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Kansas Department of Health and Environment

# Integrated Removal Site Evaluation / Site Inspection

Wade's Aluminum Products
Fort Scott, Kansas

C3-006-03010

November 2005

Bureau of Environmental Remediation

# Integrated
# Removal Site Evaluation/
# Site Inspection

**Wade's Aluminum Products**
Fort Scott, Kansas

Prepared by
Kansas Department of Health and Environment
Bureau of Environmental Remediation
Remedial Section
Site Assessment Program

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State ID: C3-006-03010

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## Section 1: Introduction

The Kansas Department of Health and Environment (KDHE) has a continuing cooperative agreement with the U.S. Environmental Protection Agency (EPA) to perform investigations of selected sites to evaluate potential or actual releases of hazardous substances, pollutants, or contaminants in Kansas. These investigations are performed under the authority of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986 and consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 CFR §§ 300.400-300.425.

This Integrated Preliminary Removal Evaluation/Site Inspection was completed to collect sufficient information at the Wade's Aluminum Products site to assess the threat posed to human health and the environment and to determine the need for further action under CERCLA/SARA consistent with the NCP. The investigation included review of historical information, collection of waste, soil and surface water samples, evaluation of the site using the Hazard Ranking System (HRS) guidance, and compilation of a comprehensive target survey.

## Section 2: Site Information

### 2.1 Site Location and Description

The Wade's Aluminum Products site is an abandoned aluminum reclamation facility located in a rural area north of Fort Scott, Kansas in Section 17, Township 25 South, Range 25 East (Reference 1). The geographic coordinates of the site are 37.87145° latitude and 94.69276° longitude (WGS84). The facility reclaimed aluminum from dross, which is the waste from primary aluminum plants. The aluminum reclamation building has been removed, leaving only a dross storage shed. The site has several other abandoned buildings that were used during the operation of a cement and concrete plant. The buildings are in very poor structural condition and one large building has collapsed. Several large piles of processed aluminum dross materials are located throughout the site. Several rubbish piles are also located throughout the site.

### 2.2 Site Background

KDHE completed a Preliminary Assessment of the property in 1995 (Reference 2). The assessment included the collection of two waste samples and one soil sample. Analytical results of samples indicated that the aluminum dross waste at the site may be potential RCRA characteristic hazardous waste because of levels of cadmium, chromium and lead. The levels were slightly above regulatory levels using the *rule of 20*, which is a method for estimating TCLP results.

When compared to EPA Region IX Preliminary Remedial Goals (PRGs) for industrial soils, the analytical results indicate that only aluminum was above the PRGs. Exposure to aluminum is not usually harmful. Antimony and beryllium levels exceeded KDHE's regulatory guidelines at the time, known as Interim Remedial Guidelines (IRGs), but do not exceed current regulatory KDHE guidelines known as Risk-based Standards for Kansas (RSK).

The site was referred to KDHE's Bureau of Waste Management because a tire shredding operation had been proposed and a permit application was pending to address the waste on site. No further CERCLA response was recommended contingent upon the waste being addressed through the Bureau of Waste Management. The planned tire shredding operation was not completed and the waste was not addressed, and consequently the site was referred back to KDHE's Bureau of Environmental Remediation.

### 2.2.1 Operational History

Wade's Aluminum Products began operation in December 1977 with two furnaces for the reclamation of aluminum dross. In 1979, two more furnaces were added: one for the reclamation of aluminum dross and one for alloying aluminum. A fifth furnace was added in 1980 for alloying aluminum. In October, 1984, Wade's Aluminum Products discontinued processing of aluminum dross and began using uncontaminated aluminum scrap materials. Wade's Aluminum Products filed for bankruptcy in November 1985.

Wade's Aluminum Products operated two types of smelting furnaces: rotary and reverberatory. The rotary furnaces were cement mixers, which were used to rotate the material while firing into the center of the mixer. The reverberatory furnaces had two separate chambers for the fuel and ore. A curved roof reflected the heat down onto the ore. The charge material fed into the furnaces for dross reclamation was 66 percent dross, 16 percent potash and 16 percent salt. The mixture was heated so that the aluminum melted at about 1400° F and was separated due to specific gravity. Aluminum alloying charge was composed of aluminum ingots, silicon and copper (Reference 3).

### 2.2.2 Regulatory History

The Wade's Aluminum Products site has been assigned CERCLIS identification number KSD087772372. The site was first inspected by KDHE Bureau of Air Quality on December 15, 1978. The facility was operating two unpermitted rotary furnaces. The two furnaces were approved and permitted after applications were submitted. Several complaints were received in 1979 by KDHE from area residents concerning emissions from the plant. An emissions control system was installed by the operator to control

particulate emissions. In 1982, a Resource Conservation and Recovery Act (RCRA) inspection of Wade's Aluminum Products was conducted by KDHE to determine compliance with state and federal regulations concerning hazardous waste. The inspection revealed that the facility did not generate hazardous waste (Reference 4).

### 2.3 Hazardous Waste Characteristics

The primary compounds of concern at the site are the heavy metals associated with secondary aluminum dross smelting, particularly lead. Information on the uses and health effects of various metals is provided in Appendix C.

## Section 3: Field Activities

Sampling for the RSE/SI was designed to partially characterize wastes, soils, and surface water at the site and document HRS requirements. Samples were collected from the site during two site visits, August 31, 2005 and October 26, 2005. See Figure 3 for sample locations.

On the initial site visit, 13 waste samples, 12 soil samples and 3 surface water samples were collected and submitted for total metals analysis by EPA Method 6010. Table 1 summarizes total metals analytical results. Upon receiving the total metals analysis from the laboratory, seven samples were re-submitted to be analyzed for TCLP because of high total lead and chromium concentrations. One of the seven samples failed TCLP for lead. Table 2 summarizes TCLP analytical results.

Also on the initial site visit, three surface water samples were collected from Wolverine Creek and an unnamed tributary to Wolverine Creek. See Figure 5 for surface water sample locations.

On the second site visit, 6 additional soil samples were collected and submitted for total metals and TCLP analysis to further characterize the waste at the site. Additionally, 28 *in-situ* readings were collected with a Niton x-ray fluorescence(XRF) spectrum analyzer. See Figure 5 for XRF locations.

### 3.1 Discussion of Analytical Results

A total of 33 samples were collected for this project, including 4 background soil samples and 3 surface water samples. The samples were analyzed by KDHE's Division of Health and Environmental Laboratories for heavy metals by EPA Method 6010. Thirteen of the

samples were also analyzed for TCLP by EPA Method 1311. Laboratory reports for the samples can be found in Appendix A.

The concentrations of heavy metals in the soil samples were similar to the waste samples, having elevated concentrations of aluminum, chromium, copper, lead, magnesium, molybdenum, sodium, and zinc relative to the background soil concentrations. Although these heavy metals were present in concentrations greater than background soils, lead was the only analyte that exceeded its regulatory guideline for industrial soils established in KDHE's Risk-based Standards for Kansas RSK Manual (Reference 5).

Total lead concentrations ranged between 270 mg/Kg and 7,300 mg/Kg. The calculated mean lead concentration for the soil and waste samples from the site is 1,082.69 mg/Kg.

Thirteen samples were submitted for TCLP analysis. Table 2 summarizes TCLP analytical results. Three of the thirteen failed TCLP for lead. The three samples that failed TCLP for lead had total lead concentrations of 1,400 mg/Kg, 3,600 mg/Kg and 7,000 mg/Kg. The TCLP concentrations were 9 mg/l, 35 mg/l, and 36 mg/L, respectively, but one sample with a total lead concentration of 2,700 mg/Kg passed TCLP with a concentration of 4.1 mg/L. The calculated mean for total lead concentrations that failed TCLP is 4,000 mg/Kg.

Comparison of the mean total lead concentration for samples from the site (1082.69 mg/Kg) to the mean TCLP failure concentration (4,000 mg/Kg) suggests that the bulk of the waste at the site would not be considered RCRA characteristic hazardous waste. The soil samples from the site do, however, contain lead and chromium at concentrations greater than KDHE's risk-based standards for residential soils, and lead at concentrations greater than KDHE's risk-based standard for industrial soils.

XRF analysis of 28 *in-situ* soil locations provides additional data regarding lead concentrations at the site. The XRF data is presented in Table 3. The *in-situ* data collected with the Niton XRF for lead ranged from 218.8 (+/-27.3) mg/Kg to 10,796.80 (+\-1,274.40) mg/Kg. Chromium ranged from less than the limit of detection (LOD) to 1,329.60 (+\-750) mg/Kg. Chromium was detected in 5 of the 28 samples but the LOD ranged from 570 mg/Kg to 2,250 mg/Kg. A linear regression was calculated for the XRF data relative to laboratory data to determine the level of data confidence and usability consistent with EPA Method 6200. The coefficient of correlation ($r^2$ value) was calculated to be 0.597, which can be considered quantitative screening level data consistent with the Region VII EPA standard operating procedure for XRF analysis.

Analysis of the surface water samples collected at the site indicates a potential release of salts to an unnamed tributary to Wolverine Creek, but the source does appear to be the Wade's Aluminum site. An upgradient sample on the unnamed tributary of Wolverine Creek contained sodium at a concentration of 6,700 mg/L, potassium at 4,500 mg/L, boron at 0.37 mg/L, calcium at 320 mg/L and magnesium at 110 mg/L. The downstream sample contained sodium at a concentration of 110 mg/L, potassium at 64mg/L, boron at 0.050 mg/L, calcium at 76 mg/L, and magnesium at 12 mg/L.

### 3.1 Sample Collection

The soil and waste samples were collected from a depth of 0 to 6 inches into 8-ounce glass jars and transported in a cooler to DHEL. Each sample was labeled with a unique identification number and the longitude and latitude (WGS-84) of the sample location recorded. A flag labeled with the sample identification was placed to identify the sampling location.

Surface water samples were collected from the locations shown in Figure 5. The samples were collected at a depth of approximately 0.6 stream depth from mid-stream into an inverted cubitainer and transferred to a nitric acid-preserved 250 ml container.

### 3.4 Quality Assurance Procedures

A Quality Assurance Project Plan (QAPP) was developed for the site consistent with KDHE's Quality Management Plan. Two duplicate samples were required for quality control for this project. The duplicate results were within acceptable parameters. All samples were collected consistent with appropriate standard operating procedures. All laboratory data was subject to the quality control and quality assurance procedures specified in a Quality Management Plan prepared by KDHE's Division of Health and Environmental Laboratories.

## Section 4: Site Inspection Component

### 4.1 HRS Ground Water Pathway

#### 4.1.1 Site Geology

The site is situated upon the Fort Scott Limestone of the Pennsylvania age. The Fort Scott Limestone Formation consists of the Higginsville Limestone Member, the Little Osage Shale Member, and the Blackjack Creek Limestone Member. The Higginsville Limestone Member has been quarried on the western part of the site. The Little Osage Shale Member appears to be the lower confining unit in the vicinity of the site (Reference 6). No karst conditions occur in the site vicinity.

Four monitoring wells have been drilled 1/4 mile south of the Wade's Aluminum Products site at a former City Dump (Fort Scott Dump #2 Site, KSD980631915). The wells were completed in bedrock. Ground water levels in the monitoring wells ranged between 6.9 and 17.3 feet below the ground surface. Data collected from the monitoring wells during a site closure study at the dump was inconclusive regarding ground water flow direction in the area (Reference 7). Field observations during the site reconnaissance in a quarry situated on the west part of the site suggest that ground water

at the site is present within the Pennsylvanian bedrock at an unknown depth greater than 20 feet below surface.

### 4.1.2 Ground Water Targets

No municipal wells were identified within the 4-mile target distance limit (TDL) of the site. Area residents obtain water from Bourbon Rural Water District No. 2 (RWD No. 2) (Reference 8). RWD No. 2 purchases water from the City of Fort Scott. KDHE water well records indicate that three domestic water wells exist within the four-mile TDL of the Wade's Aluminum Products site (Reference 9).

### 4.1.3 Ground Water Pathway Conclusions

The potential for human exposure to contaminants released to the ground water pathway from the Wade's Aluminum Products site is minimal as no municipal wells were identified within the 4-mile TDL. Three domestic water wells were identified within the 4-mile TDL but none are near the site.

## 4.2: HRS Surface Water Pathway

### 4.2.1 Hydrologic Setting

The site is located in the Osage River Basin of the Missouri River Basin. Surface drainage from the Wade's Aluminum Products site is to an unnamed tributary to Wolverine Creek. Wolverine Creek is an intermittent stream that flows south-southeast to the Marmaton River, approximately 1/2 mile downstream from the site (Figure 4 and Reference 1). The annual mean discharge of the Marmaton River for the water year 1994 at a gaging station located upstream from the site was 387 cubic feet per second (cfs) (Reference 10). The site lies above the 100 year flood plain of Wolverine Creek (Reference 2). Approximately 9 miles of the in-water surface water segment occurs in Missouri.

### 4.2.2 Surface Water Targets

No municipal surface water intakes were identified within the 15-mile downstream TDL. A surface water intake is located approximately three miles upstream from the point

where Wolverine Creek enters the Marmaton River but cannot be considered a potential target. The intake serves Fort Scott and RWD No. 2.

The Marmaton River has been designated a critical habitat for the Common Map Turtle and all stands of oak woodlands within Bourbon County have been designated critical habitats for the Broadhead Skink (Reference 11).

### 4.2.3 Surface Water Pathway Conclusions

The potential for human exposure to contaminants released from the Wade's Aluminum Products site is low as no surface water intakes were identified within the 15-mile downstream TDL. Potential surface water pathway targets include the critical habitat of the Common Map Turtle and possibly the critical habitat of the Broadfaced Skink. Other potential targets are the habitats of threatened or endangered species in Bourbon County which may coincide with Wolverine Creek or the Marmaton River.

## 4.3 HRS Soil Exposure and Air Pathways

### 4.3.1 Physical Conditions

The site consists of approximately 20 acres located in a rural area. The facility is fenced by a poorly maintained barbed wire fence. The fence is absent in several places. The property is vegetated with shrubs and grasses with some large trees in areas further from the waste material piles. The waste material piles are barren of vegetation and contain fine dust which could easily become airborne, presenting a fugitive dust emission source. Prevailing surface winds in Bourbon County are southerly with an average annual speed of 13 miles per hour (Reference13). The area north of the site is rural and consequently sparsely populated.

### 4.3.2 Soil Exposure and Air Pathway Targets

The soil exposure pathway under HRS assesses the risks associated with existing surficial contamination (0-2 feet below surface) at properties on which people live or work. No persons live or work on the site. The site appears to be routinely used for recreational of-road motorsports. The property owner indicated that, despite his attempts to control it, people trespass on the property to ride off-road vehicles on the waste piles. Nonetheless, these persons are not targets under the HRS.

