Public Health Assessment for

ST. LOUIS SMELTING & REFINING COMPANY
COLLINSVILLE, MADISON COUNTY, ILLINOIS
EPA FACILITY ID: PAD982363970
JULY 18, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

Comment Period Ends:

SEPTEMBER 2, 2005

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment-Public Comment Release was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate. This document represents the agency's best efforts, based on currently available information, to fulfill the statutory criteria set out in CERCLA section 104 (i)(6) within a limited time frame. To the extent possible, it presents an assessment of potential risks to human health. Actions authorized by CERCLA section 104 (i)(11), or otherwise authorized by CERCLA, may be undertaken to prevent or mitigate human exposure or risks to human health. In addition, ATSDR will utilize this document to determine if follow-up health actions are appropriate at this time.

This document has previously been provided to EPA and the affected state in an initial release, as required by CERCLA section 104 (i) (6) (H) for their information and review. Where necessary, it has been revised in response to comments or additional relevant information provided by them to ATSDR. This revised document has now been released for a 30-day public comment period. Subsequent to the public comment period, ATSDR will address all public comments and revise or append the document as appropriate. The public health assessment will then be reissued. This will conclude the public health assessment 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.

Agency for Toxic Substances and Disease Registry....................................Julie L. Gerberding, M.D., M.P.H., Administrator
Thomas Sinks, Ph.D., M.S., Acting Director

Division of Health Assessment and Consultation…………………………………………..William Cibulas, Jr., Ph.D., Director
Sharon Williams-Fleetwood, Ph.D., Deputy Director

Community Involvement Branch...Germano E. Pereira, M.P.A., Chief

Exposure Investigations and Consultation Branch……………………….………………........ Susan M. Moore, Ph.D., Chief

Federal Facilities Assessment Branch………………………………………………………....Sandra G. Isaacs, B.S., Chief

Superfund and Program Assessment Branch .... Richard E. Gillig, M.C.P., Chief

Use of trade names is for identification only and does not constitute endorsement by the Public Health Service or the U.S. Department of Health and Human Services.

Please address comments regarding this report to:

Agency for Toxic Substances and Disease Registry
Attn: Division of Health Assessment and Consultation (E-60)
1600 Clifton Road, N.E., Atlanta, Georgia 30333

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR or
Visit our Home Page at: http://www.atsdr.cdc.gov

PUBLIC HEALTH ASSESSMENT

ST. LOUIS SMELTING AND REFINING COMPANY
COLLINSVILLE, MADISON COUNTY, ILLINOIS
EPA Facility ID: ILD980607006

Prepared by:

Illinois Department of Public Health
Under a cooperative agreement with the
Agency for Toxic Substances and Disease Registry
U.S. Department of Health and Human Services

Table of Contents

Summary

The St. Louis Smelting and Refining site is located in a residential area of Collinsville, Illinois. The St. Louis Smelting and Refining Company operated a lead smelter at the site from 1904 to 1933. After the facility closed, the equipment was moved off the site and the buildings were razed. The remaining slag and waste piles were either recycled for lead or otherwise moved off the site with the remainder spread across the site. Pine Lake residences were built on or near the site in the 1950s and the affected areas of the Collinwoods subdivision were built generally in the 1970s and 1980s.

Portions of the Collinwoods subdivision were built on top of the old facility and slag is visible on the soil surface. Slag also is visible in drainage ways and around an unnamed pond at the east end of Pine Lake Road. Surface soils are contaminated with lead, arsenic, cadmium, and antimony. Pine Lake was used by the smelting operation and its sediments are contaminated with lead.

Residents may be exposed to contaminated soils and sediments in portions of the Pine Lake and Collinwoods subdivisions by both inhalation and ingestion. In 2002, after a Comprehensive Environmental Response, Compensation, and Liability Act Expanded Site Inspection revealed additional contamination, the Illinois Environmental Protection Agency requested that the U.S. Environmental Protection Agency consider the site for a time-critical removal action. In September 2004, the time-critical removal began in residential yards.

Currently, the St. Louis Smelting and Refining site poses a public health hazard based on exposure to lead in residential soils. Limited blood lead sampling since 1995 has found only one of 32 samples greater than 10 micrograms per deciliter. Arsenic, cadmium, and antimony also were found at elevated concentrations in soil where lead levels exceeded 1,000 ppm.

Recommendations include removal of the contaminated surface soil in residential areas and removal of sediments in Pine Lake, the unnamed pond, and drainage ways associated with these two bodies of water. The Illinois Department of Public Health also recommends that children 6 years of age and younger have their blood lead level tested.

Purpose

The Illinois Environmental Protection Agency (Illinois EPA) asked the Illinois Department of Public Health (IDPH) to evaluate the data from their expanded site investigation to determine whether current conditions at the St. Louis Smelting and Refining site pose a public health hazard. The purpose of this public health assessment is to evaluate, based on the information currently available, any known or potential adverse human health effects if people are exposed to contaminants related to the site.

Background

Site Location

The St. Louis Smelting and Refining (SLSR) site is in the northeast section of Collinsville in Madison County, Illinois (Figure 1). The St. Louis Smelting and Refining Company owned as many as 482 acres with the primary operations covering approximately 40 acres. Originally, the site was located outside of Collinsville, but has since been incorporated into the town.

The site boundaries have not been clearly delineated and may increase or decrease in size as additional sampling information is collected during the remedial activities. The site boundaries are difficult to define because lead slag and contaminated materials were moved during demolition of the facility and construction of the subdivision. For this health assessment, the site is the area of interest shown in Figure 2. The area of interest was derived by placing a 500-foot buffer around each soil sample, collected prior to May 2002, with a lead concentration of 1,000 parts per million (ppm) or greater. The outer edges of all these buffers form the area of interest. Generally, the site is bounded by California Avenue to the south, by residential lots on the west, by Maple Leaf Road to the east, and by Peachtree Lane to the north.

Surface water in the area of interest includes the 5-acre Pine Lake in the western portion of the site and an unnamed pond at the east end of Pine Lake Road. The overflow for Pine Lake flows off the site down a creek and into the lake at Woodland Park. Woodland Park is southwest of the site. Drainage from much of the Collinwoods subdivision enters the unnamed pond via a drainage way south of Pine Lake Road. These features can be seen in Figure 2.

Figure 3 shows the residential area in a 1998 aerial photo with an overlay of the primary operations from a Sanborn Fire Insurance Map dated May 1926. As would be expected, most of the elevated soil lead concentrations occur in the area of the facility.

Site History

The St. Louis Smelting and Refining Company bought land northwest of Collinsville in 1903 and began lead smelting operations in 1904. The site was operated as a primary lead smelter from 1904 until 1933 (7). An aerial photograph indicated that the facility discharged process water or waste into Pine Lake. At its peak, the facility had 425 employees. In 1915, there were records regarding environmental damage from smoke and other airborne contaminants leaving the site. In 1917, a 386 foot-tall stack was constructed presumably to relieve some of the smoke and fume problems.

The plant closed on November 21, 1933 and the smelting and refining equipment was shipped to South America. Most of the remaining facility was dismantled between 1933 and 1941. A slag pile noted near the unnamed pond in a 1941 aerial photograph is not visible in a 1955 aerial photograph (7). Portions of the property were sold from 1937 to 1939. Eagle Picher owned 50 acres of the property, including the 40-acre facility, from 1966 to 1969. National Lead bought the assets from the St. Louis Smelting and Refining Company on an unknown date (7).

