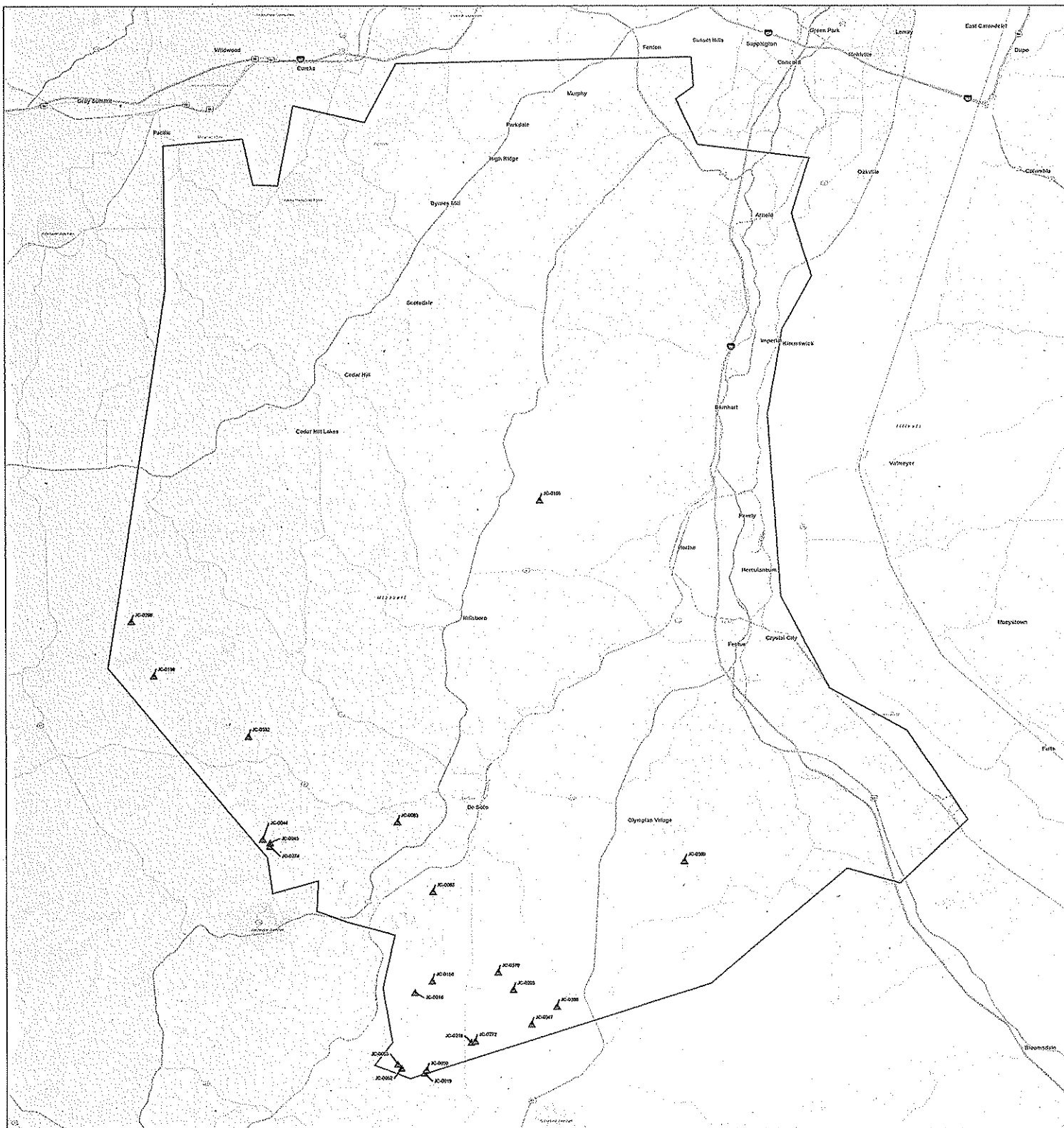
Conditions at the Site meet NCP Section 300.415(b) criteria for a removal action and I recommend your approval of the proposed removal action. The removal ceiling, if approved, will be \$1,508,121. This amount comes from the Regional Removal Allowance.


Approved:


Cecilia Tapia, Director
Superfund Division


1-15-00
Date

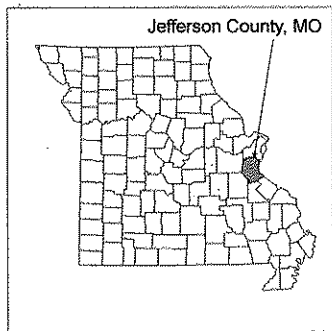
Attachments




U.S. Environmental Protection Agency

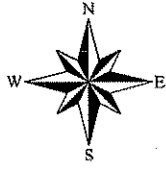
LEAD STUDY
JEFFERSON COUNTY, MISSOURI
TASK ORDER: X9004L070062000
FIGURE 3
RESIDENTIAL LOCATIONS
LEAD IN SOIL > 1200 PPM



TETRA TECH EM, INC.