The total population within four miles of the site is estimated to be 10,352 persons, based on United States Geological Survey topographic maps of the area and population census statistics for the city and surrounding areas (Reference 1, Reference 12). Distribution of soil and air pathway targets by distance are as follows:

| Distance | Estimated Human Targets |
|---|---|
| 0 - 1 mile | 85.1 |
| 1 - 2 miles | 1,007.1 |
| 2 - 3 miles | 4,997.9 |
| 3 - 4 miles | 4,261.9 |

### 4.3.3 Soil Exposure and Air Pathway Conclusions

The potential for human exposure to wastes at the site through the soil pathway appears to be minimal because the site is relatively inaccessible. The potential for human exposure to fugitive dust emissions from the waste at the site exists.

## Section 5: Removal Site Evaluation Component

The waste at the site exists as many individual piles that cover an area of 10 to 12 acres or 400,000 to 500,00 square feet. The piles vary in size with the largest being about 180 feet by 100 feet and 15 feet high and the smallest 10 feet by 10feet and 4 feet high. The site also contains several piles of crushed limestone, a remnant of a cement plant that operated on the property before Wade's Aluminum Products began operations in 1977.

The waste piles consist of fine particles of processed aluminum dross that have been weathered and contain occasional concentrations of blue and white crystalline material. The crystalline material has similar concentrations of inorganic material as the processed dross.

Based on information gathered during for the RSE component of this project, eligible conditions exist at the site to warrant further removal response consistent with §§ 300.410-300.415 of the NCP. The specific conditions identified at the site consistent with § 300.415(b)(2) are:

*(i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;* No persons live or work on the property, however evidence of recreational off-road motorsports activity was noted. The owner indicated that the recreation use of the property is without permission (trespassers). The nearest down-wind residence is about 1,200 feet from the site. The property is habitat for many species of animals.

*(ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;* No actual or potential contamination of drinking water supplies was identified.

*(iii) Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release;* No drums, barrels, tanks or bulk storage containers were identified, however numerous piles of waste were observed. Analytical data for samples collected at the site suggests that the bulk of the waste is probably not RCRA characteristic hazardous waste.

*(iv) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate;* High levels of lead were identified in surface soils to the adjacent to waste piles.

*(v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released;* None identified.

*(vi) Threat of fire or explosion;* None identified.

*(vii) The availability of other appropriate federal or state response mechanisms to respond to the release;* State solid waste disposal programs may be appropriate. *And:*

*(viii) Other situations or factors that may pose threats to public health or welfare of the United States or the environment.* None identified.

**Section 6: Summary**

The Wade's Aluminum Products site is an abandoned aluminum reclamation facility located in a rural area north of Fort Scott, Kansas. KDHE completed a Preliminary Assessment of the property in 1995. The assessment included the collection of two waste samples and one soil sample. Analytical results of samples indicated that the aluminum dross waste at the site may be potential RCRA characteristic hazardous waste because of levels of cadmium, chromium and lead. The levels were slightly above regulatory levels using the *rule of 20* which is a method for estimating TCLP results.

The site was referred to KDHE's Bureau of Waste Management because a tire shredding operation had been proposed and a permit application was pending to address the waste on site. No further CERCLA response was recommended contingent upon the waste being addressed through the Bureau of Waste Management. The planned tire shredding operation was not completed and the waste was not addressed. Consequently, the site was referred back to KDHE's Bureau of Environmental Remediation for completion of an integrated Removal Site Evaluation/Site Inspection (RSE/SI).

A total of 33 samples were collected for the RSE/SI, including 4 background soil samples and 3 surface water samples, The samples were analyzed by KDHE's Division of Health and Environmental Laboratories for heavy metals.

Although several metals were present in concentrations greater than background soils, lead was the only analyte that exceeded its regulatory guideline for industrial soils established in KDHE's Risk-based Standards for Kansas RSK Manual. Total lead concentrations ranged between 270 mg/kg and 7,300 mg/kg. The calculated mean lead concentration for the soil and waste samples from the site is 1082.69 mg/kg.

Thirteen samples were submitted for TCLP analysis. Three of the thirteen failed TCLP for lead. The three samples that failed TCLP for lead had total lead concentrations of 1,400 mg/Kg, 3,600 mg/Kg and 7,000 mg/Kg. The TCLP concentrations were 9 mg/l, 35 mg/l, and 36 mg/L, respectively, but one sample with a total lead concentration of 2,700 mg/Kg passed TCLP with a concentration of 4.1 mg/L. The calculated mean for total lead concentrations that failed TCLP is 4,000 mg/Kg.

Comparison of the mean total lead concentration for samples from the site (1082.69 mg/Kg) to the mean TCLP failure concentration (4,000 mg/Kg) suggests that the bulk of the waste at the site would not be RCRA characteristic hazardous waste. The soil samples from the site do, however, contain lead and chromium at concentrations greater than KDHE's risk-based standards for residential soils, and lead at concentrations greater than KDHE's risk-based standard for industrial soils.

Analysis of the surface water samples collected at the site indicates a potential release of salts to an unnamed tributary to Wolverine Creek, but the source does appear to be the Wade's Aluminum Site. An up-gradient sample on the unnamed tributary of Wolverine Creek contained sodium at a concentration of 6,700 mg/L, potassium at 4,500 mg/L, Boron at 0.37 mg/L, calcium at 320 mg/L and magnesium at 110 mg/L. The downstream sample contained sodium at a concentration of 110 mg/L, potassium at 64mg/L, Boron at 0.050 mg/L, calcium at 76 mg/L, and magnesium at 12 mg/L.

Although the majority of the waste at the site is probably not considered as RCRA characteristic hazardous waste, the soils surrounding the waste piles are impacted by lead at concentrations that exceed KDHE RSK and EPA clean-up goals for industrial soils. Based upon the data collected during this RSE/SI, the site appears to qualify for addition removal response consistent with §§ 300.410-300.415 of the NCP. The potential for human exposure to contaminants released from the Wade's Aluminum Products site, with the possible exception of fugitive dust, is relatively new.

A total of 33 samples were collected for the RSE/SI, including 4 background soil samples and 3 surface water samples, The samples were analyzed by KDHE's Division of Health and Environmental Laboratories for heavy metals.

Although several metals were present in concentrations greater than background soils, lead was the only analyte that exceeded its regulatory guideline for industrial soils established in KDHE's Risk-based Standards for Kansas RSK Manual. Total lead concentrations ranged between 270 mg/kg and 7,300 mg/kg. The calculated mean lead concentration for the soil and waste samples from the site is 1082.69 mg/kg.

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**Section 8: References**


1. United States Geological Survey, 7.5-minute topographic Quadrangle, *Fort Scott, Kans.*, 1958, photorevised 1978.

2. Kansas Department of Health and Environment, *Preliminary Assessment, Wade's Aluminum Products*, Fort Scott, Kansas, November 1995.

3. Kansas Department of Health and Environment, Bureau of Environmental Remediation and Bureau of Air and Radiation files.

4. Kansas Department of Health and Environment, Bureau of Waste Management, Resource Conservation and Recovery Act files.

5. Kansas Department of Health and Environment, Division of Environment, Bureau of Environmental Remediation, *Risk-based Standards for Kansas RSK Manual – 3rd Version*, March 1, 2003.

6. CDM Federal Programs Corporation, *Site Inspection Prioritization Report For Site Assessment Activity at Fort Scott Dump #2, Fort Scott, Kansas*, September 6, 1994.

7. Triad Environmental Services, *Bourbon County Landfill, Site Closure & Post Closure Plan*, December 1994.

8. Kansas Rural Water Association/Kansas Water Office/Kansas Department of Health and Environment, *Rural Water Districts in Kansas*, 1994.

9. Kansas Department of Health and Environment, Division of Environment, Bureau Water Well Record Forms WWC-5 KSA 82a-1212.

10. United States Geological Survey, *Water Resource Data, Kansas, Water Year 1994*, 1995.

11. U.S. Department of Agriculture, "Soil Survey of Bourbon County, Kansas", 1981.

12. U.S. Census Bureau, *2000 Census of Population and Housing, Summary Population and Housing Characteristics PHC-1-18, Kansas,* Washington, DC, June 2002.

## Section 9: Tables and Figures

**TABLE 1 – Analytical Summary**
**Wade's Aluminum Products Site**

| Sample ID | S-1[1] | S-2 | S-3 | S-4[1] | S-5[1] | S-6[1] | S-7 | S-8[1] | S-8 | S-9 | S-10 | S-11 | S-11A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample type | Waste (mg/Kg) | Waste (mg/Kg) | Waste (mg/Kg) | Soil (mg/Kg) | Waste (mg/Kg) | Soil (mg/Kg) | Waste (mg/Kg) | Blue waste (mg/Kg) | Duplicate (mg/Kg) | Waste (mg/Kg) | Soil (mg/Kg) | Waste (mg/Kg) | Duplicate (mg/Kg) |
| Date | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 |
| Aluminum | 270,000 | 290,000 | 240,000 | 270,000 | 260,000 | 250,000 | 310,000 | 270,000 | 270,000 | 270,000 | 170,000 | 290,000 | 280,000 |
| Antimony | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Arsenic | 5.7 | < 5.0 | < 5.0 | 6.5 | 7.3 | 6.5 | 6.8 | 5.6 | 5.4 | 5.3 | 7.0 | 6.9 | 5.3 |
| Barium | 82 | 80 | 160 | 140 | 410 | 240 | 140 | 210 | 290 | 940 | 150 | 120 | 150 |
| Beryllium | 1.0 | 1.3 | 5.7 | 2.2 | 3.9 | 4.1 | 1.0 | 4.7 | 4.1 | 3.4 | 2.8 | 2.4 | 2.1 |
| Boron | 46 | 24 | 27 | 40 | 36 | 37 | 43 | 29 | 31 | 21 | 26 | 32 | 39 |
| Cadmium | 2.2 | 4.2 | 15 | 4.9 | 5.9 | 3.9 | 2.0 | 5.8 | 5.5 | 4.9 | 5.5 | 4.2 | 3.5 |
| Calcium | 33,000 | 7,400 | 6,300 | 22,000 | 13,000 | 37,000 | 22,000 | 6,800 | 16,000 | 3,100 | 68,000 | 12,000 | 14,000 |
| Chromium | 490 | 490 | 140 | 350 | 720 | 210 | 240 | 280 | 330 | 390 | 290 | 250 | 240 |
| Cobalt | 11 | 5.4 | 2.8 | 6.7 | 12 | 6.8 | 6.9 | 4.0 | 4.4 | 3.5 | 8.8 | 9.5 | 7.6 |
| Copper | 4,600 | 5,700 | 7,600 | 7,200 | 11,000 | 4,700 | 2,500 | 11,000 | 11,000 | 10,000 | 5,000 | 6,000 | 5,700 |
| Iron | 8,500 | 9,600 | 11,000 | 16,000 | 11,000 | 8,500 | 6,200 | 8,400 | 7,200 | 7,500 | 21,000 | 6,800 | 7,200 |
| Lead | 680 | 270 | 510 | 1,200 | 860 | 640 | 290 | 7,000 | 7,300 | 570 | 480 | 570 | 640 |
| Magnesium | 9,200 | 8,000 | 9,000 | 11,000 | 22,000 | 18,000 | 14,000 | 16,00 | 17,000 | 13,000 | 12,000 | 8,100 | 8,300 |
| Manganese | 780 | 830 | 920 | 950 | 1,100 | 1,300 | 1,400 | 1,000 | 1,200 | 1,200 | 1,100 | 680 | 640 |
| Mercury | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 |
| Molybdenum | 23 | 32 | 9.0 | 13 | 18 | 6.6 | 9.1 | 12 | 12 | 28 | 11 | 14 | 9.7 |
| Nickel | 360 | 240 | 92 | 250 | 330 | 130 | 86 | 230 | 220 | 180 | 210 | 140 | 130 |
| Potassium | 530 | 400 | 340 | 760 | 1,000 | 1,300 | 550 | 420 | 440 | 210 | 1,600 | 740 | 750 |
| Selenium | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Silica | 1,800 | 1,300 | 1,500 | 2,100 | 2,200 | 1,700 | 1,400 | 1,600 | 1,100 | 1,300 | 1,400 | 1,300 | 1,300 |
| Silver | 5.5 | 3.2 | 2.5 | 4.1 | 5.7 | 2.8 | 1.7 | 12 | 10 | 4.8 | 3.2 | 2.7 | 2.9 |
| Sodium | 1,300 | 560 | 22,000 | 520 | 260 | 300 | 270 | 200 | 180 | 120 | 380 | 460 | 420 |
| Thallium | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Vanadium | 37 | 38 | 32 | 50 | 49 | 38 | 42 | 42 | 39 | 43 | 41 | 46 | 46 |
| Zinc | 4,800 | 7,600 | 9,000 | 7,800 | 8,500 | 4,000 | 1,800 | 7,400 | 7,600 | 6,000 | 5,000 | 5,800 | 6,000 |