Residential development directly adjacent to Pine Lake began in the 1950s. The area east of the Pine Lake subdivision is known as the Collinwoods subdivision. Construction of homes in this addition of Collinwoods began in the 1970s. The most recent homes have been built on Hickory Point and are less than 10 years old (7).

The site was placed on the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) list in June 1981. In July 1985, a realtor contacted the Illinois EPA Collinsville office to report that a prospective buyer observed slag in the yard of one of the homes in the Collinwoods subdivision. Concern regarding smelter slag led to environmental sampling in 1985 and after.

The site was archived on the CERLIS list in 1989 based on the Preliminary Assessment and Site Inspection conducted by Illinois EPA. In November 2001, three sediment samples from Pine Lake were collected in preparation for dredging the lake. These samples had lead levels that would require the sediment to be disposed of as hazardous waste. The additional area of lead contamination and modifications made to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) since 1989 led to a CERCLA Expanded Site Inspection (ESI), which began in 2002.

The purpose of the ESI was to fully evaluate the site to fulfill CERCLA requirements. As part of the ESI, X-ray Fluorescence (XRF) technology was used to determine lead levels in soils. At a few of these locations, samples were sent to a laboratory for verification. Material tested during the ESI included sediment, soil, surface water, and fish.

In 2004, the U.S. Environmental Protection Agency (USEPA) and the potentially responsible parties (PRPs) entered into a time-critical removal action Administrative Order on Consent. The cleanup action level agreed upon by USEPA and the PRPs was 600 ppm of lead in soils with a depth ranging from the surface to 15 inches below grade. In gardens and play areas, the clean up depth extends to 24 inches. In July 2004, the PRPs’ contractor began collecting verification samples ahead of the clean up, which began in September 2004.

Environmental Sampling

Soil

After analysis of the slag indicated a lead level of 13,000 ppm, nine soil samples from two yards were collected by IDPH on July 16, 1985. The lead levels in the nine samples ranged from less than 12 ppm to 2,600 ppm with a mean of 760 ppm. On October 17, 1985, an additional 51 soil samples were collected from 26 yards. The lead levels in the 51 samples ranged from less than the detection limit to 9,130 ppm with a mean of 1,444 ppm. Illinois EPA collected two soil samples near the unnamed pond in September 1986. The lead levels were 981 ppm and 2,700 ppm.

In May 1991, Illinois EPA and IDPH collected twenty-five samples from nine yards. Areas sampled included gardens, play areas, front yards, and back yards of residential lots in the Collinwoods subdivision. The results of these samples are summarized in Table 1.

In March 2002, Illinois EPA collected residential soil samples as part of the CERCLA reassessment investigation. One hundred and ninety seven samples were collected from 82 sample locations on 31 properties. Soil sample XRF readings ranged from less than detection limits to 90,572 ppm with a mean value of 1,911 ppm.

From April 2002 through October 2003, a total of 627 samples were screened with an XRF for lead and of these 607 were for residential soils. Further, 534 of these residential samples were within or immediately adjacent to the area of interest. The XRF readings for lead in these 534 samples ranged from less than detection limits to 23,000 ppm with a mean value of 1,131 ppm. An additional 73 residential soil samples were from yards considered to be outside the area of interest. The XRF readings for lead in these 73 samples ranged from 20 to 452 ppm with a mean value of 75.8 ppm. The remaining 20 samples from 10 locations were collected in Woodland Park from the surface and at 6 inches below surface. The XRF readings had a range of lead levels from 29 ppm to 284 ppm with a mean value of 93 ppm.

During the residential soil sampling events of the CERCLA reassessment and the ESI, fourteen soil samples were analyzed in the laboratory for inorganic compounds. This included one background and two duplicate samples. The depths of these samples were from the surface to 18 inches below the surface with 10 samples collected at a depth of six inches or less. Table 2 contains the results of these samples. The range of some of the inorganics were

- lead - 100 ppm to 36,700 ppm,
- arsenic - 4.4 ppm to 682 ppm,
- cadmium - 0.43 ppm to 30.6 ppm, and
- antimony - 0.27 ppm to 55 ppm.

The sample that contained the highest arsenic levels was described by Illinois EPA as a fluffy, burgundy, waste-like material that did not appear to be soil. It should be noted that this was the only time this substance was encountered while sampling.

In September 2004, samples were collected by the PRPs to verify the extent of the lead contamination. The sampling plan called for a residential yard to be divided into quarters and samples collected at depths of 6 inches and 15 inches. At the end of September 2004, approximately 519 XRF readings were collected from 111 properties. XRF readings ranged from less than the detection limit to 76,484 ppm. Thirty-two samples from 8 locations were analyzed in a laboratory to verify the XRF readings. The soil lead levels ranged from 226 ppm to 22,400 ppm.

The work plan for soil removal in the residential areas includes a variety of safety measures to reduce exposure for the residents and the workers. Dust controls include wetting down areas where soil is being removed, where soil is exposed but a cover material has not yet been added, streets in the vicinity of the removal activities, and the waste piles in the staging area. The waste piles in the staging areas also are covered with plastic. Air monitoring and dust monitoring are performed in areas where remedial activities are taking place and around the staging area.

Slag

In July 1985, Illinois EPA collected a slag sample. This sample had a lead level of 13,000 ppm. Two more slag samples were collected in September 1986 and had lead levels of 13,200 ppm and 14,800 ppm. Many of the soil samples collected contained slag particles.

Sediment

On September 9, 1986, two sediment samples were collected from the sediment along the edge of the unnamed pond. A sample at one of the locations was difficult to collect due to the gravel sized slag on the bottom of the pond. These samples were analyzed for total lead and ranged from less than the detection limit to 338 ppm.

In November 2001, a resident of the Pine Lake subdivision collected three sediment samples from Pine Lake. A sample was collected from each “finger” of Pine Lake. The results of these samples are listed in Table 3.

In March 2002, Illinois EPA collected and tested sediment samples from Pine Lake, the lake in Woodland Park, the drainage way between Pine Lake and the lake in Woodland Park, the unnamed pond, and the small pond north of Pine Lake. Pine Lake had the highest level of lead, with an XRF reading of 86,374 ppm. The unnamed pond had an XRF reading of 2,099 ppm lead. Table 4 summarizes this XRF data.

On June 26, 2002, 33 sediment samples were collected from 11 locations in and around the bathing beach on Pine Lake. Samples were collected at the sediment surface, and six and twelve inches deep at each location. These additional sediment samples were collected because it was expected that residents were more likely to come in contact with sediments in these locations. The XRF readings for lead in these sediment samples ranged from less than the level of detection to 4,989 ppm with a mean value for all samples of 450 ppm.

Surface Water

One pond water sample was collected from the unnamed pond on September 9, 1986. The lead level in this water sample was 0.005 ppm. In addition, a soil seep sample was collected from the dike of the unnamed pond. The lead concentration in the seep water was less than the detection limit.

On July 29, 2002, eighteen surface water samples were collected from six locations in Pine Lake. A shallow, middle-depth, and deep surface water sample was collected at each location. These samples were analyzed for inorganic compounds, semi-volatile organic compounds, PCBs, and pesticides. The lead levels in these samples ranged from less than the detection limit to 30.5 micrograms per liter (μg/L).