LEGEND

▲ LEAD IN SOIL > 1200 PPM







UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII
901 NORTH 5TH STREET
KANSAS CITY, KANSAS 66101

SEP 21 2007

MEMORANDUM

SUBJECT: Site-Specific Removal Action Levels for Lead
Southeast Missouri Mining District and Central Mining District

FROM: Mike Beringer *Mike B*
Toxicologist
ENSV/EAMB

TO: Ken Buchholz
Chief
SUPR/EFLR

✓ Scott Hayes
Chief
SUPR/ER&R

As requested, we are providing site-specific Removal Action Levels (RALs) for lead in residential drinking water at two separate lead mining areas in Missouri, including the Southeast Missouri Mining District and the Central Mining District. For the purpose of this evaluation, the Southeast Missouri Mining District is defined as the Old Lead Belt and the New Lead Belt or Viburnum Trend, consisting of Washington County, St. Francois County, Madison County, Reynolds County, Dent County, Iron County, Eastern Crawford County, and Southern Franklin and Jefferson Counties. The Central Mining District encompasses Morgan County, Cole County, Camden County, Miller County, and Moniteau County. These two lead mining areas are shown in Figure 1. While the Office of Solid Waste and Emergency Response (OSWER) has developed a RAL of 30 µg/L for lead (EPA, 1993, 1997), this value does not account for site-specific considerations, such as potential exposure from other sources of lead. Thus, we evaluated available site-specific information for each of these lead mining areas, including the magnitude and extent of lead soil contamination, to determine if an alternative RAL was warranted for lead.

In the residential setting, children under the age of 7 (i.e., < 84 months) are the primary population of concern because they (1) tend to have higher exposures to lead in soil, dust, drinking water, etc.; (2) absorb a greater fraction of ingested lead; and (3) are more sensitive to the toxic effects of lead than are older children or adults. We used the U.S. EPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children to evaluate whether a site-

specific RAL for lead was appropriate. The IEUBK model is a computer-based deterministic simulation that estimates a plausible range of blood lead (PbB) concentrations for a hypothetical child or population of children (0 to 84 months) resulting from their exposure to environmental sources of lead, including soil, dust, air, drinking water, and diet (EPA, 1994a). It is important to note that the IEUBK model uses a multimedia approach that accounts for all sources of lead in the environment.

It is our understanding that the Agency did not specifically use the IEUBK model to derive the current RAL of 30 µg/L or the Maximum Contaminant Level (MCL) of 15 µg/L. (There is no actual MCL for lead, but 15 µg/L is an "action level" where water suppliers are required to control the corrosiveness of their water when 10% of the samples exceed this level). However, the model can be used to predict the blood lead levels of children under various exposure conditions. Numerous environmental samples have been collected at each of these lead mining areas which document the presence of lead at varying concentrations and frequency in residential yard surface soil. So we used the IEUBK model to evaluate the potential health risks to young children from exposure to a range of lead concentrations in drinking water and surface soil which may occur.

More specifically, we assumed that young children (i.e., < 84 months of age) would ingest drinking water at both the MCL and RAL for lead, as well as surface soil contaminated with lead at 50 mg/kg, 400 mg/kg, and 1200 mg/kg, using the latest version of the IEUBK model (EPA, 2005). All remaining input parameters in the IEUBK model were set to EPA-specified default values, with the exception of updated dietary lead intake estimates (EPA, 2007). We also assumed no additional contribution of lead from local dietary sources, such as fruits, vegetables, meat, and fish.

Before discussing the results, it is important to point out that OSWER has established a health protection goal of limiting exposure to soil lead levels such that a full-time residential child would have an estimated probability of no more than 5% of exceeding a 10 µg/dL blood lead level (EPA, 1994b, 1998). For convenience, this is usually referred to as "P10." The basis for this goal is that health effects associated with childhood lead exposure have been determined to occur at or below a blood lead (PbB) concentration of 10 µg/dL (EPA, 1986, 1990; CDC, 1991). In addition, OSWER has recommended a screening level in surface soil of 400 mg/kg at residential properties (EPA, 1994b, 1998). This surface soil level equals a P10 of 5% when the latest version of the IEUBK model is run with all EPA-specified default parameters and updated dietary intake values.

Attachments 1 through 6 are the probability density plots from the IEUBK model runs which show the best estimate of a plausible range of PbB concentrations for a hypothetical child or population of children under the specified lead exposure scenarios. Several observations can be made from these attachments. First of all, the probability of exceeding a blood lead (PbB) concentration of 10 µg/dL or P10 is only 0.1% and 1.2% for an individual child who consumes water at the MCL and RAL (see Attachments 1 and 2), respectively, and incidentally ingests soil containing a lead concentration of 50 mg/kg. Thus, at low soil concentrations, the Removal

Action Level of 30 µg/L is protective as the P10 is significantly below OSWER's health protection goal of 5%. Second, the probability of exceeding a PbB level of 10 µg/dL is 9.3% at the MCL and 16.8% at the RAL (see Attachments 3 and 4) when the soil lead concentration is set at EPA's screening level of 400 mg/kg. Third, as the soil concentration increases, the probability of exceeding a PbB level of 10 µg/dL increases in a non-linear fashion and the lead intake from soil ingestion has a much larger impact on the predicted blood lead concentration, as compared to drinking water. This also means that as the residential yard soil levels increase, the greatest health threat is from soil ingestion, and providing alternative water will not significantly reduce predicted PbB levels until those yards are actually cleaned up. These results are summarized in the following table.

Probability of Exceeding 10 µg/dL (P10)		
Soil Concentration	MCL	RAL
50 mg/kg	0.1%	1.2%
400 mg/kg	9.3%	16.8%
1200 mg/kg	57.6%	63.2%

Overall, the results show that lead from outdoor soil may have a significant impact on predicted blood lead levels, and this additional source of lead exposure should be considered when establishing a site-specific Removal Action Level for lead. It is generally assumed that soil and dust exposure primarily occurs in the yard where a child actually resides. However, young children are also exposed to contaminated soil and dust from adjacent yards, as well as areas in their neighborhood and community that are contaminated with lead. Siblings, parents, and pets may also track this contaminated soil back to the home. If the soil contamination is widespread at levels of health concern, then the drinking water RAL of 30 µg/L may not be protective of human health. So we also considered the magnitude and extent of lead soil contamination at each of these lead mining areas, as well as the available blood lead data, as discussed below.