[1] sample was submitted for TCLP analysis. See Table 2.
BKG = background

**TABLE 1 – Analytical Summary**
**Wade's Aluminum Products Site**

| Sample ID | S-12[1] | S-13 | S-14 | S-15 | S-16 | S-17 | S-18 | S-19[1] | S-20 | S-21 | S-22 | S-23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample type | Blue waste (mg/Kg) | Soil (mg/Kg) | Soil (mg/Kg) | Waste (mg/Kg) | Blue waste (mg/Kg) | Soil (mg/Kg) | Waste (mg/Kg) | Waste (mg/Kg) | Soil (mg/Kg) | BKG Soi (mg/Kg) | BKG Soi (mg/Kg) | BKG Soil (mg/Kg) |
| Date | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 |
| Aluminum | 290,000 | 220,000 | 190,000 | 270,000 | 270,00 | 160,000 | 280,000 | 280,000 | 160,000 | 36,000 | 38,000 | 36,000 |
| Antimony | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Arsenic | 5.6 | 7.6 | 7.2 | 6.9 | < 5.0 | 9.1 | 6.1 | 7.8 | < 5.0 | 11 | 11 | 15 |
| Barium | 22 | 150 | 290 | 180 | 48 | 140 | 220 | 420 | 160 | 260 | 330 | 260 |
| Beryllium | 0.53 | 2.4 | 6.5 | 7.7 | 0.17 | 4.3 | 3.7 | 4.5 | 3.2 | 1.4 | 1.3 | 2.0 |
| Boron | 6.9 | 41 | 42 | 77 | 56 | 39 | 78 | 32 | 38 | 15 | 15 | 21 |
| Cadmium | 26 | 5.0 | 6.5 | 5.6 | 9.4 | 7.9 | 4.3 | 6.4 | 3.2 | 1.6 | 1.0 | 4.4 |
| Calcium | 4,500 | 53,000 | 55,000 | 13,000 | 4,400 | 47,000 | 6,700 | 4,900 | 84,000 | 7,500 | 13,000 | 21,000 |
| Chromium | 670 | 320 | 500 | 700 | 150 | 230 | 360 | 560 | 190 | 50 | 52 | 61 |
| Cobalt | 5.3 | 8.9 | 9.6 | 6.2 | 2.1 | 6.5 | 4.9 | 14 | 4.4 | 16 | 17 | 22 |
| Copper | 11,000 | 5,400 | 7,800 | 10,000 | 17,000 | 5,900 | 12,000 | 16,000 | 5,400 | 48 | 33 | 57 |
| Iron | 5,700 | 15,000 | 18,000 | 8,800 | 2,600 | 13,000 | 6,500 | 14,000 | 13,000 | 29,000 | 29,000 | 52,000 |
| Lead | 370 | 500 | 1,100 | 430 | 570 | 730 | 420 | 650 | 580 | 44 | 35 | 65 |
| Magnesium | 2,900 | 11,000 | 20,000 | 19,000 | 2,100 | 10,000 | 10,000 | 15,000 | 13,000 | 2,800 | 3,000 | 3,300 |
| Manganese | 1,400 | 820 | 1,100 | 1,100 | 980 | 770 | 990 | 1,300 | 790 | 1,600 | 1,600 | 1,800 |
| Mercury | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | <0.050 | <0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 |
| Molybdenum | 17 | 14 | 16 | 17 | 13 | 19 | 14 | 18 | 8.7 | < 2.0 | < 2.0 | 4.9 |
| Nickel | 2,300 | 160 | 280 | 480 | 260 | 170 | 200 | 1,700 | 110 | 27 | 27 | 72 |
| Potassium | 130 | 1,500 | 1,600 | 1,200 | 210 | 3,000 | 1,300 | 840 | 2,600 | 6,200 | 6,000 | 6,900 |
| Selenium | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Silica | 1,400 | 1,400 | 2,000 | 1,300 | 1,200 | 1,300 | 1,700 | 1,600 | 1,800 | 1,900 | 1,600 | 1,800 |
| Silver | 17 | 2.7 | 6.9 | 3.4 | 3.7 | 5.3 | 4.4 | 6.2 | 2.4 | < 1.0 | 6.0 | < 1.0 |
| Sodium | 110 | 860 | 600 | 450 | 64 | 890 | 570 | 350 | 790 | 210 | 180 | 210 |
| Thallium | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 |
| Vanadium | 68 | 43 | 49 | 49 | 26 | 69 | 53 | 48 | 36 | 65 | 71 | 77 |
| Zinc | 16,000 | 4,500 | 6,800 | 5,000 | 9,200 | 5,300 | 4,700 | 4,500 | 4,200 | 170 | 100 | 920 |

[1] sample was submitted for TCLP analysis. See Table 2.
BKG = background

**TABLE 1 – Analytical Summary**
**Wade's Aluminum Products Site**

| Sample ID | S-24 | S-25 | S-26[1] | S-27[1] | S-28[1] | S-29[1] | S-30[1] | S-31[1] | | W-1 | W-2 | W-3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample type | BKG Soil (mg/Kg) | BKG Soil (mg/Kg) | Soil (mg/Kg) | Waste (mg/Kg) | Waste (mg/Kg)) | Soil (mg/Kg) | Waste (mg/Kg) | Waste (mg/Kg) | | Surface water (Up-stream) (mg/L) | Surface water (Down-stream (mg/L) | Surface water (Up-stream) (mg/L) |
| Date | 8/31/05 | 8/31/05 | 10/26/05 | 10/26/05 | 10/26/05 | 10/26/05 | 10/26/05 | 10/26/05 | | 8/31/05 | 8/31/05 | 8/31/05 |
| Aluminum | 16,000 | 6,000 | 210,000 | 250,000 | 250,000 | 250,000 | 270,000 | 250,000 | | < 0.050 | 1.2 | 1.2 |
| Antimony | < 5.0 | < 5.0 | 17 | 25 | 21 | 25 | 23 | 33 | | < 0.050 | < 0.050 | < 0.050 |
| Arsenic | 5.0 | < 5.0 | 8.2 | 8.3 | 9.0 | 9.5 | 8.7 | 8.8 | | < 0.050 | < 0.050 | < 0.050 |
| Barium | 110 | 47 | 210 | 3.7 | 190 | 320 | 540 | 320 | | 0.53 | 0.93 | 0.090 |
| Beryllium | 0.54 | 0.23 | 4.5 | 9.4 | 1.6 | 3.6 | 7.0 | 5.4 | | < 0.001 | < 0.0010 | < 0.0010 |
| Boron | 13 | 6.0 | 33 | 69 | 36 | 39 | 44 | 38 | | 0.37 | 0.050 | < 0.050 |
| Cadmium | 1.1 | 2.2 | < 1.0 | 3.3 | 1.9 | 2.8 | 5.3 | 5.8 | | < 0.0050 | < 0.050 | < 0.0050 |
| Calcium | 200,000 | 280,000 | 25,000 | 3,700 | 42,000 | 26,000 | 9,100 | 16,000 | | 320 | 76 | 64 |
| Chromium | 34 | 15 | 810 | 270 | 260 | 370 | 460 | 520 | | < 0.010 | < 0.010 | < 0.010 |
| Cobalt | 6.1 | 2.5 | 12 | 4.8 | 8.3 | 5.7 | 7.0 | 7.2 | | < 0.010 | < 0.010 | < 0.010 |
| Copper | 66 | 18 | 6,000 | 8,200 | 3,500 | 6,800 | 17,000 | 14,000 | | 0.13 | 0.011 | < 0.010 |
| Iron | 16,000 | 12,000 | 12,000 | 5,100 | 11,000 | 9,300 | 6,700 | 8,900 | | 0.23 | 0.97 | 0.085< 0.050 |
| Lead | 15 | 13 | 450 | 2,700 | 480 | 460 | 3,600 | 1,400 | | < 0.050 | < 0.050 | < 0.050 |
| Magnesium | 7,200 | 7,300 | 15,000 | 17,000 | 12,000 | 20,000 | 22,000 | 13,000 | | 110 | 12 | 6.9 |
| Manganese | 1,100 | 870 | 800 | 1,100 | 1,400 | 1,400 | 980 | 1,100 | | 1.2 | 0.32 | 0.12 |
| Mercury | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.50 | < 0.50 | | < 0.50 | < 0.50 | < 0.50 |
| Molybdenum | 2.45 | 2.2 | 24 | 20 | 16 | 20 | 16 | 22 | | 0.044 | < 0.020 | < 0.020 |
| Nickel | 22 | 10 | 270 | 100 | 110 | 150 | 560 | 460 | | 0.0096 | 0.017 | 0.0064 |
| Potassium | 3,500 | 1,600 | 1,500 | 250 | 740 | 580 | 1,100 | 930 | | 4500 | 64 | 16 |
| Selenium | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | | < 0.050 | < 0.050 | < 0.050 |
| Silica | 1,400 | 1,100 | 1,100 | 1,100 | 1,200 | 1,100 | 1,500 | 1,500 | | 9.9 | 18 | 18 |
| Silver | < 1.0 | < 1.0 | 2.9 | 5.9 | 6.3 | 3.3 | 15 | 8.0 | | < 0.010 | < 0.010 | < 0.010 |
| Sodium | 170 | 130 | 980 | 130 | 270 | 310 | 530 | 400 | | 6700 | 110 | 19 |
| Thallium | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | | < 0.050 | < 0.050 | < 0.050 |
| Vanadium | 35 | 14 | 52 | 34 | 42 | 41 | 44 | 43 | | < 0.050 | < 0.050 | < 0.050 |
| Zinc | 160 | 340 | 5,900 | 10,000 | 2,800 | 5,500 | 17,000 | 9,200 | | 0.042 | 0.024 | 0.0076 |

[1] sample was submitted for TCLP analysis. See Table 2.
BKG = background

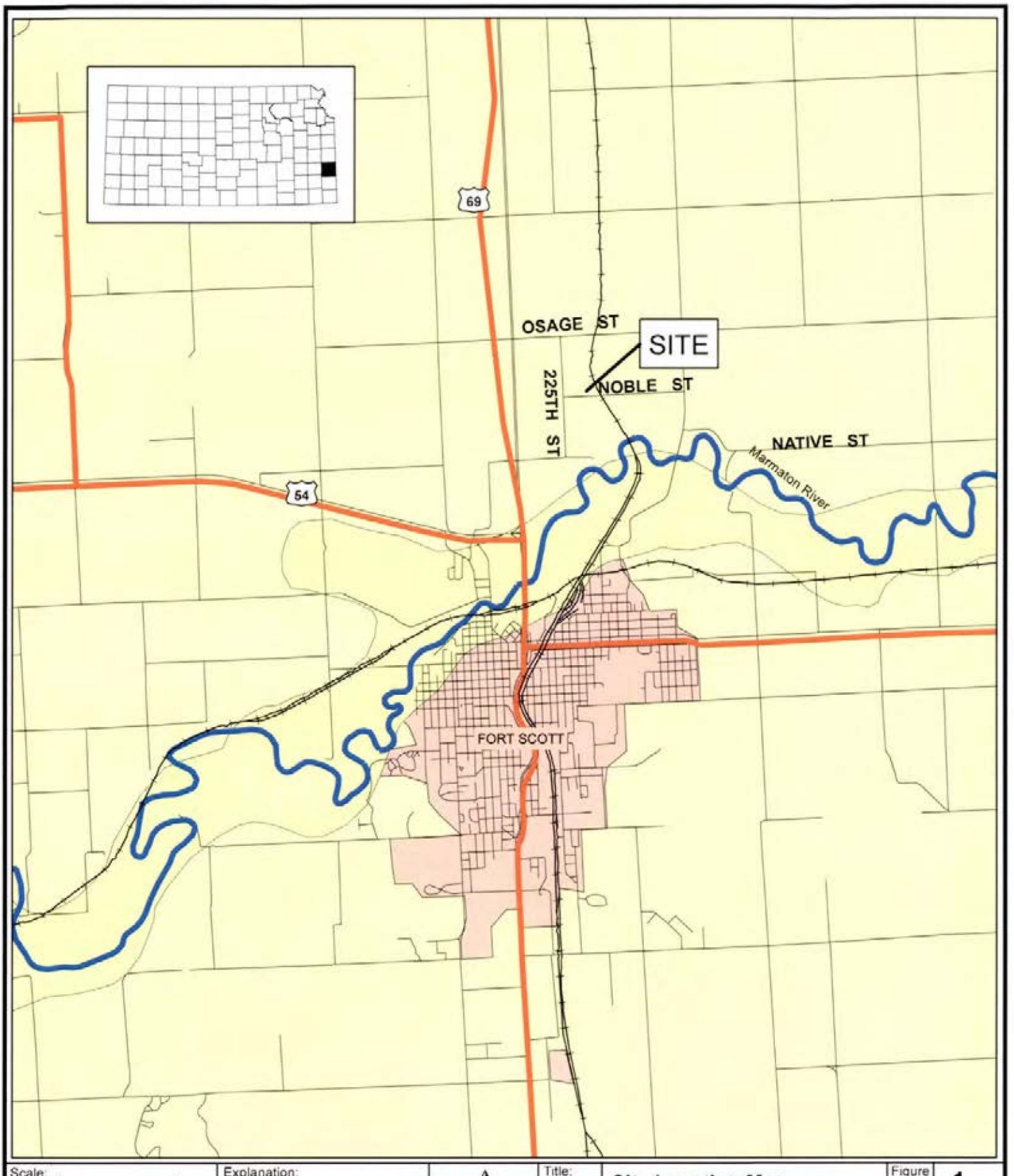
**TABLE 2 – TCLP Summary**
**Wade's Aluminum Products Site**

| Sample ID | S-1 | S-4 | S-5 | S-6 | S-8 | S-12 | S-19 | S-26 | S-27 | S-28 | S-29 | S-30 | S-31 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample type | Waste (mg/L) | Soil ( mg/L) | Waste (mg/L) | Soil (mg/L) | Blue waste (mg/L) | Blue waste (mg/L) | Waste (mg/L) | Soil (mg/L) | Waste (mg/L) | Waste (mg/L) | Soil (mg/L) | Waste (mg/L) | Waste (mg/L) |
| Date | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 8/31/05 | 10/26/05 | 10/26/05 | 10/26/05 | 10/26/05 | 10/26/05 | 10/26/05 |
| Arsenic | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 |
| Barium | 1.3 | 1.9 | 4.9 | 2.9 | 5.9 | 1.6 | 4.7 | 1.5 | 6.8 | 2.2 | 4.6 | 5.7 | 4.8 |
| Cadmium | 0.010 | 0.016 | 0.016 | 0.0094 | 0.017 | 0.036 | 0.023 | < 0.0050 | 0.018 | < 0.0050 | 0.0088 | 0.041 | 0.051 |
| Chromium | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 |
| Lead | < 0.050 | 0.81 | 0.46 | < 0.50 | 36 | 0.78 | 0.55 | < 0.050 | 4.1 | < 0.050 | 0.33 | 35 | 9.0 |
| Mercury | < 0.00050 | < 0.00050 | < 0.00050 | < 0.00050 | < 00050 | < 0.00050 | < 0.00050 | < 0.00050 | < 0.00050 | < 0.00050 | < 0.00050 | < 0.00050 | < 0.00050 |
| Selenium | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 | < 0.050 |
| Silver | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 | < 0.010 |

**Table 3 - X-Ray Fluorescence Spectrum Analyzer Data Summary**
**Wades Aluminum Products**

| XRF Reading No. | Lead (mg/Kg) | +\- | Chromium (mg/Kg) | +/- | Description |
|---|---|---|---|---|---|
| 252 | 5449.60 | 120.00 | < 1650.00 | | High standard |
| 253 | 1380.00 | 50.90 | < 720.00 | | Near sample S-8. |
| 254 | 6537.60 | 150.00 | < 945.00 | | 5 feet north of S-8. |
| 255 | 3459.20 | 87.50 | < 795.00 | | 5 feet north of 254. |
| 256 | 583.20 | 36.90 | 960.00 | 600.00 | 5 feet north of 255. |
| 257 | 1589.60 | 57.00 | < 825.00 | | East side of pile 8. Collected sample as S-27. |
| 258 | | | | | No reading. |
| 259 | 10796.80 | 260.00 | < 1274.40 | | Same location as 254, depth of 6 inches. |
| 260 | 887.20 | 58.40 | 1140.00 | 760.00 | Same location as 255, depth of 6 inches. |
| 261 | 995.20 | 52.00 | < 855.00 | | 5 feet south of S-8. |
| 262 | 625.60 | 43.10 | < 810.00 | | Same location as 261, depth of 6 inches. |
| 263 | 454.80 | 37.40 | < 840.00 | | East side of S-7 pile. |
| 264 | 218.80 | 27.30 | < 810.00 | | Northwest end of S-7 pile. |
| 265 | 414.00 | 29.80 | < 600.00 | | South side of S-7 pile. |
| 266 | <LOD | 52.35 | < 1110.00 | | Same location as 264, depth of 6 inches. |
| 267 | 660.40 | 45.70 | < 960.00 | | Run-off from S-8 pile. Sampled as S-28. |
| 268 | 589.20 | 42.60 | < 840.00 | | East side of pile S-8. Collected as sample S-29. |
| 269 | 827.20 | 46.00 | < 795.00 | | South side of pile S-8. |
| 270 | 694.80 | 40.10 | < 750.00 | | 5 feet north of sample S-5. |
| 271 | 374.40 | 31.20 | < 645.00 | | Same as 270, depth of 6 inches. |
| 272 | 684.40 | 42.90 | < 840.00 | | 5 feet south of Sample S-5. |
| 273 | 279.20 | 29.30 | < 810.00 | | 5 feet east of SampleS-18. |
| 274 | 879.20 | 53.30 | 1029.60 | 670.00 | 3 feet North of S-4. |
| 275 | 836.80 | 48.20 | 936.00 | 570.00 | 15 feet south of S-4 on pile by the wall. |
| 276 | 614.80 | 47.10 | < 1065.00 | | Near S-14. |
| 277 | 274.60 | 28.40 | < 840.00 | | 4 feet southwest of S-15. |
| 278 | 1269.60 | 62.50 | < 960.00 | | 15 feet south of 277. |
| 279 | 1908.80 | 83.20 | < 990.00 | | 15 feet south of 278. Sampled as S-30. |
| 280 | 2499.20 | 90.20 | 1329.60 | 750.00 | 15 feet south of 279. Sampled as S-31. |
| 281 | 509.20 | 36.90 | < 795.00 | | 15 feet south of 280. |
| 282 | 5507.20 | 160.00 | < 2250.00 | | High Standard. |
| 283 | 1080.00 | 57.00 | < 1050.00 | | Medium Standard. |

Data collected *in-situ* using Niton XRF Serial #XL700-U1060NK918 on 10/25/05.