Air

Air samples are being collected in association with the remedial activities at both the homes where the yards are being remediated and the staging area. Air monitoring consists of personal data monitors that collect a dust sample that is analyzed in a laboratory and real-time aerosol monitors that measure dust levels in air. The units are placed side by side at three locations during remedial activities. One is placed upwind, another downwind, and the third is placed at the nearest exposure point in a home, which is usually a door or window closest to the removal activity. The personal data monitors are used to collect dust samples the first 3 days of the month, for each month worked. These samples are analyzed in a laboratory for lead. If no lead is detected then the personal data monitors are not used until the next month, however real-time dust levels in air are recorded continuously during soil removal activities. No lead levels were greater than the detection limit for the September or October 2004 air samples. Dust levels in air have not exceeded site specific guidelines for dust in air.

Fish

In March 2002, the Illinois Department of Natural Resources collected fillets from largemouth bass, bluegill, and crappie. Two size classes of largemouth bass were collected, one class had an average weight of 0.3 pounds and the other class was 1.3 pounds. In addition, one large channel catfish was later collected by Illinois EPA. All fish tissue samples were less than the detection limit for lead. The detection limit ranged from 1.2 mg/kg to 2.6 mg/kg depending on the sample.

Blood

On October 16, 1985, IDPH conducted a voluntary blood lead screening of children in the Collinwoods subdivision. Emphasis was on screening children six years of age and younger; however, the screening was available to children of all ages. The screening method used was erythrocyte protoporphyrine. Details of the blood lead sampling can be found later in the document in the Health Outcome Data section.

Site Visits

IDPH representatives have conducted numerous site visits since July 1985. In 1985, site visits were made to collect surface soil samples and to screen children's blood for zinc protoporphyrin (ZPP). Slag was evident on the surface soil at several locations. In 1987, IDPH and Illinois EPA collected surface soil samples at a residence near the site. Large amounts of slag were noted near the unnamed pond at the east end of Pine Lake Drive. The drainage way south of Pine Lake Road, which drains into the unnamed pond, has visible slag in portions of the banks and bottom. In 1991, IDPH and Illinois EPA collected soil samples from gardens located at the site. In 2002, the site was visited several times to observe soil, water, sediment, and fish sample collection and discuss the contamination with residents.

On October 7, 2004, IDPH personnel visited the site to observe remedial activities along Raintree Trail. Remedial activities were observed in various stages of completion. The most notable aspects of the soil removal was that around the drip line of large trees only the surface soil, sometimes as little as 1 to 3 inches, was removed prior to filling with clean soil. Shrubs were also left in place with little soil removal occurring in those areas. In some yards, large sections of the yard are under the drip line of trees. Subsequently, little soil is removed from large areas of the yard, and contaminated soil is only a few inches below the ground surface.

Discussion

Chemicals of Interest

IDPH compared the maximum level of each chemical detected during environmental sampling with appropriate screening comparison values to select contaminants for further evaluation for carcinogenic and non-carcinogenic health endpoints (1). Chemicals that exceeded comparison values were selected for further evaluation. A description of each of the comparison values used is found in Attachment 1.

The comparison values are used only to select chemicals that should be evaluated further and do not represent thresholds of toxicity. Though some of these chemicals may exist at levels greater than comparison values, they can only affect someone who is exposed and receives a high enough dose for adverse health effects to occur. Whether exposure to a chemical will cause adverse health effects depends on how much has entered the body, the duration of the exposure, how the chemical entered the body, and how the body responds. The chemicals of interest at this site are lead, arsenic, cadmium, antimony, manganese, thallium, nickel, and zinc.

Antimony, arsenic, lead, and manganese levels in Pine Lake water samples exceed comparison values for drinking water. Pine Lake is used for swimming and fishing; however, it is not a source of drinking water. Chemicals of interest in sediments from Pine Lake, the unnamed pond, and nearby creeks were antimony, arsenic, cadmium, lead, manganese, nickel, and thallium. During dry periods some of the sediments in Pine Lake and the unnamed pond are exposed. The sediments from creeks and drainage ways on and around the site are exposed most of the time. Chemicals of interest in soil are antimony, arsenic, cadmium, lead, thallium, and zinc.

Exposure Pathways

Adverse health effects may occur when a contaminant reaches a receptor population through an exposure pathway. These pathways are separated into completed and potential pathways (4). Completed exposure pathways consist of five elements: 1) a source of contamination, 2) transport through an environmental medium, 3) a point of exposure, 4) a route of human exposure, and 5) an exposed population. Potential exposure pathways have at least one element missing, but the missing element could exist. Potential exposure pathways suggest that exposure could have occurred in the past, could be occurring, or could occur in the future. An exposure pathway is eliminated if one or more of the elements is missing and will never be present.

The completed exposure pathways associated with the site are summarized in Table 5. Likely routes of exposure to residents near the SLSR site include ingestion and possible inhalation of contaminated soils and dust during recreational activities. Because of their behavior and play, children ingest a certain amount of soil daily. Children who exhibit frequent hand-to-mouth activity may ingest much more soil. Adults ingest a small amount of soil daily through accidental hand-to-mouth transfer. Playing in the soil, gardening, or digging in contaminated soil will increase exposure of area residents. Residents using Pine Lake or the unnamed pond and coming into contact with sediments would add to the exposure already occurring from soil.

Toxicological Evaluation

IDPH estimated exposure doses for the chemicals of interest and completed exposure pathways. These doses were compared with health guidelines for non-cancer health effects. The exposure estimates for surface soil are based on a 16 kg child exposed to the maximum level of contaminants in soil with 50 percent of metals contacted absorbed and assumes that the child ingests 200 milligrams of soil 5 days a week for 40 weeks per year. For adult exposure to surface soil IDPH assumed a 70 kilograms adult would incidentally ingest 100 mg of soil 5 days a week for 40 weeks per year and 50 percent of metals contacted would be absorbed (Table 6). An increased risk of non-cancer adverse health effects in children may exist from exposure to lead, cadmium, and antimony in soil near the site. Exposure to arsenic in soil would be expected to cause no apparent increased risk of cancer for adults or children (Table 7).

Exposure to thallium and zinc in the soil would not be expected to cause any adverse health effects for either children or adults.

For sediment exposure IDPH assumed a 16 kg child would incidentally ingest 50 mg of soil 5 days a week for 40 weeks per year. For adults, IDPH used the same scenario with a body weight of 70 kg (Table 6). Exposure to chemicals in sediment would not be expected to cause adverse health effects in adults or children.

Lead

Exposure to lead can cause adverse health effects, especially for young children and pregnant women, since it is a neurotoxin that permanently interrupts normal brain development. Lead has no beneficial biological function and is known to accumulate in the body. No safe threshold has been identified. The U.S. Food and Drug Administration published a provisional tolerable daily lead intake value of 6 micrograms for a 10-kg child based on a blood lead level of 10 micrograms per deciliter (μg/dL). A survey of a variety of foods determined the average adult lead intake to be 54 micrograms per day (μg/day) (4).

The primary exposure routes to lead are inhalation and ingestion. Lead is not readily absorbed through the skin. Children, especially those who are preschool age, are at particular risk if exposed to lead because they ingest more lead through normal hand-to-mouth activity, absorb more of the lead they ingest, and are most sensitive to its effects.