Southeast Missouri Mining District

The Southeast Missouri Mining District is comprised of those counties (or portions of counties) located within the Old Lead Belt and the New Lead Belt or Viburnum Trend. The Missouri Geological Survey Inventory of Mines, Occurrences, and Prospects (IMOP) database shows that mining activity has occurred at several thousand locations in the Southeast Missouri Mining District, beginning in the early 1700's (see Figure 1).

Region 7 and the Missouri Department of Natural Resources (MDNR) have sampled environmental media to screen many of the potentially impacted areas. Samples have been collected from source areas, observed chat and tailings piles, sediment from surface drainage pathways, and along the shoulders of roads that have been used as routes for hauling mining

materials. In addition, Region 7 and MDNR have collected surface soil samples in residential areas at or near current and former mining operations. These results are contained in numerous site investigation reports which document the presence of lead throughout the Southeast Missouri Mining District.

Table 1 provides a summary of surface soil and groundwater sample results from a subset of counties in the Southeast Missouri Mining District. More specifically, the table lists the total number of residential yards sampled, the number and percentage of yards with at least one sample where the lead concentration was between 400 and 1200 mg/kg, or above 1200 mg/kg. The table also shows the number and percentage of private drinking wells with a lead concentration above the MCL of 15 µg/L and RAL of 30 µg/L. This information was compiled by Superfund Division staff on September 4, 2007, from site investigation reports developed over the last several years. We did not reanalyze each report to confirm these numbers, and assumed they are an accurate summary of the sampling results.

While the sampling results are limited to Washington, Jefferson, and Franklin counties, they do show that lead contamination of surface soil is widespread across the Washington County Lead District Sites, with lead concentrations in at least one surface soil sample exceeding 400 mg/kg in about 30%, 58%, and 29% of the residential properties sampled at the Old Mines, Potosi, and Richwoods Sites, respectively. For Jefferson County, 55 of 276 yards sampled (16%) had at least one location with the lead concentration greater than 400 mg/kg and another 22 yards (6%) had one or more locations with greater than 1200 mg/kg of lead in surface soil. Less than 4% of the Franklin County properties sampled had one or more locations with greater than 400 mg/kg of lead. These results are not unexpected, given that much of the past historical mining activity occurred in Washington and southwestern Jefferson counties.

Region 7 has also collected soil samples along haul routes used to transport mining commodities throughout the Southeast Missouri Mining District. Sample results show the presence of lead at concentrations significantly greater than 1200 mg/kg at many locations. Figure 2 summarizes soil sample results along haul roads located in the Viburnum Trend area. These results further document the pervasive nature of lead contamination in the Southeast Missouri Mining District.

The widespread occurrence of lead in several environmental media also coincides with an increased incidence of young children with blood lead levels exceeding 10 µg/dL (see Figures 1 and 3). While the data in Figures 1 and 3 are limited to 2003, they do provide further evidence that mining activities have likely impacted blood lead levels in young children.

In addition, EPA has placed several sites from the Southeast Missouri Mining District on the National Priorities List (NPL) due to extensive environmental lead contamination and elevated blood levels in young children. At the Big River Mine Tailings Site, located in St. Francois County, Region 7 has implemented non-time critical removal actions at four large mine waste piles and replaced surface soil in over 400 residential yards. EPA has also instituted land use controls to restrict the use of lead-contaminated mine waste and informed the local

population of the risks associated with uncontrolled uses of mine waste. The Madison County Mines Site is on the NPL primarily because of lead contamination in residential yards and surface water bodies. Much of the residential soil contamination is due to individuals using tailings from piles as fill for yards, gardens, roads, and driveways. As a result, Region 7 has cleaned up 804 residential properties to date. The Annapolis Mine Site is located in Iron County and elevated levels of lead have been documented in groundwater, surface water, sediment, and surface soil, with the highest concentration of 20,000 mg/kg in surface soil adjacent to an on-site residence. An emergency response was conducted to relocate children with elevated blood lead levels from this residence. EPA has also recently proposed adding three separate sites from the Washington County Mining District to the NPL, which includes the Old Mines, Potosi, and Richwoods Sites. The data in Table 1 show that mining activities in Washington County have contributed to elevated levels of lead in soil and groundwater in this area.

Overall, the available environmental data documents the presence of lead from mining operations is likely an additional source of childhood exposure at many locations throughout the Southeast Missouri Mining District. As a result, the current OSWER RAL of 30 µg/L may not be protective of human health at many residential properties due to pervasive surface soil contamination. Therefore, we recommend using the MCL of 15 µg/L as the Removal Action Level for the Southeast Missouri Mining District.

Central Mining District

Mining activities have also occurred at hundreds of locations in the Central Mining District. Region 7 and MDNR have collected numerous environmental samples to evaluate potentially impacted areas in the Central Mining District, including samples from source areas, chat and tailings piles, and sediment. Surface soil samples have also been collected in residential properties at or near current and former mining operations.

The results document the presence of lead at various locations throughout the Central Mining District as a result of mining activities, but at much lower concentrations as compared to the Southeast Mining Area. Table 1 shows that only 5 of 610 sampled properties (< 1%) had a lead concentration greater than 400 mg/kg in at least one surface soil sample. Also, Figures 1 and 3 do not demonstrate an increased incidence of elevated blood lead levels in children less than 6 years of age, except for limited areas of the District. This information is not indicative of widespread soil contamination that would contribute to childhood exposure on a site-wide basis. We conclude there is not sufficient justification to warrant recommending a District-wide lead RAL below 30 µg/L for the Central Mining District.