Scale: 0 1 Miles

Sources:
Aerial Photography: Data Access & Support Center, 2002 Digital Orthophoto Quarter Quadrangle

Explanation:
- cities
- Stream_label
- alluv
- kdot_highway
- ksrail100k
- county

| | | | |
|---|---|---|---|
| Title: | Site Location Map | Figure No: | 1 |
| Site: | Wade's Aluminum Products | | |
| Project Type: | Removal Site Evaluation/Site Inspection | | |
| Bureau: | Environmental Remediation | Date: | December 12, 2005 |
| Program: | Site Assessment | Drawn by: | T. Kogl |

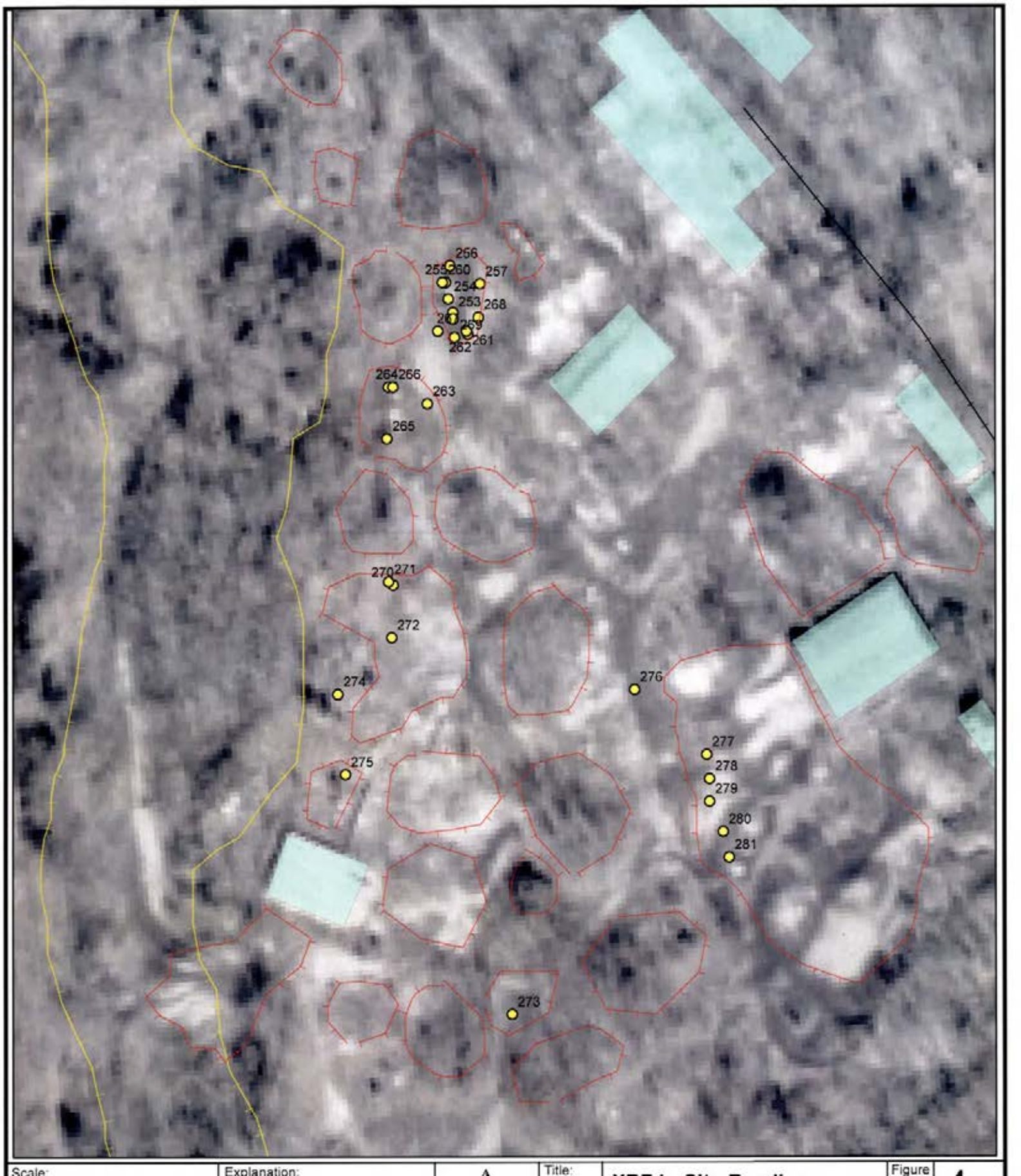
Scale: 0 120 240 Feet

Sources: Aerial Photography: Data Access & Support Center, 2002 Digital Orthophoto Quarter Quadrangle

Explanation:
- Waste pile
- Buildings
- quarry
- Buildings

| | | | |
|---|---|---|---|
| Title: | Site Map | Figure No: | 2 |
| Site: | Wade's Aluminum Products | | |
| Project Type: | Removal Site Evaluation/Site Inspection | | |
| Bureau: | Environmental Remediation | Date: | December 12, 2005 |
| Program: | Site Assessment | Drawn by: | T. Kogl |

| | | | | | |
|---|---|---|---|---|---|
| Scale: 0 60 120 Feet | Explanation: sample location with ID; Waste pile; quarry; Buildings | | Title: | On-Site Sample Locations | Figure No: 3 |
| | | | Site: | Wade's Aluminum Products | |
| Sources: Aerial Photography: Data Access & Support Center, 2002 Digital Orthophoto Quarter Quadrangle | See Tables 1 & 2 for analytical results. | | Project Type: | Removal Site Evaluation/Site Inspection | |
| | | | Bureau: | Environmental Remediation | Date: December 12, 2005 |
| | | | Program: | Site Assessment | Drawn by: T. Kogl |



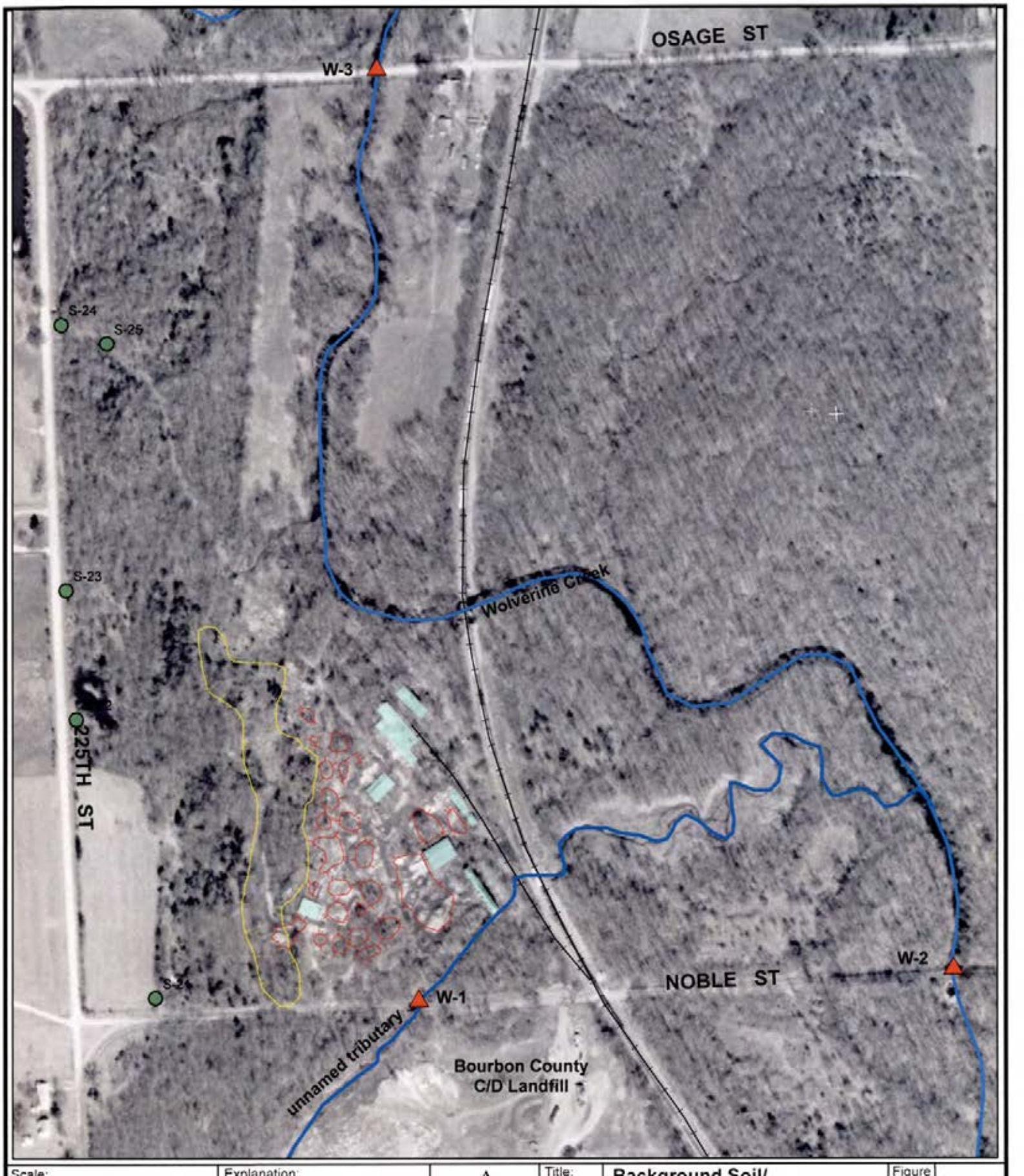

Scale: 0 50 100 Feet

Sources: Aerial Photography: Data Access & Support Center, 2002 Digital Orthophoto Quarter Quadrangle

Explanation:
- XRF location with reading no.
- Waste pile
- Buildings
- quarry

See Table 3 for XRF results.

| | | | |
|---|---|---|---|
| Title: | XRF In-Situ Readings | Figure No: | 4 |
| Site: | Wade's Aluminum Products | | |
| Project Type: | Removal Site Evaluation/Site Inspection | | |
| Bureau: | Environmental Remediation | Date: | December 12, 2005 |
| Program: | Site Assessment | Drawn by: | T. Kogl |




Scale: 0 210 420 Feet

Sources: Aerial Photography: Data Access & Support Center, 2002 Digital Orthophoto Quarter Quadrangle

Explanation:
- Surface water sample
- Background soil sample
- Waste pile
- quarry
- Buildings

| | | | |
|---|---|---|---|
| Title: | Background Soil/ Surface Water Samples | Figure No: | 5 |
| Site: | Wade's Aluminum Products | | |
| Project Type: | Removal Site Evaluation/Site Inspection | | |
| Bureau: | Environmental Remediation | Date: | December 12, 2005 |
| Program: | Site Assessment | Drawn by: | T. Kogl |

# APPENDIX A

# ANALYTICAL RESULTS

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459619
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-1
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 11:30
Date/Time Received: 09/01/05 11:20

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 270000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Arsenic (Total) | 5.7 | mg/Kg | 09/07/05 | EPA 6010 |
| Barium (Total) | 82 | mg/Kg | 09/07/05 | EPA 6010 |
| Beryllium (Total) | 1.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Boron (Total) | 46 | mg/Kg | 09/07/05 | EPA 6010 |
| Cadmium (Total) | 2.2 | mg/Kg | 09/07/05 | EPA 6010 |
| Calcium (Total) | 33000 | mg/Kg | 09/07/05 | EPA 6010 |
| Chromium (Total) | 490 | mg/Kg | 09/07/05 | EPA 6010 |
| Cobalt (Total) | 11 | mg/Kg | 09/07/05 | EPA 6010 |
| Copper (Total) | 4600 | mg/Kg | 09/07/05 | EPA 6010 |
| Iron (Total) | 8500 | mg/Kg | 09/07/05 | EPA 6010 |
| Lead (Total) | 680 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 9200 | mg/Kg | 09/07/05 | EPA 6010 |
| Manganese (Total) | 780 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/07/05 | EPA 245.1 |
| Molybdenum (Total) | 23 | mg/Kg | 09/07/05 | EPA 6010 |
| Nickel (Total) | 360 | mg/Kg | 09/07/05 | EPA 6010 |
| Percent Solids | 64 | Percent | 09/01/05 | EPA 1311 |
| Potassium (Total) | 530 | mg/Kg | 09/07/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Silica (Total) | 1800 | mg/Kg | 09/07/05 | EPA 6010 |
| Silver (Total) | 5.5 | mg/Kg | 09/07/05 | EPA 6010 |
| Sodium (Total) | 1300 | mg/Kg | 09/07/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Vanadium (Total) | 37 | mg/Kg | 09/07/05 | EPA 6010 |
| Zinc (Total) | 4800 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

RECEIVED
SEP 15 2005
BUREAU OF
ENVIRONMENTAL REMEDIATION

Duane R. Boline, Ph.D., Director
Laboratory Customer Service - (785) 296-1620
Laboratory Fax - (785) 296-1641
CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 461133
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-1
Collector: T. Kogl KDHE/BER
Matrix: Soil
Collect Depth:
Date/Time Collected: 08/31/05 11:30
Date/Time Received: 09/01/05 11:20