Lead exposure may cause learning difficulties and reduce the growth of young children. Exposure to lead is also dangerous for the fetus because lead can adversely affect the developing organ systems, particularly the nervous system. Lead easily crosses the placenta and appears in umbilical cord blood at nearly the same concentration as in the mother=s blood (4). Lead exposure in middle-aged men may increase blood pressure.

The IDPH Lead Poisoning Prevention Code states that the permissible limit of lead in bare soil that is readily accessible to children is 400 ppm. Exposure to average lead levels in a yard greater than 1,000 ppm may increase lead uptake into the body. Lead levels as high as 36,700 ppm have been identified in lab analyzed soil samples in the area. Lead concentrations in Pine Lake sediments have been identified as high as 35,900 ppm. In addition, lead concentrations in the unnamed pond sediments have been identified at 5,840 ppm.

Because levels greater than 1,000 ppm were detected in and near the site, IDPH recommended that children 6 years of age or younger residing in, or having contact with soil in the area of interest have their blood tested for lead to find out if they were being exposed to lead in the soil.

Arsenic

The population exposed to arsenic would likely be the same as those exposed to lead. Soil exposure may occur by ingestion or inhalation. Arsenic is a known human carcinogen by inhalation and ingestion.

Non-carcinogenic effects that may be associated with arsenic include irritation of the stomach and intestines with symptoms of nausea, vomiting, and diarrhea, a decrease in the production of red and white blood cells, abnormal heart function, blood vessel damage, and impaired nerve function that causes a "pins and needles" sensation in the hands and feet.

Long-term ingestion of arsenic may also lead to a pattern of skin changes including a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso. These skin changes may later develop into skin cancer. Chronic ingestion of arsenic has also been reported to increase the risk of liver, bladder, kidney, and lung cancers.

Arsenic levels were reported with all XRF readings; however, there can be an instrument interference when lead is present at high levels, as it is at this site. The highest level of arsenic in the soil samples was collected from a small layer of waste material located 6 to 8 inches below the ground surface. At this depth, the arsenic would not be easily accessible. The concentration used to calculate the exposures to arsenic was taken from the highest level found in the top 6 inches of soil. This arsenic concentration is 28.8 ppm. Exposure to arsenic in soils at this level would not be expected to cause adverse health effects.

Antimony

There are no human data for low-level, long-term ingestion of antimony. Animal data from low levels of exposure to antimony over long periods of time include slight changes in the liver and increased cholesterol and decreased glucose in blood. A chronic oral reference dose (RfD) has been established for humans based on this animal data. Exposure estimates for children to antimony in soil are equal to, but do not exceed the chronic oral RfD level. Exposure estimates for sediment are much less than this chronic oral RfD. No adverse health effects would be expected from exposure to antimony at the site.

Cadmium

Oral cadmium exposure in humans has been associated with kidney effects. Exposure estimates for children contacting the maximum level of cadmium in surface soils do not exceed, but are equal to the no-observed-effect level. No adverse health effects would be expected from exposure to the highest level of cadmium detected in the soil. Estimated exposures to cadmium in sediment are small, so even when combined with the estimated soil exposure, there is no change in the overall estimated exposure.

Health Outcome Data

On October 16, 1985, IDPH used the mobile lead screening van to conduct an erythrocyte protoporphyrin (EP) screening in the vicinity of the SLSR site. Forty children under the age of fourteen were screened. The EP levels ranged between 6-21 µg/dL. The mean EP level was 12 µg/dL. In 1985, CDC introduced a lower screening level for whole blood lead levels in children of 25 µg/dL or greater. The intervention level had been 30 µg/dL or greater prior to 1985. Furthermore, CDC defined lead toxicity in 1985 as, "an elevated blood lead level with an EP level of 35 ug/dL or greater (formerly 50 ug/dL or greater)" (5). Based on the results of the samples collected in 1985 the children in the vicinity of the site did not have elevated EP levels.

In 1991 the intervention level for blood lead was lowered from 25 µg/dL to 10 µg/dL. As a result, the EP test was discontinued as a screening tool because EP is not sensitive enough at blood lead levels less than 25 µg/dL in children. The results of the samples collected in 1985 indicated that the children in the vicinity of the site did not have elevated EP levels and would not have been expected to have blood lead levels greater than 25 µg/dL. However, the results of the 1985 EP screening cannot be used to assess whether or not the children were below the current intervention level of 10 µg/dL blood lead because the instrument is not accurate in predicting blood levels below 25 µg/dL.

In May 2002, 320 letters were sent to residents recommending that all children six years of age and younger that live or spend much of their time at these homes have their blood tested for lead. These letters were sent to homes within the area of interest (Figure 2), including homes on all of Raintree Trail, Lemontree Lane, Lemontree Circle, Aspen, Pine Lake Drive, Briarwood, Tessy Lane, Dogwood Trail, Pinehurst Court, Banyan Tree Road, Cedar Point, Hickory Point, Driftwood Lane, and portions of Pine Lake Road, California Avenue, Peachtree, and Ravenwood. Homes falling in this area do not necessarily have soil lead levels greater than 1,000 ppm.

IDPH reviewed a department database for children tested for lead as part of a statewide screening program. In addition, a few residents sent in their children's blood lead results directly to IDPH. Blood lead samples were collected either by the finger stick or venipuncture methods. From 1995 through 2003, 31 blood samples were collected from children aged 6 years or younger living in the area where children were requested to have their blood lead levels measured. Blood lead levels ranged from 1 to 11 μg/dL, with an average level of 3.5 μg/dL. Based on the 2000 census, the estimated number of children less than 5 years of age, living in the area where parents were requested to have their children's blood lead levels measured, was 65. The largest numbers of children, 6 years of age and younger, tested in one year was 10 and of these, 7 were children under 5 years of age. This represents a testing rate for children less than 5 years of age of approximately 10% in the year with the highest participation rate.

In Illinois, any child with a blood lead level between 10 μg/dL and 14 μg/dL is tested again in a few months. If the confirmed blood level is at least 15 μg/dL, case follow-up is conducted. If a blood lead level of at least 20 μg/dL is detected, IDPH conducts an environmental investigation.

Community Health Concerns

IDPH visited the site numerous times to collect samples, observe Illinois EPA sampling activities, and to talk with residents in the area. IDPH contacted 320 residents by mail recommending that their children have their blood lead level tested, and included the fact sheet entitled "Reducing Exposure to Contaminants in Soil." IDPH, Illinois EPA, and USEPA have held several public meetings and availability sessions in the past three years to keep residents up-to-date and answer health-related questions and concerns regarding exposures to contaminants associated with the site. The following information is a summary of the health concerns expressed and our answers to these questions.

Should I let my children/grandchildren play in the yard?

Children who live and play in a contaminated area can have increased exposure. Preschool-age children are more likely to be exposed because of their frequent hand-to-mouth activity. By taking the following measures, you can protect your children from exposure:

$ Wash children's hands and faces frequently, especially before eating and at bedtime. Keep their fingernails clean and short. Discourage children from placing fingers and non-food items in their mouths.
$ Frequently clean toys or objects that children put in their mouths.
$ Remove shoes upon entering your home to prevent tracking contaminated soil inside.
$ Provide a covered sandbox to encourage play in the sandbox rather than digging in the soil.

Is it safe for me to work in the yard/garden?

Although children are at the greatest risk for exposures to soil contaminants because of their frequent hand-to-mouth activity, adults may also ingest a certain amount of soil daily, through accidental hand-to-mouth transfer. Activities such as gardening, or excavating contaminated soil could increase their exposure. To reduce or prevent exposure to contaminants in soil, adults should follow the same measures discussed above including practicing good personal hygiene habits and housekeeping techniques.