However, as discussed above, if someone ingests water containing lead at the RAL and soil at EPA's screening level of 400 mg/kg, then the probability of exceeding a blood lead level of 10 µg/dL is about 17%. Thus, we recommend providing alternative drinking water when the lead concentration at the tap equals or exceeds the current MCL of 15 µg/L and the yard-wide average soil concentration of lead is greater than 400 mg/kg. We also recommend a Removal Action Level of 15 µg/L if the lead concentration in a child play area exceeds 400 mg/kg.

Summary

As requested, we evaluated available site-specific information for the Southeast Missouri Mining District and Central Mining District to determine if an alternative Removal Action Level for lead was warranted. Our analysis shows that the current OSWER RAL of 30 $\mu\text{g/L}$ is protective at relatively low soil concentrations, but it may not be protective of human health in the Southeast Missouri Mining District due to pervasive lead contamination in surface soil. Thus, we recommend a District-wide RAL of 15 $\mu\text{g/L}$. In the case of the Central Mining District, the available information does not warrant a District-wide lead RAL below 30 $\mu\text{g/L}$. However, we do recommend providing alternative drinking water on a site-specific basis when the lead concentration at the tap equals or exceeds the current MCL of 15 $\mu\text{g/L}$, and the yard-wide average or child play area soil concentration of lead is greater than 400 mg/kg. It is also important to reiterate that as residential yard soil levels increase, the greatest health threat is from soil ingestion, and providing alternative water will not significantly reduce predicted PbB levels until those yards are actually cleaned up.

These site-specific recommendations are not necessarily applicable to all Superfund sites with contaminated groundwater. We also note that while these recommended values are protective of human health, the final decision regarding an appropriate RAL for these sites rests with the Superfund program. If you have any questions or need additional information, please let me know.

References

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U.S. EPA (2007). Frequent Questions from Risk Assessors on the IEUBK Model. Newer lead in food data are available from the FDA total diet study. Available online at <http://www.epa.gov/superfund/health/contaminants/lead/ieubkfaq.htm>.

Attachments

Figure 1

Missouri Lead Mining & Smelter Sites and Percentage of Children Under the Age of 6 Sampled with Elevated Blood Lead Levels

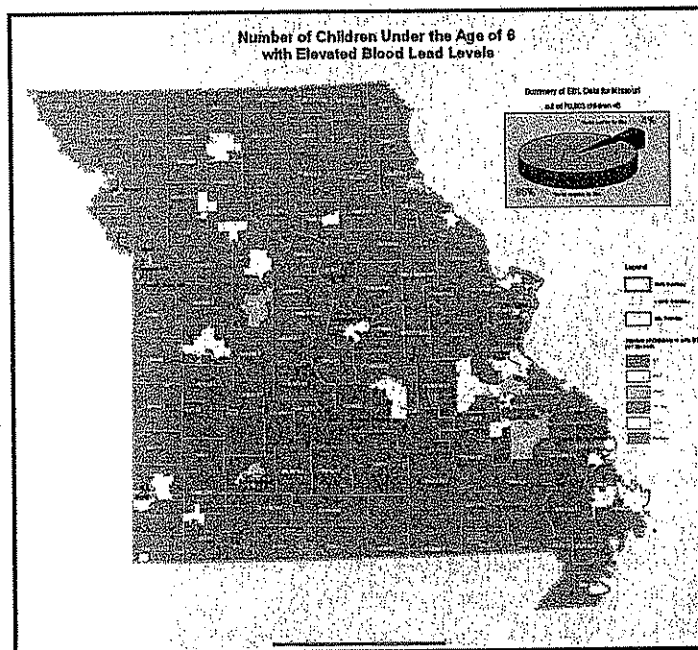
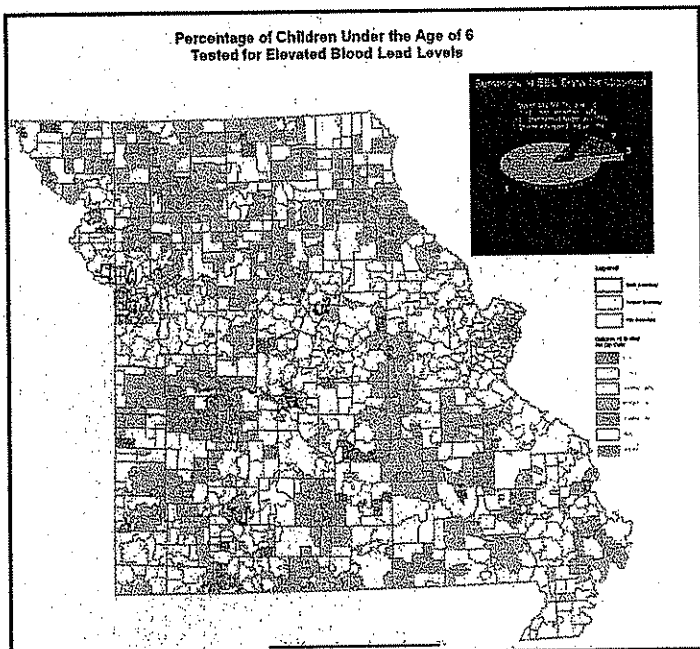
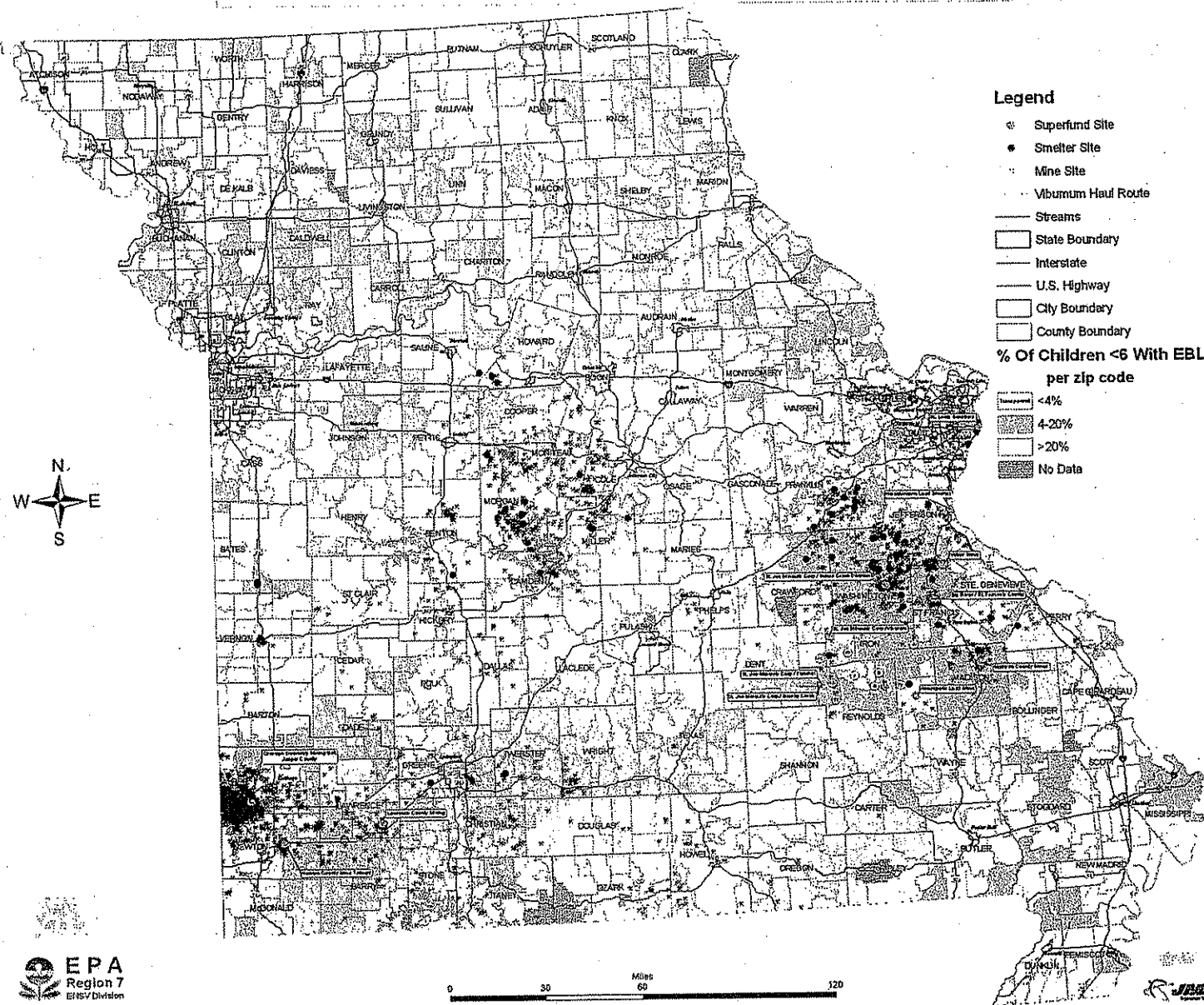