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Arsenic (TCLP) | < 0.050 | mg/L | 10/03/05 | EPA 1311 |
| Barium (TCLP) | 1.3 | mg/L | 10/03/05 | EPA 1311 |
| Cadmium (TCLP) | 0.010 | mg/L | 10/03/05 | EPA 1311 |
| Chromium (TCLP) | < 0.010 | mg/L | 10/03/05 | EPA 1311 |
| Lead (TCLP) | < 0.050 | mg/L | 10/03/05 | EPA 1311 |
| Mercury (TCLP) | < 0.00050 * | mg/L | 10/04/05 | EPA 1311 |
| Percent Solids | 100 | Percent | 09/30/05 | EPA 1311 |
| Selenium (TCLP) | < 0.050 | mg/L | 10/03/05 | EPA 1311 |
| Silver (TCLP) | < 0.010 | mg/L | 10/03/05 | EPA 1311 |

Reporting Analyst: JAB
Date Reported: 10/06/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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Duane R. Boline, Ph.D., Director
Laboratory Customer Service - (785) 296-1620
Laboratory Fax - (785) 296-1641
CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459620
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-2
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 11:35
Date/Time Received: 09/01/05 11:20

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 290000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Arsenic (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Barium (Total) | 80 | mg/Kg | 09/07/05 | EPA 6010 |
| Beryllium (Total) | 1.3 | mg/Kg | 09/07/05 | EPA 6010 |
| Boron (Total) | 24 | mg/Kg | 09/07/05 | EPA 6010 |
| Cadmium (Total) | 4.2 | mg/Kg | 09/07/05 | EPA 6010 |
| Calcium (Total) | 7400 | mg/Kg | 09/07/05 | EPA 6010 |
| Chromium (Total) | 490 | mg/Kg | 09/07/05 | EPA 6010 |
| Cobalt (Total) | 5.4 | mg/Kg | 09/07/05 | EPA 6010 |
| Copper (Total) | 5700 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 9600 | mg/Kg | 09/07/05 | EPA 6010 |
| Lead (Total) | 270 | mg/Kg | 09/07/05 | EPA 6010 |
| Magnesium (Total) | 8000 | mg/Kg | 09/07/05 | EPA 6010 |
| Manganese (Total) | 830 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/07/05 | EPA 245.1 |
| Molybdenum (Total) | 32 | mg/Kg | 09/07/05 | EPA 6010 |
| Nickel (Total) | 240 | mg/Kg | 09/07/05 | EPA 6010 |
| Percent Solids | 69 | Percent | 09/01/05 | EPA 1311 |
| Potassium (Total) | 400 | mg/Kg | 09/07/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Silica (Total) | 1300 | mg/Kg | 09/07/05 | EPA 6010 |
| Silver (Total) | 3.2 | mg/Kg | 09/07/05 | EPA 6010 |
| Sodium (Total) | 560 | mg/Kg | 09/07/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Vanadium (Total) | 38 | mg/Kg | 09/07/05 | EPA 6010 |
| Zinc (Total) | 7600 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459622
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-3
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 11:40
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 240000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Arsenic (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Barium (Total) | 160 | mg/Kg | 09/07/05 | EPA 6010 |
| Beryllium (Total) | 5.7 | mg/Kg | 09/07/05 | EPA 6010 |
| Boron (Total) | 27 | mg/Kg | 09/07/05 | EPA 6010 |
| Cadmium (Total) | 15 | mg/Kg | 09/07/05 | EPA 6010 |
| Calcium (Total) | 6300 | mg/Kg | 09/07/05 | EPA 6010 |
| Chromium (Total) | 140 | mg/Kg | 09/07/05 | EPA 6010 |
| Cobalt (Total) | 2.8 | mg/Kg | 09/07/05 | EPA 6010 |
| Copper (Total) | 7600 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 11000 | mg/Kg | 09/07/05 | EPA 6010 |
| Lead (Total) | 510 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 9000 | mg/Kg | 09/07/05 | EPA 6010 |
| Manganese (Total) | 920 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/07/05 | EPA 245.1 |
| Molybdenum (Total) | 9.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Nickel (Total) | 92 | mg/Kg | 09/07/05 | EPA 6010 |
| Percent Solids | 71 | Percent | 09/01/05 | EPA 1311 |
| Potassium (Total) | 340 | mg/Kg | 09/07/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Silica (Total) | 1500 | mg/Kg | 09/07/05 | EPA 6010 |
| Silver (Total) | 2.5 | mg/Kg | 09/07/05 | EPA 6010 |
| Sodium (Total) | 2200 | mg/Kg | 09/07/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Vanadium (Total) | 32 | mg/Kg | 09/07/05 | EPA 6010 |
| Zinc (Total) | 9000 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459623
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-4
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 11:50
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 270000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Arsenic (Total) | 6.5 | mg/Kg | 09/07/05 | EPA 6010 |
| Barium (Total) | 140 | mg/Kg | 09/07/05 | EPA 6010 |
| Beryllium (Total) | 2.2 | mg/Kg | 09/07/05 | EPA 6010 |
| Boron (Total) | 40 | mg/Kg | 09/07/05 | EPA 6010 |
| Cadmium (Total) | 4.9 | mg/Kg | 09/07/05 | EPA 6010 |
| Calcium (Total) | 22000 | mg/Kg | 09/07/05 | EPA 6010 |
| Chromium (Total) | 350 | mg/Kg | 09/07/05 | EPA 6010 |
| Cobalt (Total) | 6.7 | mg/Kg | 09/07/05 | EPA 6010 |
| Copper (Total) | 7200 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 16000 | mg/Kg | 09/07/05 | EPA 6010 |
| Lead (Total) | 1200 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 11000 | mg/Kg | 09/07/05 | EPA 6010 |
| Manganese (Total) | 950 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 13 | mg/Kg | 09/07/05 | EPA 6010 |
| Nickel (Total) | 250 | mg/Kg | 09/07/05 | EPA 6010 |
| Percent Solids | 73 | Percent | 09/01/05 | EPA 1311 |
| Potassium (Total) | 760 | mg/Kg | 09/07/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Silica (Total) | 2100 | mg/Kg | 09/07/05 | EPA 6010 |
| Silver (Total) | 4.1 | mg/Kg | 09/07/05 | EPA 6010 |
| Sodium (Total) | 520 | mg/Kg | 09/07/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Vanadium (Total) | 50 | mg/Kg | 09/07/05 | EPA 6010 |
| Zinc (Total) | 7800 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
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**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION  Analysis Code: PT  Lab Number: 461134

CURTIS SOB SUITE 410
TOPEKA KS 66612

4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-4
Collector: T Kogl KDHE/BER  Matrix: Soil  Collect Depth: 000
Date/Time Collected: 08/31/05 11:50  Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|---|
| Arsenic (TCLP) | < 0.050 | | mg/L | 10/03/05 | EPA 1311 |
| Barium (TCLP) | 1.9 | | mg/L | 10/03/05 | EPA 1311 |
| Cadmium (TCLP) | 0.016 | | mg/L | 10/03/05 | EPA 1311 |
| Chromium (TCLP) | < 0.010 | | mg/L | 10/03/05 | EPA 1311 |
| Lead (TCLP) | 0.81 | | mg/L | 10/03/05 | EPA 1311 |
| Mercury (TCLP) | < 0.00050 | * | mg/L | 10/04/05 | EPA 1311 |
| Percent Solids | 100 | | Percent | 09/30/05 | EPA 1311 |
| Selenium (TCLP) | < 0.050 | | mg/L | 10/03/05 | EPA 1311 |
| Silver (TCLP) | < 0.010 | | mg/L | 10/03/05 | EPA 1311 |

Reporting Analyst: JAB
Date Reported: 10/06/05
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## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459624
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-5
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 11:55
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 260000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Arsenic (Total) | 7.3 | mg/Kg | 09/07/05 | EPA 6010 |
| Barium (Total) | 410 | mg/Kg | 09/07/05 | EPA 6010 |
| Beryllium (Total) | 3.9 | mg/Kg | 09/07/05 | EPA 6010 |
| Boron (Total) | 36 | mg/Kg | 09/07/05 | EPA 6010 |
| Cadmium (Total) | 5.9 | mg/Kg | 09/07/05 | EPA 6010 |
| Calcium (Total) | 13000 | mg/Kg | 09/07/05 | EPA 6010 |
| Chromium (Total) | 720 | mg/Kg | 09/07/05 | EPA 6010 |
| Cobalt (Total) | 12 | mg/Kg | 09/07/05 | EPA 6010 |
| Copper (Total) | 11000 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 11000 | mg/Kg | 09/07/05 | EPA 6010 |
| Lead (Total) | 860 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 22000 | mg/Kg | 09/07/05 | EPA 6010 |
| Manganese (Total) | 1100 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 18 | mg/Kg | 09/07/05 | EPA 6010 |
| Nickel (Total) | 330 | mg/Kg | 09/07/05 | EPA 6010 |
| Percent Solids | 73 | Percent | 09/01/05 | EPA 1311 |
| Potassium (Total) | 1000 | mg/Kg | 09/07/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Silica (Total) | 2200 | mg/Kg | 09/07/05 | EPA 6010 |
| Silver (Total) | 5.7 | mg/Kg | 09/07/05 | EPA 6010 |
| Sodium (Total) | 260 | mg/Kg | 09/07/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Vanadium (Total) | 49 | mg/Kg | 09/07/05 | EPA 6010 |
| Zinc (Total) | 8500 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
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**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 461135
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-5
Collector: T Kogl KDHE/BER
Matrix: Soil
Collect Depth:
Date/Time Collected: 08/31/05 11:55
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|---|
| Arsenic (TCLP) | < 0.050 | | mg/L | 10/03/05 | EPA 1311 |
| Barium (TCLP) | 4.9 | | mg/L | 10/03/05 | EPA 1311 |
| Cadmium (TCLP) | 0.016 | | mg/L | 10/03/05 | EPA 1311 |
| Chromium (TCLP) | < 0.010 | | mg/L | 10/03/05 | EPA 1311 |
| Lead (TCLP) | 0.46 | | mg/L | 10/03/05 | EPA 1311 |
| Mercury (TCLP) | < 0.00050 | * | mg/L | 10/04/05 | EPA 1311 |
| Percent Solids | 100 | | Percent | 09/30/05 | EPA 1311 |
| Selenium (TCLP) | < 0.050 | | mg/L | 10/03/05 | EPA 1311 |
| Silver (TCLP) | < 0.010 | | mg/L | 10/03/05 | EPA 1311 |

Reporting Analyst: JAB
Date Reported: 10/06/05
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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459625
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-6
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 11:57
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 250000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Arsenic (Total) | 6.5 | mg/Kg | 09/07/05 | EPA 6010 |
| Barium (Total) | 240 | mg/Kg | 09/07/05 | EPA 6010 |
| Beryllium (Total) | 4.1 | mg/Kg | 09/07/05 | EPA 6010 |
| Boron (Total) | 37 | mg/Kg | 09/07/05 | EPA 6010 |
| Cadmium (Total) | 3.9 | mg/Kg | 09/07/05 | EPA 6010 |
| Calcium (Total) | 37000 | mg/Kg | 09/07/05 | EPA 6010 |
| Chromium (Total) | 210 | mg/Kg | 09/07/05 | EPA 6010 |
| Cobalt (Total) | 6.8 | mg/Kg | 09/07/05 | EPA 6010 |
| Copper (Total) | 4700 | mg/Kg | 09/07/05 | EPA 6010 |
| Iron (Total) | 8500 | mg/Kg | 09/07/05 | EPA 6010 |
| Lead (Total) | 640 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 18000 | mg/Kg | 09/07/05 | EPA 6010 |
| Manganese (Total) | 1300 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 9.6 | mg/Kg | 09/07/05 | EPA 6010 |
| Nickel (Total) | 130 | mg/Kg | 09/07/05 | EPA 6010 |
| Percent Solids | 76 | Percent | 09/01/05 | EPA 1311 |
| Potassium (Total) | 1300 | mg/Kg | 09/07/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Silica (Total) | 1700 | mg/Kg | 09/07/05 | EPA 6010 |
| Silver (Total) | 2.8 | mg/Kg | 09/07/05 | EPA 6010 |
| Sodium (Total) | 300 | mg/Kg | 09/07/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Vanadium (Total) | 38 | mg/Kg | 09/07/05 | EPA 6010 |
| Zinc (Total) | 4000 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 461136
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-6
Collector: T Kogl KDHE/BER
Matrix: Soil
Collect Depth:
Date/Time Collected: 08/31/05 11:57
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|---|
| Arsenic (TCLP) | < 0.050 | | mg/L | 10/03/05 | EPA 1311 |
| Barium (TCLP) | 2.9 | | mg/L | 10/03/05 | EPA 1311 |
| Cadmium (TCLP) | 0.0094 | | mg/L | 10/03/05 | EPA 1311 |
| Chromium (TCLP) | < 0.010 | | mg/L | 10/03/05 | EPA 1311 |
| Lead (TCLP) | < 0.050 | | mg/L | 10/03/05 | EPA 1311 |
| Mercury (TCLP) | < 0.00050 | * | mg/L | 10/04/05 | EPA 1311 |
| Percent Solids | 100 | | Percent | 09/30/05 | EPA 1311 |
| Selenium (TCLP) | < 0.050 | | mg/L | 10/03/05 | EPA 1311 |
| Silver (TCLP) | < 0.010 | | mg/L | 10/03/05 | EPA 1311 |

Reporting Analyst: JAB
Date Reported: 10/06/05
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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459626
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-7
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 12:00
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 310000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Arsenic (Total) | 6.8 | mg/Kg | 09/07/05 | EPA 6010 |
| Barium (Total) | 140 | mg/Kg | 09/07/05 | EPA 6010 |
| Beryllium (Total) | 1.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Boron (Total) | 43 | mg/Kg | 09/07/05 | EPA 6010 |
| Cadmium (Total) | 2.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Calcium (Total) | 22000 | mg/Kg | 09/07/05 | EPA 6010 |
| Chromium (Total) | 240 | mg/Kg | 09/07/05 | EPA 6010 |
| Cobalt (Total) | 6.9 | mg/Kg | 09/07/05 | EPA 6010 |
| Copper (Total) | 2500 | mg/Kg | 09/07/05 | EPA 6010 |
| Iron (Total) | 6200 | mg/Kg | 09/07/05 | EPA 6010 |
| Lead (Total) | 290 | mg/Kg | 09/07/05 | EPA 6010 |
| Magnesium (Total) | 14000 | mg/Kg | 09/07/05 | EPA 6010 |
| Manganese (Total) | 1400 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 9.1 | mg/Kg | 09/07/05 | EPA 6010 |
| Nickel (Total) | 86 | mg/Kg | 09/07/05 | EPA 6010 |
| Percent Solids | 76 | Percent | 09/01/05 | EPA 1311 |
| Potassium (Total) | 550 | mg/Kg | 09/07/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Silica (Total) | 1400 | mg/Kg | 09/07/05 | EPA 6010 |
| Silver (Total) | 1.7 | mg/Kg | 09/07/05 | EPA 6010 |
| Sodium (Total) | 270 | mg/Kg | 09/07/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Vanadium (Total) | 42 | mg/Kg | 09/07/05 | EPA 6010 |
| Zinc (Total) | 1800 | mg/Kg | 09/07/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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BUREAU OF ENVIRONMENTAL REMEDIATION