Is it safe to swim in Pine Lake?

Lead and other metals associated with past operations are not easily absorbed through the skin. Swimming would not be a significant source of exposure. However, the sediments in the lake contain high levels of lead and should be avoided. The bathing beach has had sand brought in and this would reduce contact with contaminated sediments in Pine Lake. You can protect your children from exposure to sediments by using the same measures as were listed under the question "*Should I let my children/grandchildren play in the yard?*."

Is it safe to eat fish caught from Pine Lake?

Fish in Pine Lake did not have detectable levels of lead; however, other chemicals of interest were not analyzed in these fish. Since lead was not detected in the fish, IDPH does not recommend reducing consumption of fish caught in Pine Lake. Persons should follow the fish consumption advice in the Illinois Fishing Information guide published yearly by the Illinois Department of Natural Resources. A copy can be obtained by calling 217-782-7498.

Can I eat vegetables grown in my garden?

The most important route of exposure to lead is through ingestion of contaminated soil and dust. In soils with high levels of lead, a small amount of lead could be taken up into the plant; however, the greater risk is eating contaminated soil and dust on the plant rather than uptake of lead by the plant. Lead levels in five garden soil samples were less than 500 ppm, which would not be expected to cause any adverse health effects. Before consuming any garden vegetables, you should thoroughly wash the produce with warm soapy water.

Isn't there going to be more exposure to residents while removing the contaminated soil than there would be if it was left in place?

There would be expected to be some increase in exposure with removal of soil. However, it should not be significant if the planned safety measures are followed. Additionally, there will be a reduction in exposure after the contaminants are removed.

I live near the contaminated soil staging area and have children, should I have my children tested?

The staging area has several controls in place that should reduce exposure of residents and workers to the contaminated soil. The soil is to be kept constantly wet to reduce the creation of dust. The piles will be covered with plastic to keep them from drying out. The soils are being treated to reduce the mobility of the lead. The final decision to have your children tested should be made by the resident and the physician.

Child Health Considerations

IDPH and ATSDR recognize that children are especially sensitive to some contaminants including lead, which is the primary contaminant at this site. For this reason, IDPH included children when evaluating exposures to contaminants. Children are the most sensitive population considered in this health assessment because of their frequent hand-to-mouth play habits.

Conclusions

On the basis of the information reviewed, IDPH concludes the St. Louis Smelting and Refining site poses a public health hazard for individuals contacting contaminated soil. The contaminated soil is in residential yards and can be easily contacted. Results of blood lead samples suggest current exposure to lead in soil is minimal; however, this is based on a limited number of samples. The blood test does not provide information on past or possible future exposures. IDPH educational efforts on reducing exposure to contaminants in soil also may have influenced lead levels. No health effects are expected from exposure to cadmium, arsenic, and antimony in soils in the area of interest. High soil levels of arsenic, cadmium, and antimony are associated with lead levels greater than 1,000 ppm and will be removed with the lead contaminated soil greater than 600 ppm. Based on the available data, the soils and lake in Woodland Park do not have elevated lead levels. Exposure to lead from fish and surface water in Pine Lake do not pose a health hazard.

Recommendations

IDPH recommends that:

1) The contaminated surface soil associated with the St. Louis Smelting and Refining site be removed and replaced with clean soil. It is understood that all the contaminated materials cannot easily be removed as the waste varies in depth and was redistributed in many areas.

2) A barrier be placed between the clean soil and contaminated soil below. In areas where this is not feasible, the residents should be notified in writing where a barrier does not delineate areas of contaminated soil and what the depth to contamination is in this area.

3) Airborne lead levels continue to be monitored throughout the removal action.

4) Children 6 years of age and younger, living in the area of interest, have their blood tested to determine their blood lead concentration.

5) Sediments, from Pine Lake and contaminated drainage ways, which are easily accessible or exposed during dry periods, should be removed to reduce exposures.

Public Health Actions

IDPH has undertaken public health actions to address issues and concerns about potential adverse human health effects associated with contaminants present at the site. The actions taken and recommended are described as follows:

- IDPH screened children in the Collinwoods subdivision on October 16, 1985.

- Illinois EPA collected environmental samples from residential areas from March 2002 to October 2003. IDPH reviewed all sample results and provided written explanations to the homeowners.

- IDPH distributed educational material including a fact sheet on how to reduce exposures to contaminants in soil to all residents in the area of interest.

- IDPH reviewed a department database for children tested for lead as part of a statewide screening program. From 1995 through 2003, 31 blood samples were collected from children ages 6 years or younger living in the area of interest. Blood lead levels ranged from 1 to 11 micrograms per deciliter (μg/dL), with an average level of 3.5 μg/dL. Only one blood lead level was slightly elevated in this data set.

- IDPH provided community health education through public availability sessions. On May 14, 2002, an availability session for Pine Lake residents was held with Illinois EPA staff. Three additional availability sessions have been held in 2002-2004. Other agencies present were Illinois EPA and USEPA, and representatives from the city of Collinsville, Illinois.

- Information on how to reduce exposure to contaminants in soil was included in Illinois EPA mailings sent to residents in the vicinity of the site.

- IDPH will continue to educate persons living in the area on how to reduce exposure to site-related contaminants as needed.

Preparers of Report

Preparer
David Webb
Environmental Toxicologist
Illinois Department of Public Health

Reviewer
Jennifer Davis
Environmental Toxicologist
Illinois Department of Public Health

ATSDR Regional Representative
Mark Johnson
Regional Operations, Office of the Assistant Administrator

ATSDR Technical Project Officers
Charisse Walcott
Division of Health Assessment and Consultation

Steve Inserra
Division of Health Studies

Sylvia Allen-Lewis
Division of Health Assessment and Consultation

References

1. Agency for Toxic Substances and Disease Registry. Comparison values for air, drinking water, and soil. Atlanta: US Department of Health and Human Services; 2004.

2. Agency for Toxic Substances and Disease Registry. Public health assessment guidance manual. Atlanta: US Department of Health and Human Services; 1992.

3. Agency for Toxic Substances and Disease Registry. Toxicological profile for antimony. Atlanta: US Department of Health and Human Services; 1992 September.

4. Agency for Toxic Substances and Disease Registry. Toxicological profile for lead. Atlanta: US Department of Health and Human Services; 1999 July.

5. CDC (Centers for Disease Control). Preventing lead poisoning in young children: a statement by the Centers for Disease Control. Atlanta: CDC, 1985; CDC report no. 99-2230.

6. CDC. 1991. Preventing lead poisoning in young children. Atlanta, GA: US Department of Health and Human Services, Public Health Service, Centers for Disease Control.

7. CERCLA Expanded Site Inspection. St. Louis Smelting and Refining, Madison County, Collinsville, Illinois, ILD980607006. IEPA. September 19, 2003.

8. Envirodyne Engineers. Letter from Richard Mannz, Envirodyne Engineers to Sue Doubet, IEPA with sampling results from September 9, 1986 samples. October 13, 1986.

9. Illinois Department of Public Health. Lead Poisoning Prevention Code. 1995 March.

10. Jerry Willman telephone conversation regarding sample X111. October 22, 2004.

11. Memorandum. R.L. Johnson to J. Janssen. Superfund - Technical Report on Collinwoods. September 10, 1986.

12. St. Louis Smelting and Refining - a.k.a. Collinwood Subdivision, Collinsville, IL. EPA Region V. Pollution Report #1 – Initial. September 17, 2004.