Figure 2

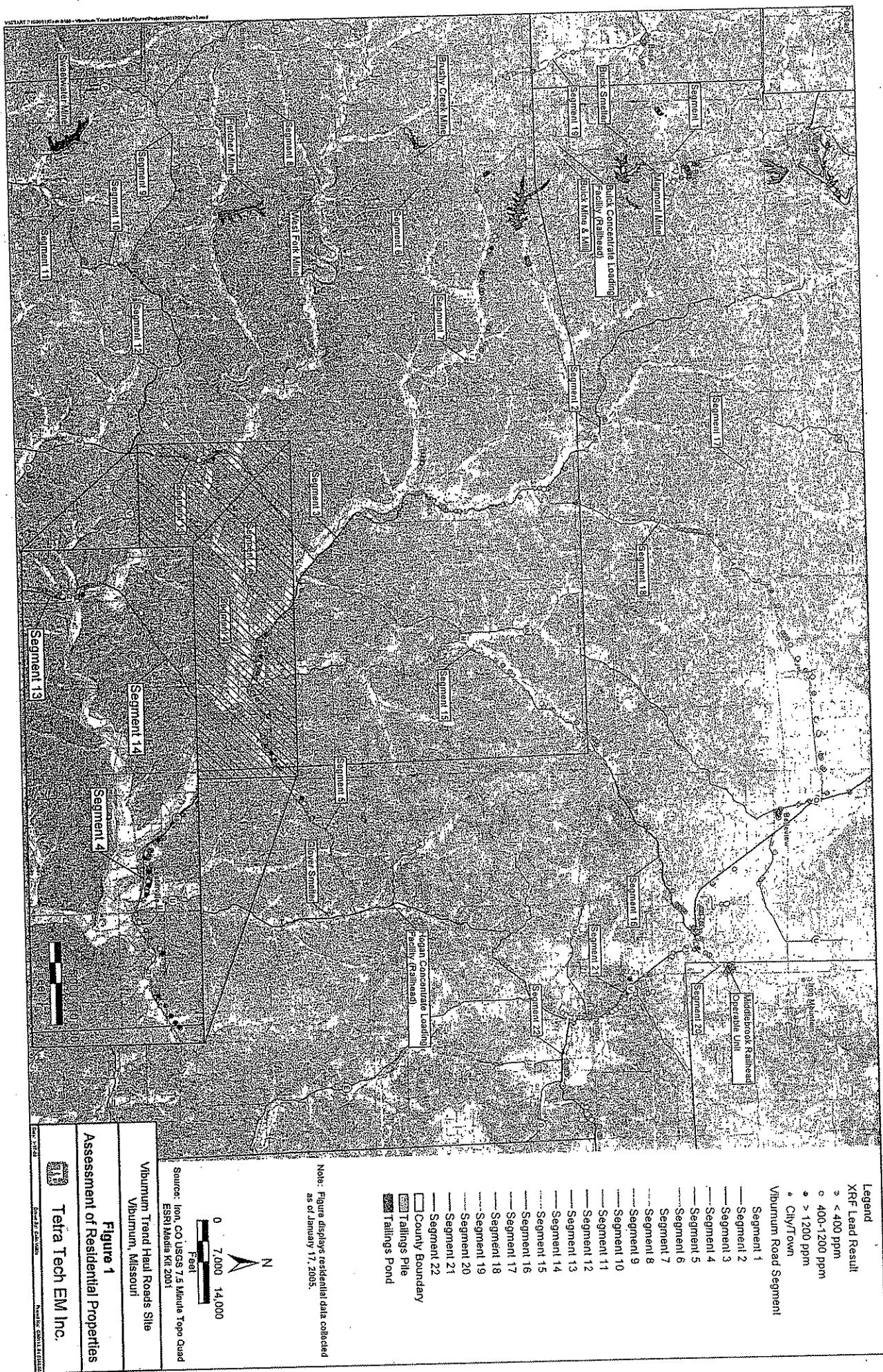


Figure 3