Duane R. Boline, Ph.D., Director
Laboratory Customer Service - (785) 296-1620
Laboratory Fax - (785) 296-1641
CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459627
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-8
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 12:05
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 270000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Arsenic (Total) | 5.6 | mg/Kg | 09/07/05 | EPA 6010 |
| Barium (Total) | 210 | mg/Kg | 09/07/05 | EPA 6010 |
| Beryllium (Total) | 4.7 | mg/Kg | 09/07/05 | EPA 6010 |
| Boron (Total) | 29 | mg/Kg | 09/07/05 | EPA 6010 |
| Cadmium (Total) | 5.8 | mg/Kg | 09/07/05 | EPA 6010 |
| Calcium (Total) | 6800 | mg/Kg | 09/07/05 | EPA 6010 |
| Chromium (Total) | 280 | mg/Kg | 09/07/05 | EPA 6010 |
| Cobalt (Total) | 4.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Copper (Total) | 11000 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 8400 | mg/Kg | 09/07/05 | EPA 6010 |
| Lead (Total) | 7000 | mg/Kg | 09/07/05 | EPA 6010 |
| Magnesium (Total) | 16000 | mg/Kg | 09/07/05 | EPA 6010 |
| Manganese (Total) | 1000 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 12 | mg/Kg | 09/07/05 | EPA 6010 |
| Nickel (Total) | 230 | mg/Kg | 09/07/05 | EPA 6010 |
| Percent Solids | 64 | Percent | 09/01/05 | EPA 1311 |
| Potassium (Total) | 420 | mg/Kg | 09/07/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Silica (Total) | 1600 | mg/Kg | 09/07/05 | EPA 6010 |
| Silver (Total) | 12 | mg/Kg | 09/07/05 | EPA 6010 |
| Sodium (Total) | 200 | mg/Kg | 09/07/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/07/05 | EPA 6010 |
| Vanadium (Total) | 42 | mg/Kg | 09/07/05 | EPA 6010 |
| Zinc (Total) | 7400 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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Duane R. Boline, Ph.D., Director
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CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 461137
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-8
Collector: T Kogl KDHE/BER
Matrix: Soil
Collect Depth: 000
Date/Time Collected: 08/31/05 12:05
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|---|
| Arsenic (TCLP) | < 0.050 | | mg/L | 10/03/05 | EPA 1311 |
| Barium (TCLP) | 5.9 | | mg/L | 10/03/05 | EPA 1311 |
| Cadmium (TCLP) | 0.017 | | mg/L | 10/03/05 | EPA 1311 |
| Chromium (TCLP) | < 0.010 | | mg/L | 10/03/05 | EPA 1311 |
| Lead (TCLP) | 36 | | mg/L | 10/03/05 | EPA 1311 |
| Mercury (TCLP) | < 0.00050 | * | mg/L | 10/04/05 | EPA 1311 |
| Percent Solids | 100 | | Percent | 09/30/05 | EPA 1311 |
| Selenium (TCLP) | < 0.050 | | mg/L | 10/03/05 | EPA 1311 |
| Silver (TCLP) | < 0.010 | | mg/L | 10/03/05 | EPA 1311 |

Reporting Analyst: JAB
Date Reported: 10/06/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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Duane R. Boline, Ph.D., Director
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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

# REPORT OF ANALYSIS

## INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459629
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-8A
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 12:06
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 270000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Arsenic (Total) | 5.4 | mg/Kg | 09/08/05 | EPA 6010 |
| Barium (Total) | 290 | mg/Kg | 09/08/05 | EPA 6010 |
| Beryllium (Total) | 4.1 | mg/Kg | 09/08/05 | EPA 6010 |
| Boron (Total) | 31 | mg/Kg | 09/08/05 | EPA 6010 |
| Cadmium (Total) | 5.5 | mg/Kg | 09/08/05 | EPA 6010 |
| Calcium (Total) | 16000 | mg/Kg | 09/08/05 | EPA 6010 |
| Chromium (Total) | 330 | mg/Kg | 09/08/05 | EPA 6010 |
| Cobalt (Total) | 4.4 | mg/Kg | 09/08/05 | EPA 6010 |
| Copper (Total) | 11000 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 7200 | mg/Kg | 09/08/05 | EPA 6010 |
| Lead (Total) | 7300 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 17000 | mg/Kg | 09/08/05 | EPA 6010 |
| Manganese (Total) | 1200 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 12 | mg/Kg | 09/08/05 | EPA 6010 |
| Nickel (Total) | 220 | mg/Kg | 09/08/05 | EPA 6010 |
| Percent Solids | 64000 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 440 | mg/Kg | 09/08/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Silica (Total) | 1100 | mg/Kg | 09/08/05 | EPA 6010 |
| Silver (Total) | 10 | mg/Kg | 09/08/05 | EPA 6010 |
| Sodium (Total) | 180 | mg/Kg | 09/08/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Vanadium (Total) | 39 | mg/Kg | 09/08/05 | EPA 6010 |
| Zinc (Total) | 7600 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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ENVIRONMENTAL REMEDIATION

Duane R. Boline, Ph.D., Director
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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459628
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-9
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 12:15
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 270000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Arsenic (Total) | 5.3 | mg/Kg | 09/08/05 | EPA 6010 |
| Barium (Total) | 940 | mg/Kg | 09/08/05 | EPA 6010 |
| Beryllium (Total) | 3.4 | mg/Kg | 09/08/05 | EPA 6010 |
| Boron (Total) | 21 | mg/Kg | 09/08/05 | EPA 6010 |
| Cadmium (Total) | 4.9 | mg/Kg | 09/08/05 | EPA 6010 |
| Calcium (Total) | 3100 | mg/Kg | 09/08/05 | EPA 6010 |
| Chromium (Total) | 390 | mg/Kg | 09/08/05 | EPA 6010 |
| Cobalt (Total) | 3.5 | mg/Kg | 09/08/05 | EPA 6010 |
| Copper (Total) | 10000 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 7500 | mg/Kg | 09/08/05 | EPA 6010 |
| Lead (Total) | 570 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 13000 | mg/Kg | 09/08/05 | EPA 6010 |
| Manganese (Total) | 1200 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 28 | mg/Kg | 09/08/05 | EPA 6010 |
| Nickel (Total) | 180 | mg/Kg | 09/08/05 | EPA 6010 |
| Percent Solids | 69 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 210 | mg/Kg | 09/08/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Silica (Total) | 1300 | mg/Kg | 09/08/05 | EPA 6010 |
| Silver (Total) | 4.8 | mg/Kg | 09/08/05 | EPA 6010 |
| Sodium (Total) | 120 | mg/Kg | 09/08/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Vanadium (Total) | 43 | mg/Kg | 09/08/05 | EPA 6010 |
| Zinc (Total) | 6000 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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* - Holding Time Exceeded

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Duane R. Boline, Ph.D., Director
Laboratory Customer Service - (785) 296-1620
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CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459630
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-10
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 12:18
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 170000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Arsenic (Total) | 7.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Barium (Total) | 150 | mg/Kg | 09/08/05 | EPA 6010 |
| Beryllium (Total) | 2.8 | mg/Kg | 09/08/05 | EPA 6010 |
| Boron (Total) | 26 | mg/Kg | 09/08/05 | EPA 6010 |
| Cadmium (Total) | 5.5 | mg/Kg | 09/08/05 | EPA 6010 |
| Calcium (Total) | 68000 | mg/Kg | 09/08/05 | EPA 6010 |
| Chromium (Total) | 290 | mg/Kg | 09/08/05 | EPA 6010 |
| Cobalt (Total) | 8.8 | mg/Kg | 09/08/05 | EPA 6010 |
| Copper (Total) | 5000 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 21000 | mg/Kg | 09/08/05 | EPA 6010 |
| Lead (Total) | 480 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 12000 | mg/Kg | 09/08/05 | EPA 6010 |
| Manganese (Total) | 1100 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 11 | mg/Kg | 09/08/05 | EPA 6010 |
| Nickel (Total) | 210 | mg/Kg | 09/08/05 | EPA 6010 |
| Percent Solids | 77 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 1600 | mg/Kg | 09/08/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Silica (Total) | 1400 | mg/Kg | 09/08/05 | EPA 6010 |
| Silver (Total) | 3.2 | mg/Kg | 09/08/05 | EPA 6010 |
| Sodium (Total) | 380 | mg/Kg | 09/08/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Vanadium (Total) | 41 | mg/Kg | 09/08/05 | EPA 6010 |
| Zinc (Total) | 5000 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459631
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-11
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 12:55
Date/Time Received: 09/01/05 11:21

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 290000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Arsenic (Total) | 6.9 | mg/Kg | 09/08/05 | EPA 6010 |
| Barium (Total) | 120 | mg/Kg | 09/08/05 | EPA 6010 |
| Beryllium (Total) | 2.4 | mg/Kg | 09/08/05 | EPA 6010 |
| Boron (Total) | 32 | mg/Kg | 09/08/05 | EPA 6010 |
| Cadmium (Total) | 4.2 | mg/Kg | 09/08/05 | EPA 6010 |
| Calcium (Total) | 12000 | mg/Kg | 09/08/05 | EPA 6010 |
| Chromium (Total) | 250 | mg/Kg | 09/08/05 | EPA 6010 |
| Cobalt (Total) | 9.5 | mg/Kg | 09/08/05 | EPA 6010 |
| Copper (Total) | 6000 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 6800 | mg/Kg | 09/08/05 | EPA 6010 |
| Lead (Total) | 570 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 8100 | mg/Kg | 09/08/05 | EPA 6010 |
| Manganese (Total) | 680 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 14 | mg/Kg | 09/08/05 | EPA 6010 |
| Nickel (Total) | 140 | mg/Kg | 09/08/05 | EPA 6010 |
| Percent Solids | 74 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 740 | mg/Kg | 09/08/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Silica (Total) | 1300 | mg/Kg | 09/08/05 | EPA 6010 |
| Silver (Total) | 2.7 | mg/Kg | 09/08/05 | EPA 6010 |
| Sodium (Total) | 460 | mg/Kg | 09/08/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Vanadium (Total) | 46 | mg/Kg | 09/08/05 | EPA 6010 |
| Zinc (Total) | 5800 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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* - Holding Time Exceeded

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Duane R. Boline, Ph.D., Director
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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459632
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-11A
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 12:56
Date/Time Received: 09/01/05 11:22

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 280000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Arsenic (Total) | 5.3 | mg/Kg | 09/08/05 | EPA 6010 |
| Barium (Total) | 150 | mg/Kg | 09/08/05 | EPA 6010 |
| Beryllium (Total) | 2.1 | mg/Kg | 09/08/05 | EPA 6010 |
| Boron (Total) | 39 | mg/Kg | 09/08/05 | EPA 6010 |
| Cadmium (Total) | 3.5 | mg/Kg | 09/08/05 | EPA 6010 |
| Calcium (Total) | 14000 | mg/Kg | 09/08/05 | EPA 6010 |
| Chromium (Total) | 240 | mg/Kg | 09/08/05 | EPA 6010 |
| Cobalt (Total) | 7.6 | mg/Kg | 09/08/05 | EPA 6010 |
| Copper (Total) | 5700 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 7200 | mg/Kg | 09/08/05 | EPA 6010 |
| Lead (Total) | 640 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 8300 | mg/Kg | 09/08/05 | EPA 6010 |
| Manganese (Total) | 640 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 9.7 | mg/Kg | 09/08/05 | EPA 6010 |
| Nickel (Total) | 130 | mg/Kg | 09/08/05 | EPA 6010 |
| Percent Solids | 73 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 750 | mg/Kg | 09/08/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Silica (Total) | 1300 | mg/Kg | 09/08/05 | EPA 6010 |
| Silver (Total) | 2.9 | mg/Kg | 09/08/05 | EPA 6010 |
| Sodium (Total) | 420 | mg/Kg | 09/08/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Vanadium (Total) | 46 | mg/Kg | 09/08/05 | EPA 6010 |
| Zinc (Total) | 6000 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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BUREAU OF ENVIRONMENTAL REMEDIATION

Duane R. Boline, Ph.D., Director
Laboratory Customer Service - (785) 296-1620
Laboratory Fax - (785) 296-1641
CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459633
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-12
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 13:00
Date/Time Received: 09/01/05 11:22

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 290000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Arsenic (Total) | 5.6 | mg/Kg | 09/08/05 | EPA 6010 |
| Barium (Total) | 22 | mg/Kg | 09/08/05 | EPA 6010 |
| Beryllium (Total) | 0.53 | mg/Kg | 09/08/05 | EPA 6010 |
| Boron (Total) | 6.9 | mg/Kg | 09/08/05 | EPA 6010 |
| Cadmium (Total) | 26 | mg/Kg | 09/08/05 | EPA 6010 |
| Calcium (Total) | 4500 | mg/Kg | 09/08/05 | EPA 6010 |
| Chromium (Total) | 670 | mg/Kg | 09/08/05 | EPA 6010 |
| Cobalt (Total) | 5.3 | mg/Kg | 09/08/05 | EPA 6010 |
| Copper (Total) | 11000 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 5700 | mg/Kg | 09/08/05 | EPA 6010 |
| Lead (Total) | 370 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 2900 | mg/Kg | 09/08/05 | EPA 6010 |
| Manganese (Total) | 1400 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 17 | mg/Kg | 09/08/05 | EPA 6010 |
| Nickel (Total) | 2300 | mg/Kg | 09/08/05 | EPA 6010 |
| Percent Solids | 69 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 130 | mg/Kg | 09/08/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Silica (Total) | 1400 | mg/Kg | 09/08/05 | EPA 6010 |
| Silver (Total) | 17 | mg/Kg | 09/08/05 | EPA 6010 |
| Sodium (Total) | 110 | mg/Kg | 09/08/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Vanadium (Total) | 68 | mg/Kg | 09/08/05 | EPA 6010 |
| Zinc (Total) | 16000 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 461138
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-12
Collector: T Kogl KDHE/BER
Matrix: Soil
Collect Depth: 000
Date/Time Collected: 08/31/05 13:00
Date/Time Received: 09/01/05 11:22

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Arsenic (TCLP) | < 0.050 | mg/L | 10/03/05 | EPA 1311 |
| Barium (TCLP) | 1.6 | mg/L | 10/03/05 | EPA 1311 |
| Cadmium (TCLP) | 0.036 | mg/L | 10/03/05 | EPA 1311 |
| Chromium (TCLP) | < 0.010 | mg/L | 10/03/05 | EPA 1311 |
| Lead (TCLP) | 0.78 | mg/L | 10/03/05 | EPA 1311 |
| Mercury (TCLP) | < 0.00050 * | mg/L | 10/04/05 | EPA 1311 |
| Percent Solids | 100 | Percent | 09/30/05 | EPA 1311 |
| Selenium (TCLP) | < 0.050 | mg/L | 10/03/05 | EPA 1311 |
| Silver (TCLP) | < 0.010 | mg/L | 10/03/05 | EPA 1311 |