Tables

Table 1. Locations and lead concentrations of May 1991 samples

Location	Number of Samples	Lead Concentration in ppm	
		Range	Mean
Garden	5	9-140	80
Play Areas	4	11-1,500	770
Front Yard	6	20-1,200	345
Back Yard	10*[1]	20-4,700	1,850

ppm = parts per million
* - includes one duplicate sample
1- duplicate sample not used in calculation of range or mean

Table 2. Laboratory analyses of soil samples from the CERCLA Reassessment and the Expanded Site Investigation.

Sample Depth	0"	1-3"	1-3"	0"	1-2"	3"	0-2"	3-6"	3-6"	12"	12-18"	6-8"	6"	12"
Sample Number	X101	X102 [1]	X103 [1]	X104	X105	X106	X115 [2]	X107 [3]	X108 [3]	X109	X110 [4]	X111 [4,5]	X112	X113
Analyte														
Aluminum	4610	7970	6180	8050	6050	6940	5360	9420	9980	4830	1950	2700	9400	6700
Antimony	**55**	**4.9**	**5.3**	**8.8**	**1.3**	***1***	**0.27**	**13.9**	**13.8**	***0.29***	**4.6**	**18.7**	**0.43**	**0.39**
Arsenic	28.8	12.9	12.4	11.5	9.9	11.6	4.4	7.5	6.9	4.4	33.4	682	6.4	5.9
Barium	250	359	349	317	110	150	246	**495**	**445**	**489**	**92.1**	**139**	**173**	**153**
Beryllium	0.52	0.84	0.68	0.75	0.53	0.92	0.4	**0.89**	**0.93**	**0.39**	**0.21**	**0.12**	**0.48**	**0.47**
Cadmium	30.6	16	16.2	1.1	17.4	9	1.2	**7.9**	**6.2**	**2.3**	**7.3**	**10**	**0.43**	**1.3**
Calcium	17700	15200	23500	32000	55900	37000	3010	21100	23800	2370	2830	11600	2410	4840
Chromium	10.5	13.4	9.9	13.4	10.7	17.3	**9.2**	**8.4**	**7.8**	**7.9**	**5.8**	**14.6**	**12.5**	**11.8**
Cobalt	**44.1**	**14.9**	**70.6**	**225**	**33.8**	**137**	7.3	15	16.6	6.7	9.4	33.5	6.3	8.3
Copper	526	70.8	99.1	321	58.6	80.8	11.6	91.3	88.4	11.5	521	733	12.8	23.9
Iron	30700	29400	28700	63100	16800	29500	9650	64600	73400	8770	42400	68700	14700	15200
Lead	**36700**	**6730**	**6550**	**6680**	**2730**	389	**122**	**16400**	**15700**	**500**	**1920**	**5260**	**100**	**463**
Magnesium	2170	4700	4280	8350	3720	14500	1440	620	597	871	28.4	162	608	481
Manganese	1220	616	592	780	1100	2030	747	620	597	871	28.4	162	608	481
Mercury	0.64	0.28	0.23	0.07	0.57	0.09	0.08	0.22	0.21	0.12	0.4	0.37	0.1	0.14
Nickel	211	32.6	36.1	163	32.5	460	**12.3**	**19.3**	**16.9**	**11.2**	**21.3**	**134**	**13.8**	**16.5**
Potassium	1180	1700	1330	2480	720	1210	**795**	**1840**	**2040**	**522**	**567**	**537**	**651**	**640**
Selenium	3.5	0.85	0.94	1.3	*0.66*	2.4	**1.5**	**3.6**	**3**	**0.77**	**3.2**	**2.8**	**1.2**	**1.5**
Silver	10.9	**0.37**	**0.48**	*0.28*	*0.29*	*0.36*	***0.17***	**0.4**	**0.38**	***0.19***	**2.4**	**6.7**	***0.19***	***0.18***
Sodium	924	2490	2560	**5850**	1160	1620	**99.5**	*351*	1360	98.9	*64*	*72.6*	96	228
Thallium	**1.5**	*1.2*	*1.2*	**2.6**	*1.1*	*1.4*	***0.52***	***0.55***	***0.51***	***0.58***	**0.9**	**7.5**	***0.57***	***0.54***
Vanadium	16.8	23	19.3	17.4	22	28.1	17	25.8	24.8	15.5	13.3	37.8	23.3	21.7
Zinc	**775**	**3390**	**3970**	**10000**	**698**	**1460**	**82.6**	**22700**	**24500**	**110**	**1100**	**3710**	**50.9**	**116**
Cyanide	**0.4**	***0.06***	***0.06***	***0.05***	***0.05***	***0.07***	0.13	0.28	0.39	0.13	0.37	0.17	0.11	0.13

Bold = Estimated Value
Italics = Not detected above reporting limits
1 – Sample X102 and X103 duplicate samples
2 – Sample X115 is a background sample
3 – Sample X107 and X108 duplicate samples
4 – Samples X110 and X111 Co-located
5 – Sample X111 was described as silt with burgundy staining

Table 3. November 2001 Sediment Sample Results from Pine Lake

Sample Location	Total Lead (in mg/kg)	TCLP Lead (in mg/L)	Total Arsenic (in mg/kg)
Area 1	2,310	26.9	17.5
Area 2	2,680	31.9	6.89
Area 3	6,220	12.7	7.35

mg/kg = milligrams per kilogram
mg/L = milligrams per Liter
TCLP = Toxicity Characteristic Leaching Procedure

Table 4. March 2002 XRF readings from sediments near the SLSR site

Location	Number of Sample Locations	Range of Lead Concentration in ppm
Pine Lake	16	BDL - 86,374
Lake in Woodland Park	3	40 - 357
Drainage way*	2	BDL - 419
Unnamed Pond	2	37 - 2,099
Pond north of Pine Lake	1	36 - 82

Generally 4 samples, at different depths, were collected from each location
* - Drainage way drains overflow from Pine Lake into lake in Woodland Park
BDL = Below Detection Limit

Table 5. Completed Exposure Pathway

Pathway Name	Source	Medium	Exposure Point	Exposure Route	Receptor Population	Time of Exposure	Exposure Activities	Estimated Number Exposed	Chemicals
On-site Surface Soil	Soil/dust	Soil	Yards	Ingestion Inhalation	Residents	Past Present Future	Outdoor recreation; Gardening; Lawn Mowing; Remediation Activities	800 total 65 less than five years old	Lead, Arsenic, Cadmium, Antimony
On-site Surface Soil	Soil/dust	Soil	Yards	Ingestion Inhalation	Remediation Workers	Present Future	Remedial Activities	40	Lead, Arsenic, Cadmium, Antimony
Pine Lake and Unnamed Pond Sediments	Pine Lake Unnamed Pond	Sediment	Pine Lake and Unnamed Pond bottom	Ingestion	Residents	Past Present Future	Swimming, fishing, playing in exposed sediments	110	Lead, Arsenic, Cadmium, Antimony

Table 6. Estimated Exposure Doses that Exceed Health Guidelines

Pathway	Estimated Exposure Dose (in milligrams per kilogram-day)	Health Guideline (in milligrams per kilogram-day)	Source
Antimony			
Child, Surface Soil	0.0004	0.0004	USEPA RfD
Cadmium			
Child, Surface Soil	0.0002	0.0002	ATSDR MRL

Table 7. Estimated Cancer Risk

IDPH estimated cancer risk for children exposed to arsenic in soil for 20 out of 70 years and estimated cancer risk for adults exposed to arsenic in soil for 30 out of 70 years.