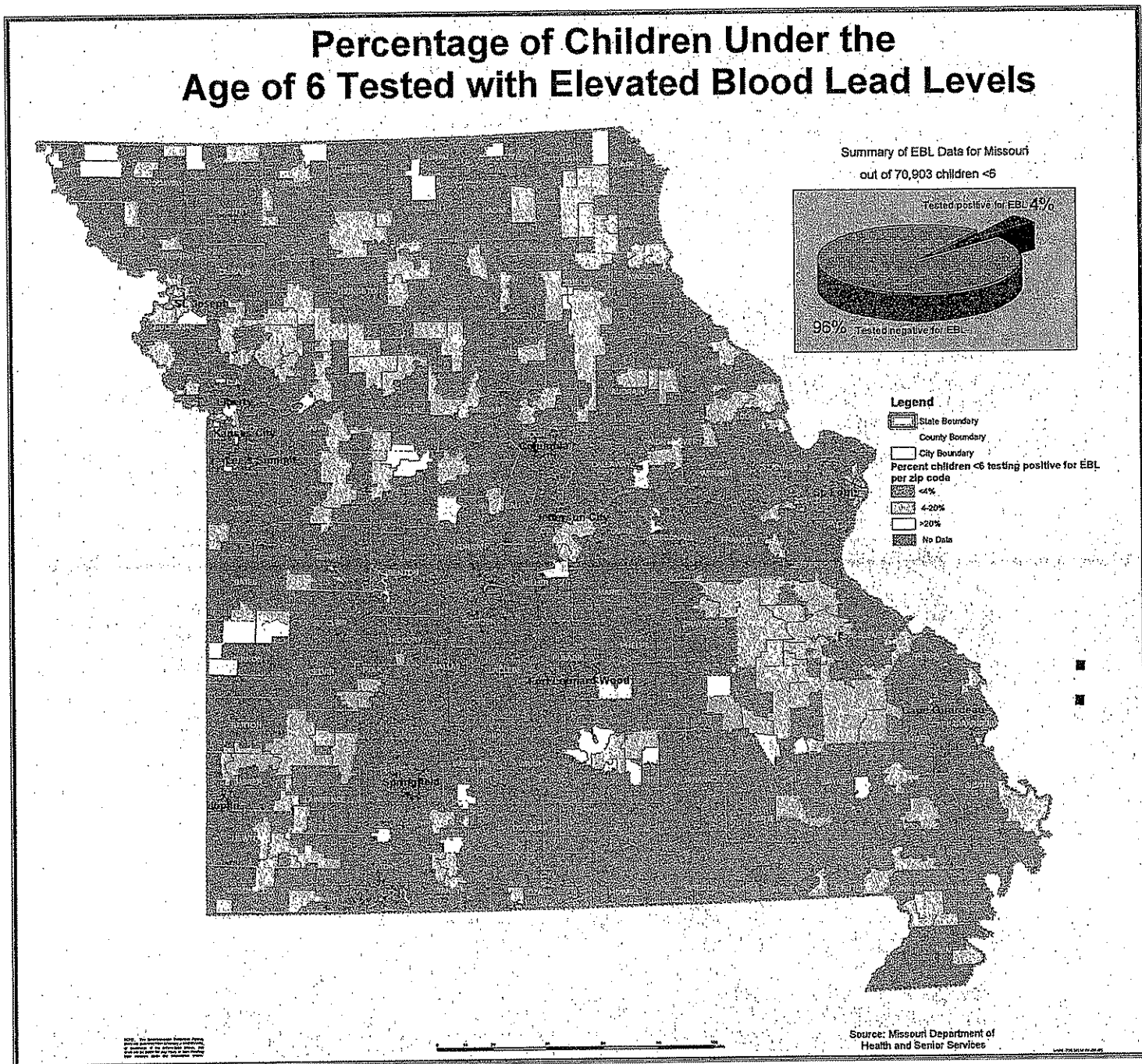
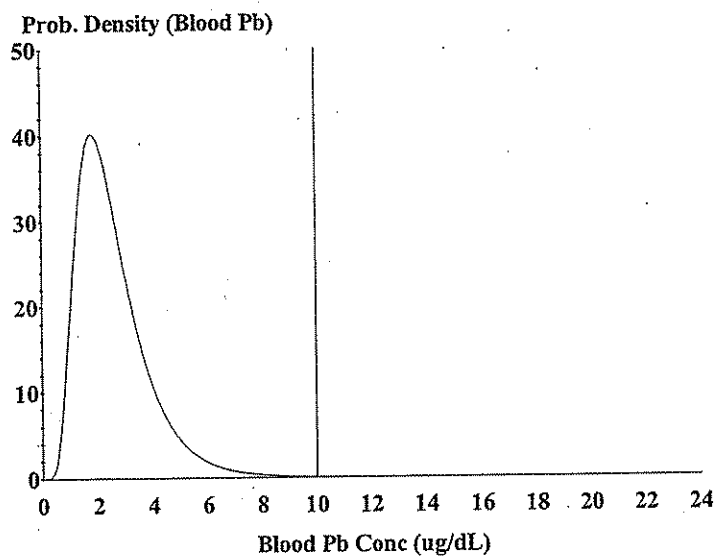