Reporting Analyst: JAB
Date Reported: 10/06/05
Copies To: File

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* - Holding Time Exceeded

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CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459634
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-13
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 12:05
Date/Time Received: 09/01/05 11:22

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 220000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Arsenic (Total) | 7.6 | mg/Kg | 09/08/05 | EPA 6010 |
| Barium (Total) | 150 | mg/Kg | 09/08/05 | EPA 6010 |
| Beryllium (Total) | 2.4 | mg/Kg | 09/08/05 | EPA 6010 |
| Boron (Total) | 41 | mg/Kg | 09/08/05 | EPA 6010 |
| Cadmium (Total) | 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Calcium (Total) | 53000 | mg/Kg | 09/08/05 | EPA 6010 |
| Chromium (Total) | 320 | mg/Kg | 09/08/05 | EPA 6010 |
| Cobalt (Total) | 8.9 | mg/Kg | 09/08/05 | EPA 6010 |
| Copper (Total) | 5400 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 15000 | mg/Kg | 09/08/05 | EPA 6010 |
| Lead (Total) | 500 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 11000 | mg/Kg | 09/08/05 | EPA 6010 |
| Manganese (Total) | 820 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 14 | mg/Kg | 09/08/05 | EPA 6010 |
| Nickel (Total) | 160 | mg/Kg | 09/08/05 | EPA 6010 |
| Percent Solids | 84 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 1500 | mg/Kg | 09/08/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Silica (Total) | 1400 | mg/Kg | 09/08/05 | EPA 6010 |
| Silver (Total) | 2.7 | mg/Kg | 09/08/05 | EPA 6010 |
| Sodium (Total) | 860 | mg/Kg | 09/08/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Vanadium (Total) | 43 | mg/Kg | 09/08/05 | EPA 6010 |
| Zinc (Total) | 4500 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459635
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-14
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 13:15
Date/Time Received: 09/01/05 11:22

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 190000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Arsenic (Total) | 7.2 | mg/Kg | 09/08/05 | EPA 6010 |
| Barium (Total) | 290 | mg/Kg | 09/08/05 | EPA 6010 |
| Beryllium (Total) | 6.5 | mg/Kg | 09/08/05 | EPA 6010 |
| Boron (Total) | 42 | mg/Kg | 09/08/05 | EPA 6010 |
| Cadmium (Total) | 6.5 | mg/Kg | 09/08/05 | EPA 6010 |
| Calcium (Total) | 55000 | mg/Kg | 09/08/05 | EPA 6010 |
| Chromium (Total) | 500 | mg/Kg | 09/08/05 | EPA 6010 |
| Cobalt (Total) | 9.6 | mg/Kg | 09/08/05 | EPA 6010 |
| Copper (Total) | 7800 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 18000 | mg/Kg | 09/08/05 | EPA 6010 |
| Lead (Total) | 1100 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 20000 | mg/Kg | 09/08/05 | EPA 6010 |
| Manganese (Total) | 1100 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 16 | mg/Kg | 09/08/05 | EPA 6010 |
| Nickel (Total) | 280 | mg/Kg | 09/08/05 | EPA 6010 |
| Percent Solids | 86 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 1600 | mg/Kg | 09/08/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Silica (Total) | 2000 | mg/Kg | 09/08/05 | EPA 6010 |
| Silver (Total) | 6.9 | mg/Kg | 09/08/05 | EPA 6010 |
| Sodium (Total) | 600 | mg/Kg | 09/08/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Vanadium (Total) | 49 | mg/Kg | 09/08/05 | EPA 6010 |
| Zinc (Total) | 6800 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459636
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-15
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 13:20
Date/Time Received: 09/01/05 11:22

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 270000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Arsenic (Total) | 6.9 | mg/Kg | 09/08/05 | EPA 6010 |
| Barium (Total) | 180 | mg/Kg | 09/08/05 | EPA 6010 |
| Beryllium (Total) | 7.7 | mg/Kg | 09/08/05 | EPA 6010 |
| Boron (Total) | 77 | mg/Kg | 09/08/05 | EPA 6010 |
| Cadmium (Total) | 5.6 | mg/Kg | 09/08/05 | EPA 6010 |
| Calcium (Total) | 13000 | mg/Kg | 09/08/05 | EPA 6010 |
| Chromium (Total) | 700 | mg/Kg | 09/08/05 | EPA 6010 |
| Cobalt (Total) | 6.2 | mg/Kg | 09/08/05 | EPA 6010 |
| Copper (Total) | 10000 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 8800 | mg/Kg | 09/08/05 | EPA 6010 |
| Lead (Total) | 430 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 19000 | mg/Kg | 09/08/05 | EPA 6010 |
| Manganese (Total) | 1100 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 17 | mg/Kg | 09/08/05 | EPA 6010 |
| Nickel (Total) | 480 | mg/Kg | 09/08/05 | EPA 6010 |
| Percent Solids | 68 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 1200 | mg/Kg | 09/08/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Silica (Total) | 1300 | mg/Kg | 09/08/05 | EPA 6010 |
| Silver (Total) | 3.4 | mg/Kg | 09/08/05 | EPA 6010 |
| Sodium (Total) | 450 | mg/Kg | 09/08/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Vanadium (Total) | 49 | mg/Kg | 09/08/05 | EPA 6010 |
| Zinc (Total) | 5000 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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* - Holding Time Exceeded

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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459637
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-16
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 13:21
Date/Time Received: 09/01/05 11:22

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 270000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Arsenic (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Barium (Total) | 48 | mg/Kg | 09/08/05 | EPA 6010 |
| Beryllium (Total) | 0.17 | mg/Kg | 09/08/05 | EPA 6010 |
| Boron (Total) | 56 | mg/Kg | 09/08/05 | EPA 6010 |
| Cadmium (Total) | 9.4 | mg/Kg | 09/08/05 | EPA 6010 |
| Calcium (Total) | 4400 | mg/Kg | 09/08/05 | EPA 6010 |
| Chromium (Total) | 150 | mg/Kg | 09/08/05 | EPA 6010 |
| Cobalt (Total) | 2.1 | mg/Kg | 09/08/05 | EPA 6010 |
| Copper (Total) | 17000 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 2600 | mg/Kg | 09/08/05 | EPA 6010 |
| Lead (Total) | 570 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 2100 | mg/Kg | 09/08/05 | EPA 6010 |
| Manganese (Total) | 980 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 13 | mg/Kg | 09/08/05 | EPA 6010 |
| Nickel (Total) | 260 | mg/Kg | 09/08/05 | EPA 6010 |
| Percent Solids | 57 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 210 | mg/Kg | 09/08/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Silica (Total) | 1200 | mg/Kg | 09/08/05 | EPA 6010 |
| Silver (Total) | 3.7 | mg/Kg | 09/08/05 | EPA 6010 |
| Sodium (Total) | 64 | mg/Kg | 09/08/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Vanadium (Total) | 26 | mg/Kg | 09/08/05 | EPA 6010 |
| Zinc (Total) | 9200 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459638
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-17
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 13:35
Date/Time Received: 09/01/05 11:22

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 160000 | mg/Kg | 09/08/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Arsenic (Total) | 9.1 | mg/Kg | 09/08/05 | EPA 6010 |
| Barium (Total) | 140 | mg/Kg | 09/08/05 | EPA 6010 |
| Beryllium (Total) | 4.3 | mg/Kg | 09/08/05 | EPA 6010 |
| Boron (Total) | 39 | mg/Kg | 09/08/05 | EPA 6010 |
| Cadmium (Total) | 7.9 | mg/Kg | 09/08/05 | EPA 6010 |
| Calcium (Total) | 47000 | mg/Kg | 09/08/05 | EPA 6010 |
| Chromium (Total) | 230 | mg/Kg | 09/08/05 | EPA 6010 |
| Cobalt (Total) | 6.5 | mg/Kg | 09/08/05 | EPA 6010 |
| Copper (Total) | 5900 | mg/Kg | 09/08/05 | EPA 6010 |
| Iron (Total) | 13000 | mg/Kg | 09/08/05 | EPA 6010 |
| Lead (Total) | 730 | mg/Kg | 09/08/05 | EPA 6010 |
| Magnesium (Total) | 10000 | mg/Kg | 09/08/05 | EPA 6010 |
| Manganese (Total) | 770 | mg/Kg | 09/08/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 19 | mg/Kg | 09/08/05 | EPA 6010 |
| Nickel (Total) | 170 | mg/Kg | 09/08/05 | EPA 6010 |
| Percent Solids | 83 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 3000 | mg/Kg | 09/08/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Silica (Total) | 1300 | mg/Kg | 09/08/05 | EPA 6010 |
| Silver (Total) | 5.3 | mg/Kg | 09/08/05 | EPA 6010 |
| Sodium (Total) | 890 | mg/Kg | 09/08/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/08/05 | EPA 6010 |
| Vanadium (Total) | 69 | mg/Kg | 09/08/05 | EPA 6010 |
| Zinc (Total) | 5300 | mg/Kg | 09/08/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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* - Holding Time Exceeded

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Laboratory Customer Service - (785) 296-1620
Laboratory Fax - (785) 296-1641
CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459639
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-18
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 13:50
Date/Time Received: 09/01/05 11:23

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 280000 | mg/Kg | 09/09/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Arsenic (Total) | 6.1 | mg/Kg | 09/09/05 | EPA 6010 |
| Barium (Total) | 220 | mg/Kg | 09/09/05 | EPA 6010 |
| Beryllium (Total) | 3.7 | mg/Kg | 09/09/05 | EPA 6010 |
| Boron (Total) | 78 | mg/Kg | 09/09/05 | EPA 6010 |
| Cadmium (Total) | 4.3 | mg/Kg | 09/09/05 | EPA 6010 |
| Calcium (Total) | 6700 | mg/Kg | 09/09/05 | EPA 6010 |
| Chromium (Total) | 360 | mg/Kg | 09/09/05 | EPA 6010 |
| Cobalt (Total) | 4.9 | mg/Kg | 09/09/05 | EPA 6010 |
| Copper (Total) | 12000 | mg/Kg | 09/09/05 | EPA 6010 |
| Iron (Total) | 6500 | mg/Kg | 09/09/05 | EPA 6010 |
| Lead (Total) | 420 | mg/Kg | 09/09/05 | EPA 6010 |
| Magnesium (Total) | 10000 | mg/Kg | 09/09/05 | EPA 6010 |
| Manganese (Total) | 990 | mg/Kg | 09/09/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 14 | mg/Kg | 09/09/05 | EPA 6010 |
| Nickel (Total) | 200 | mg/Kg | 09/09/05 | EPA 6010 |
| Percent Solids | 68 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 1300 | mg/Kg | 09/09/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Silica (Total) | 1700 | mg/Kg | 09/09/05 | EPA 6010 |
| Silver (Total) | 4.4 | mg/Kg | 09/09/05 | EPA 6010 |
| Sodium (Total) | 570 | mg/Kg | 09/09/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Vanadium (Total) | 53 | mg/Kg | 09/09/05 | EPA 6010 |
| Zinc (Total) | 4700 | mg/Kg | 09/09/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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Duane R. Boline, Ph.D., Director
Laboratory Customer Service - (785) 296-1620
Laboratory Fax - (785) 296-1641
CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459640
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-19
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 13:55
Date/Time Received: 09/01/05 11:23

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 280000 | mg/Kg | 09/09/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Arsenic (Total) | 7.8 | mg/Kg | 09/09/05 | EPA 6010 |
| Barium (Total) | 420 | mg/Kg | 09/09/05 | EPA 6010 |
| Beryllium (Total) | 4.5 | mg/Kg | 09/09/05 | EPA 6010 |
| Boron (Total) | 32 | mg/Kg | 09/09/05 | EPA 6010 |
| Cadmium (Total) | 6.4 | mg/Kg | 09/09/05 | EPA 6010 |
| Calcium (Total) | 4900 | mg/Kg | 09/09/05 | EPA 6010 |
| Chromium (Total) | 560 | mg/Kg | 09/09/05 | EPA 6010 |
| Cobalt (Total) | 14 | mg/Kg | 09/09/05 | EPA 6010 |
| Copper (Total) | 16000 | mg/Kg | 09/09/05 | EPA 6010 |
| Iron (Total) | 14000 | mg/Kg | 09/09/05 | EPA 6010 |
| Lead (Total) | 650 | mg/Kg | 09/09/05 | EPA 6010 |
| Magnesium (Total) | 15000 | mg/Kg | 09/09/05 | EPA 6010 |
| Manganese (Total) | 1300 | mg/Kg | 09/09/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 18 | mg/Kg | 09/09/05 | EPA 6010 |
| Nickel (Total) | 1700 | mg/Kg | 09/09/05 | EPA 6010 |
| Percent Solids | 66 | Percent | 09/02/05 | EPA 1311 |
| Potassium (Total) | 840 | mg/Kg | 09/09/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Silica (Total) | 1600 | mg/Kg | 09/09/05 | EPA 6010 |
| Silver (Total) | 6.2 | mg/Kg | 09/09/05 | EPA 6010 |
| Sodium (Total) | 350 | mg/Kg | 09/09/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Vanadium (Total) | 48 | mg/Kg | 09/09/05 | EPA 6010 |
| Zinc (Total) | 4500 | mg/Kg | 09/09/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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* - Holding Time Exceeded

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CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 461139
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-19
Collector: T Kogl KDHE/BER
Matrix: Soil
Collect Depth: 000
Date/Time Collected: 08/31/05 13:55
Date/Time Received: 09/01/05 11:23

Sample Comments:

| Parameter | Analytical Result | | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|---|
| Arsenic (TCLP) | < 0.050 | | mg/L | 10/03/05 | EPA 1311 |
| Barium (TCLP) | 4.7 | | mg/L | 10/03/05 | EPA 1311 |
| Cadmium (TCLP) | 0.023 | | mg/L | 10/03/05 | EPA 1311 |
| Chromium (TCLP) | < 0.010 | | mg/L | 10/03/05 | EPA 1311 |
| Lead (TCLP) | 0.55 | | mg/L | 10/03/05 | EPA 1311 |
| Mercury (TCLP) | < 0.00050 | * | mg/L | 10/04/05 | EPA 1311 |
| Percent Solids | 100 | | Percent | 09/30/05 | EPA 1311 |
| Selenium (TCLP) | < 0.050 | | mg/L | 10/03/05 | EPA 1311 |
| Silver (TCLP) | < 0.010 | | mg/L | 10/03/05 | EPA 1311 |

Reporting Analyst: JAB
Date Reported: 10/06/05
Copies To: File

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Duane R. Boline, Ph.D., Director
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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