Age and Pathway	Estimated Dose	Potency Factor	Estimated Cancer Risk
Adult, Surface Soil	0.00001	1.5	6.4×10^{-6}
Child, Surface Soil	0.0002	1.5	8.6×10^{-5}

Figures

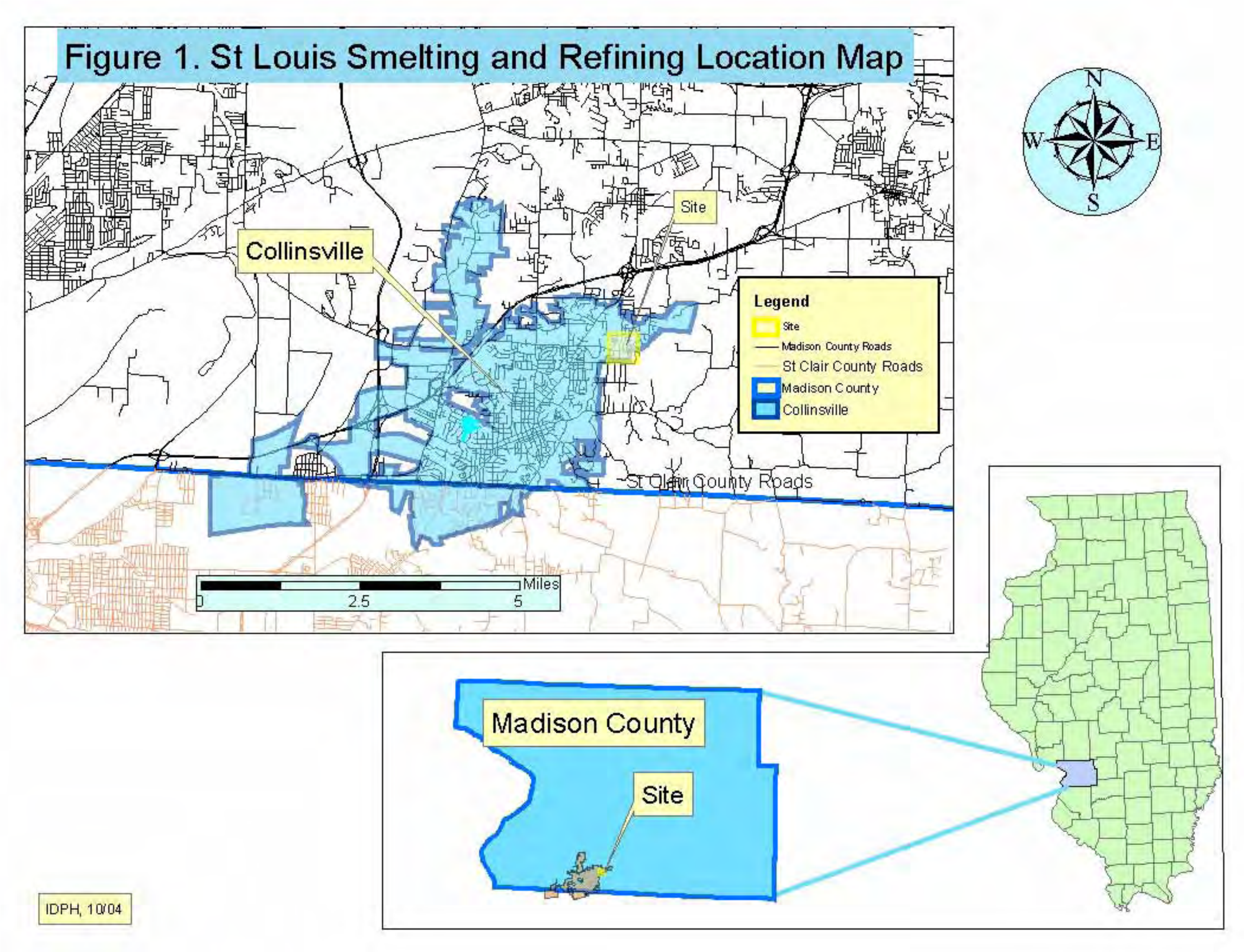
Figure 1. St Louis Smelting and Refining Location Map
Collinsville
Site
Legend
Site
Madison County Roads
St Clair County Roads
Madison County
Collinsville
St Clair County Roads
Miles
0
2.5
5
N
S
W
E
Madison County
Site
IDPH, 10/04

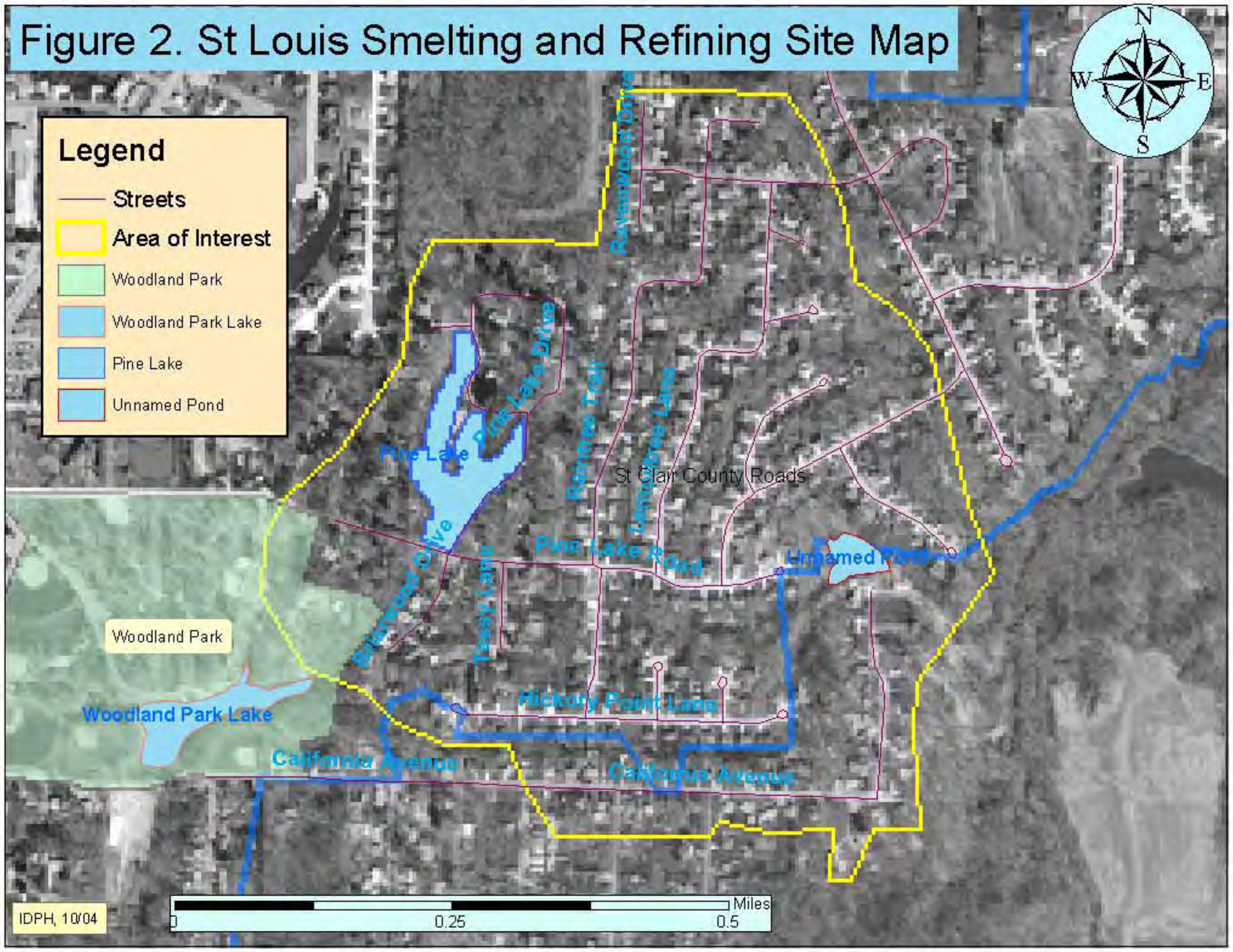
Figure 2. St Louis Smelting and Refining Site Map
Legend
Streets
Area of Interest
Woodland Park
Woodland Park Lake
Pine Lake
Unnamed Pond
N
S
W
E
Woodland Park
Woodland Park Lake
Pine Lake
Pine Lake Drive
Ravenwood Drive
Raintree Trail
St Clair County Roads
Pine Lake Road
Unnamed Pond
Teasy Lane
Hickory Point Lane
California Avenue
California Avenue
IDPH, 10/04
0
0.25
0.5
Miles