Table 1. Comparison of Soil and Drinking Water Investigations Under the Lead Initiative in Missouri

Site Name(s)	No. of residential yards sampled	% of residential yards with lead contamination			No. of Drinking Wells sampled	% of drinking water wells with lead contamination	
		% of yards with concentration less than 400 mg/kg	% of yards with contamination above 400 mg/kg and less than 1,200 mg/kg	% of yards with contamination above 1,200 mg/kg		Wells above MCL for Lead (15 µg/L)	Wells above RAL for Lead (30 µg/L)
Southeast Missouri							
Mining Area							
Jefferson County	353	78% (276 yards)	16% (55 yards)	6% (22 yards)	304	6.6% (20 wells)	5.2% (16 wells)
Franklin County	112	96% (108 yards)	2.6% (3 yards)	0.9% (1 yard)	103	17.4% (18 wells)	1.9% (2 wells)
Washington County Lead District Sites	1,895	57.5% (1,090 yards)	34.3% (651 yards)	8.1% (154 yards)	1,340	16.3% (219 wells)	0.2% (3 wells)
Old Mines	864	70% (608 yards)	24% (208 yards)	5.5% (48 yards)	785	15.4% (121 wells)	--
Potosi	863	42.2% (363 yards)	46.3% (400 yards)	11.5% (100 yards)	427	21.5% (92 wells)	--
Richwoods	168	70.8% (119 yards)	25.5% (43 yards)	3.5% (6 yards)	128	4.6% (6 wells)	2.3% (3 wells)
Central Mining District Sites	610	99.1% (605 yards)	0.65% (4 yards)	0.16% (1 yards)	595	1.8% (11 wells)	3.2% (19 wells)
Morgan County	250	99.4% (249 yards)	0.4% (1 yard)	0% (0 yard)	244	0.4% (1 well)	3.2% (8 wells)
Cole County	111	99.1% (110 yards)	0.9% (1 yard)	0% (0 yard)	110	4.5% (5 wells)	3.6% (4 wells)
Camden County	27	100% (27 yards)	0% (0 yards)	0% (0 yards)	25	0.4% (1 wells)	0% (0 wells)
Miller County	137	99.2% (136 yards)	0.7% (1 yard)	0% (0 yards)	142	0.7% (1 well)	3.5% (5 wells)
Moniteau County	85	97.6% (83 yards)	1.2% (1 yard)	1.2% (1 yard)	72	2.7% (2 wells)	4.1% (3 wells)

By: Ron King
Date: September 4, 2007

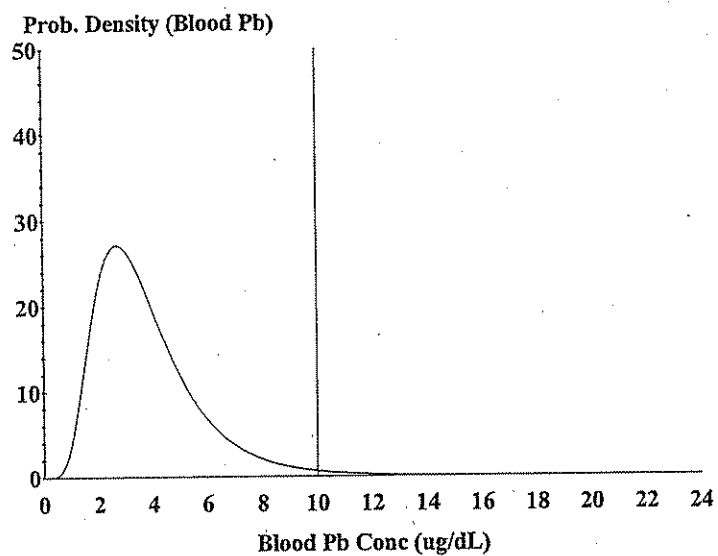
Attachment 1



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Geo Mean = 2.354
GSD = 1.600
% Above = 0.104
% Below = 99.896

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Time Step = Every 4 Hours
Run Mode = Research
Comment = 50 mg/kg & 15 ug/L

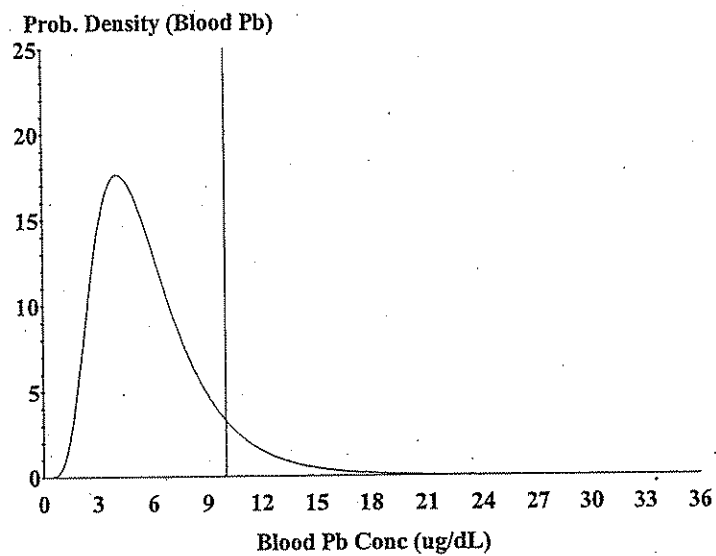
Attachment 2.



Cutoff = 10.000 ug/dl
Geo Mean = 3.485
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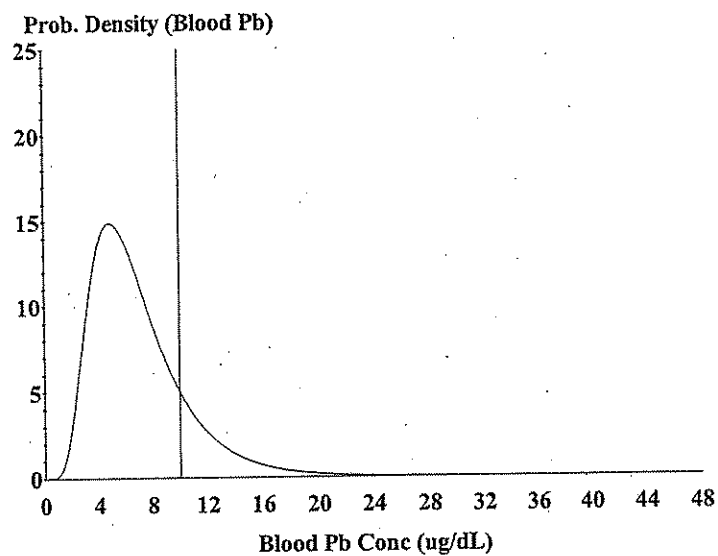
Attachment 3



Cutoff = 10.000 ug/dl
Geo Mean = 5.367
GSD = 1.600
% Above = 9.273
% Below = 90.727

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = 400 mg/kg & 15 ug/L

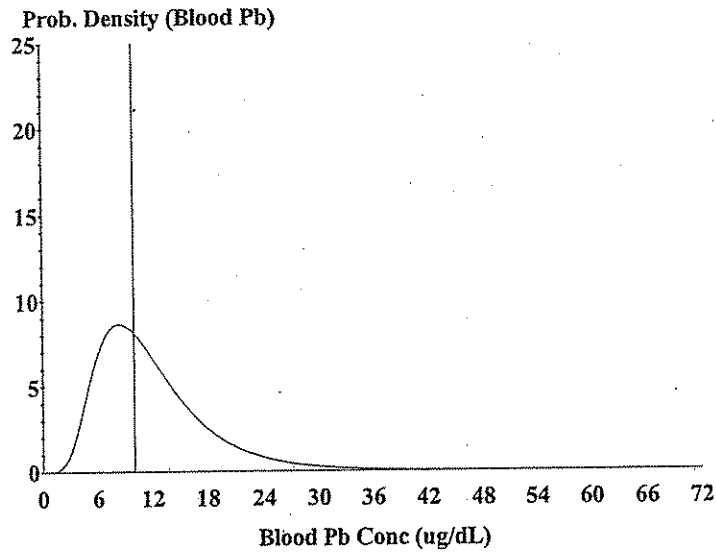
Attachment 4



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Geo Mean = 6.357
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% Above = 16.758
% Below = 83.242

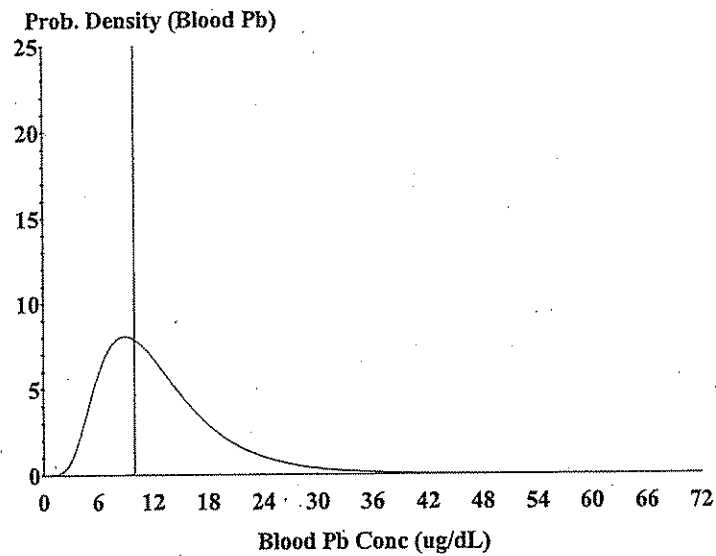
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Attachment 5



Cutoff = 10.000 ug/dl
Geo Mean = 10.940
GSD = 1.600
% Above = 57.582
% Below = 42.418

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = 1200 mg/kg & 15 ug/L



Cutoff = 10.000 ug/dl
Geo Mean = 11.717
GSD = 1.600
% Above = 63.197
% Below = 36.803

Age Range = 0 to 84 months
Time Step = Every 4 Hours
Run Mode = Research
Comment = 1200 mg/kg & 30 ug/L