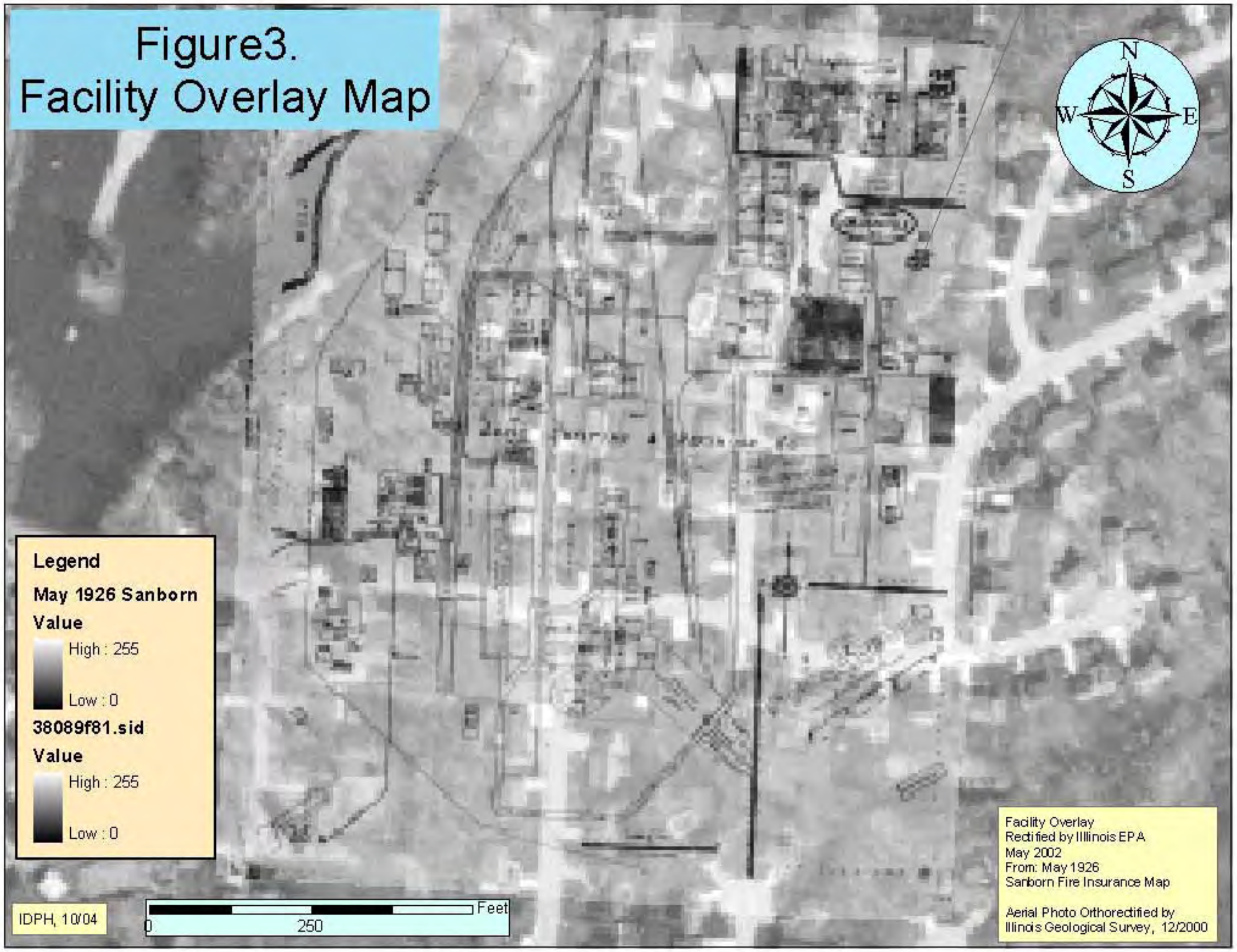
Figure3.
Facility Overlay Map
N
S
E
W
Legend
May 1926 Sanborn
Value
High : 255
Low : 0
38089f81.sid
Value
High : 255
Low : 0
IDPH, 10/04
0
250
Feet
Facility Overlay
Rectified by Illinois EPA
May 2002
From: May 1926
Sanborn Fire Insurance Map
Aerial Photo Orthorectified by
Illinois Geological Survey, 12/2000

Attachments

Attachment 1

Comparison Values Used in Screening Contaminants For Further Evaluation

Environmental Media Evaluation Guides (EMEGs) are developed for chemicals based on their toxicity, frequency of occurrence at National Priorities List (NPL) sites, and potential for human exposure. They are comparison values used only to select chemicals for further evaluation. They are developed without consideration for carcinogenic effects, chemical interactions, multiple routes of exposure, or other media-specific routes of exposure. They are very conservative concentration values designed to protect sensitive members of the populations.

Reference Dose Media Evaluation Guides (RMEGs) are another type of comparison value derived to protect the most sensitive populations. They are developed without consideration for carcinogenic effects, chemical interactions, multiple routes of exposure, or other media-specific routes of exposure. They are conservative concentrations.

Cancer Risk Evaluation Guides (CREGs) are estimated contaminant concentrations based on one excess cancer in a million persons exposed to a chemical over a lifetime. These are also conservative values designed to protect sensitive members of the population.

Maximum Contaminant Levels (MCLs) have been established by USEPA for public water supplies to reduce the chances of adverse health effects from use of contaminated drinking water. These standards are well below levels for which health effects have been observed and take into account the financial feasibility of achieving specific contaminant levels. These are enforceable limits that public water supplies must meet.

Lifetime Health Advisories (LTHAs) have been established by USEPA for drinking water and are the concentration of a chemical in drinking water that is not expected to cause any adverse, non-carcinogenic effects over a lifetime of exposure. These are conservative values that incorporate a margin of safety.