# REPORT OF ANALYSIS

## INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459641
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-20
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 14:00
Date/Time Received: 09/01/05 11:23

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 160000 | mg/Kg | 09/09/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Arsenic (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Barium (Total) | 160 | mg/Kg | 09/09/05 | EPA 6010 |
| Beryllium (Total) | 3.2 | mg/Kg | 09/09/05 | EPA 6010 |
| Boron (Total) | 38 | mg/Kg | 09/09/05 | EPA 6010 |
| Cadmium (Total) | 3.2 | mg/Kg | 09/09/05 | EPA 6010 |
| Calcium (Total) | 84000 | mg/Kg | 09/09/05 | EPA 6010 |
| Chromium (Total) | 190 | mg/Kg | 09/09/05 | EPA 6010 |
| Cobalt (Total) | 4.4 | mg/Kg | 09/09/05 | EPA 6010 |
| Copper (Total) | 5400 | mg/Kg | 09/09/05 | EPA 6010 |
| Iron (Total) | 13000 | mg/Kg | 09/09/05 | EPA 6010 |
| Lead (Total) | 580 | mg/Kg | 09/09/05 | EPA 6010 |
| Magnesium (Total) | 13000 | mg/Kg | 09/09/05 | EPA 6010 |
| Manganese (Total) | 790 | mg/Kg | 09/09/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 8.7 | mg/Kg | 09/09/05 | EPA 6010 |
| Nickel (Total) | 110 | mg/Kg | 09/09/05 | EPA 6010 |
| Percent Solids | 84 | Percent | 09/06/05 | EPA 1311 |
| Potassium (Total) | 2600 | mg/Kg | 09/09/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Silica (Total) | 1800 | mg/Kg | 09/09/05 | EPA 6010 |
| Silver (Total) | 2.4 | mg/Kg | 09/09/05 | EPA 6010 |
| Sodium (Total) | 790 | mg/Kg | 09/09/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Vanadium (Total) | 36 | mg/Kg | 09/09/05 | EPA 6010 |
| Zinc (Total) | 4200 | mg/Kg | 09/09/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459642
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products S-21
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 14:10
Date/Time Received: 09/01/05 11:23

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 36000 | mg/Kg | 09/09/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Arsenic (Total) | 11 | mg/Kg | 09/09/05 | EPA 6010 |
| Barium (Total) | 260 | mg/Kg | 09/09/05 | EPA 6010 |
| Beryllium (Total) | 1.4 | mg/Kg | 09/09/05 | EPA 6010 |
| Boron (Total) | 15 | mg/Kg | 09/09/05 | EPA 6010 |
| Cadmium (Total) | 1.6 | mg/Kg | 09/09/05 | EPA 6010 |
| Calcium (Total) | 7500 | mg/Kg | 09/09/05 | EPA 6010 |
| Chromium (Total) | 50 | mg/Kg | 09/09/05 | EPA 6010 |
| Cobalt (Total) | 16 | mg/Kg | 09/09/05 | EPA 6010 |
| Copper (Total) | 48 | mg/Kg | 09/09/05 | EPA 6010 |
| Iron (Total) | 29000 | mg/Kg | 09/09/05 | EPA 6010 |
| Lead (Total) | 44 | mg/Kg | 09/09/05 | EPA 6010 |
| Magnesium (Total) | 2800 | mg/Kg | 09/09/05 | EPA 6010 |
| Manganese (Total) | 1600 | mg/Kg | 09/09/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | < 2.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Nickel (Total) | 27 | mg/Kg | 09/09/05 | EPA 6010 |
| Percent Solids | 76 | Percent | 09/06/05 | EPA 1311 |
| Potassium (Total) | 6200 | mg/Kg | 09/09/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Silica (Total) | 1900 | mg/Kg | 09/09/05 | EPA 6010 |
| Silver (Total) | < 1.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Sodium (Total) | 210 | mg/Kg | 09/09/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Vanadium (Total) | 65 | mg/Kg | 09/09/05 | EPA 6010 |
| Zinc (Total) | 170 | mg/Kg | 09/09/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459643
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-22
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 14:15
Date/Time Received: 09/01/05 11:23

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 38000 | mg/Kg | 09/09/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Arsenic (Total) | 11 | mg/Kg | 09/09/05 | EPA 6010 |
| Barium (Total) | 330 | mg/Kg | 09/09/05 | EPA 6010 |
| Beryllium (Total) | 1.3 | mg/Kg | 09/09/05 | EPA 6010 |
| Boron (Total) | 15 | mg/Kg | 09/09/05 | EPA 6010 |
| Cadmium (Total) | 1.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Calcium (Total) | 13000 | mg/Kg | 09/09/05 | EPA 6010 |
| Chromium (Total) | 52 | mg/Kg | 09/09/05 | EPA 6010 |
| Cobalt (Total) | 17 | mg/Kg | 09/09/05 | EPA 6010 |
| Copper (Total) | 33 | mg/Kg | 09/09/05 | EPA 6010 |
| Iron (Total) | 29000 | mg/Kg | 09/09/05 | EPA 6010 |
| Lead (Total) | 35 | mg/Kg | 09/09/05 | EPA 6010 |
| Magnesium (Total) | 3000 | mg/Kg | 09/09/05 | EPA 6010 |
| Manganese (Total) | 1600 | mg/Kg | 09/09/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | < 2.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Nickel (Total) | 27 | mg/Kg | 09/09/05 | EPA 6010 |
| Percent Solids | 80 | Percent | 09/06/05 | EPA 1311 |
| Potassium (Total) | 6000 | mg/Kg | 09/09/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Silica (Total) | 1600 | mg/Kg | 09/09/05 | EPA 6010 |
| Silver (Total) | 6.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Sodium (Total) | 180 | mg/Kg | 09/09/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Vanadium (Total) | 71 | mg/Kg | 09/09/05 | EPA 6010 |
| Zinc (Total) | 100 | mg/Kg | 09/09/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459644
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-23
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 14:17
Date/Time Received: 09/01/05 11:23

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 36000 | mg/Kg | 09/09/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Arsenic (Total) | 15 | mg/Kg | 09/09/05 | EPA 6010 |
| Barium (Total) | 260 | mg/Kg | 09/09/05 | EPA 6010 |
| Beryllium (Total) | 2.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Boron (Total) | 21 | mg/Kg | 09/09/05 | EPA 6010 |
| Cadmium (Total) | 4.4 | mg/Kg | 09/09/05 | EPA 6010 |
| Calcium (Total) | 21000 | mg/Kg | 09/09/05 | EPA 6010 |
| Chromium (Total) | 61 | mg/Kg | 09/09/05 | EPA 6010 |
| Cobalt (Total) | 22 | mg/Kg | 09/09/05 | EPA 6010 |
| Copper (Total) | 57 | mg/Kg | 09/09/05 | EPA 6010 |
| Iron (Total) | 52000 | mg/Kg | 09/09/05 | EPA 6010 |
| Lead (Total) | 65 | mg/Kg | 09/09/05 | EPA 6010 |
| Magnesium (Total) | 3300 | mg/Kg | 09/09/05 | EPA 6010 |
| Manganese (Total) | 1800 | mg/Kg | 09/09/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 4.9 | mg/Kg | 09/09/05 | EPA 6010 |
| Nickel (Total) | 72 | mg/Kg | 09/09/05 | EPA 6010 |
| Percent Solids | 80 | Percent | 09/06/05 | EPA 1311 |
| Potassium (Total) | 6900 | mg/Kg | 09/09/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Silica (Total) | 1800 | mg/Kg | 09/09/05 | EPA 6010 |
| Silver (Total) | < 1.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Sodium (Total) | 210 | mg/Kg | 09/09/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Vanadium (Total) | 77 | mg/Kg | 09/09/05 | EPA 6010 |
| Zinc (Total) | 920 | mg/Kg | 09/09/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459645
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-24
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 14:20
Date/Time Received: 09/01/05 11:23

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 16000 | mg/Kg | 09/09/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Arsenic (Total) | 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Barium (Total) | 110 | mg/Kg | 09/09/05 | EPA 6010 |
| Beryllium (Total) | 0.54 | mg/Kg | 09/09/05 | EPA 6010 |
| Boron (Total) | 13 | mg/Kg | 09/09/05 | EPA 6010 |
| Cadmium (Total) | 1.1 | mg/Kg | 09/09/05 | EPA 6010 |
| Calcium (Total) | 200000 | mg/Kg | 09/09/05 | EPA 6010 |
| Chromium (Total) | 34 | mg/Kg | 09/09/05 | EPA 6010 |
| Cobalt (Total) | 6.1 | mg/Kg | 09/09/05 | EPA 6010 |
| Copper (Total) | 66 | mg/Kg | 09/09/05 | EPA 6010 |
| Iron (Total) | 16000 | mg/Kg | 09/09/05 | EPA 6010 |
| Lead (Total) | 15 | mg/Kg | 09/09/05 | EPA 6010 |
| Magnesium (Total) | 7200 | mg/Kg | 09/09/05 | EPA 6010 |
| Manganese (Total) | 1100 | mg/Kg | 09/09/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 2.4 | mg/Kg | 09/09/05 | EPA 6010 |
| Nickel (Total) | 22 | mg/Kg | 09/09/05 | EPA 6010 |
| Percent Solids | 84 | Percent | 09/06/05 | EPA 1311 |
| Potassium (Total) | 3500 | mg/Kg | 09/09/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Silica (Total) | 1400 | mg/Kg | 09/09/05 | EPA 6010 |
| Silver (Total) | < 1.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Sodium (Total) | 170 | mg/Kg | 09/09/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Vanadium (Total) | 35 | mg/Kg | 09/09/05 | EPA 6010 |
| Zinc (Total) | 160 | mg/Kg | 09/09/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459646
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products S-25
Collector: T. Kogl - KDHE/BER
Matrix: Soil
Collect Depth: 0000
Date/Time Collected: 08/31/05 14:22
Date/Time Received: 09/01/05 11:23

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 6000 | mg/Kg | 09/09/05 | EPA 6010 |
| Antimony (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Arsenic (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Barium (Total) | 47 | mg/Kg | 09/09/05 | EPA 6010 |
| Beryllium (Total) | 0.23 | mg/Kg | 09/09/05 | EPA 6010 |
| Boron (Total) | 6.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Cadmium (Total) | 2.2 | mg/Kg | 09/09/05 | EPA 6010 |
| Calcium (Total) | 280000 | mg/Kg | 09/09/05 | EPA 6010 |
| Chromium (Total) | 15 | mg/Kg | 09/09/05 | EPA 6010 |
| Cobalt (Total) | 2.5 | mg/Kg | 09/09/05 | EPA 6010 |
| Copper (Total) | 18 | mg/Kg | 09/09/05 | EPA 6010 |
| Iron (Total) | 12000 | mg/Kg | 09/09/05 | EPA 6010 |
| Lead (Total) | 13 | mg/Kg | 09/09/05 | EPA 6010 |
| Magnesium (Total) | 7300 | mg/Kg | 09/09/05 | EPA 6010 |
| Manganese (Total) | 870 | mg/Kg | 09/09/05 | EPA 6010 |
| Mercury (Total) | < 0.050 | mg/Kg | 09/09/05 | EPA 245.1 |
| Molybdenum (Total) | 2.2 | mg/Kg | 09/09/05 | EPA 6010 |
| Nickel (Total) | 10 | mg/Kg | 09/09/05 | EPA 6010 |
| Percent Solids | 91 | Percent | 09/06/05 | EPA 1311 |
| Potassium (Total) | 1600 | mg/Kg | 09/09/05 | EPA 6010 |
| Selenium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Silica (Total) | 1100 | mg/Kg | 09/09/05 | EPA 6010 |
| Silver (Total) | < 1.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Sodium (Total) | 130 | mg/Kg | 09/09/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 09/09/05 | EPA 6010 |
| Vanadium (Total) | 14 | mg/Kg | 09/09/05 | EPA 6010 |
| Zinc (Total) | 340 | mg/Kg | 09/09/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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BUREAU OF ENVIRONMENTAL REMEDIATION

Duane R. Boline, Ph.D., Director
Laboratory Customer Service - (785) 296-1620
Laboratory Fax - (785) 296-1641
CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN TRAVIS KOGL
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 462339
Site ID: 4EM80
Account Code: EP

Collection Location: WADE'S ALUMINUM PRODUCTS S-26
Collector: T. KOGL BER
Matrix: Soil
Collect Depth:
Date/Time Collected: 10/25/05 12:15
Date/Time Received: 10/26/05 11:06

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 210000 | mg/Kg | 10/28/05 | EPA 6010 |
| Antimony (Total) | 17 | mg/Kg | 10/28/05 | EPA 6010 |
| Arsenic (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Arsenic (Total) | 8.2 | mg/Kg | 10/28/05 | EPA 6010 |
| Barium (TCLP) | 1.5 | mg/L | 10/31/05 | EPA 1311 |
| Barium (Total) | 210 | mg/Kg | 10/28/05 | EPA 6010 |
| Beryllium (Total) | 4.5 | mg/Kg | 10/28/05 | EPA 6010 |
| Boron (Total) | 33 | mg/Kg | 10/28/05 | EPA 6010 |
| Cadmium (TCLP) | < 0.0050 | mg/L | 10/31/05 | EPA 1311 |
| Cadmium (Total) | < 1.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Calcium (Total) | 25000 | mg/Kg | 10/28/05 | EPA 6010 |
| Chromium (TCLP) | < 0.010 | mg/L | 10/31/05 | EPA 1311 |
| Chromium (Total) | 810 | mg/Kg | 10/28/05 | EPA 6010 |
| Cobalt (Total) | 12 | mg/Kg | 10/28/05 | EPA 6010 |
| Copper (Total) | 6000 | mg/Kg | 10/28/05 | EPA 6010 |
| Iron (Total) | 12000 | mg/Kg | 10/28/05 | EPA 6010 |
| Lead (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Lead (Total) | 450 | mg/Kg | 10/28/05 | EPA 6010 |
| Magnesium (Total) | 15000 | mg/Kg | 10/28/05 | EPA 6010 |
| Manganese (Total) | 800 | mg/Kg | 10/28/05 | EPA 6010 |
| Mercury (TCLP) | < 0.00050 | mg/L | 11/02/05 | EPA 1311 |
| Mercury (Total) | < 0.050 | mg/Kg | 11/02/05 | EPA 245.1 |
| Molybdenum (Total) | 24 | mg/Kg | 10/28/05 | EPA 6010 |
| Nickel (Total) | 270 | mg/Kg | 10/28/05 | EPA 6010 |
| Percent Solids | 77 | Percent | 10/28/05 | EPA 1311 |
| Potassium (Total) | 1500 | mg/Kg | 10/28/05 | EPA 6010 |
| Selenium (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Selenium (Total) | < 5.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Silica (Total) | 1100 | mg/Kg | 10/28/05 | EPA 6010 |
| Silver (TCLP) | < 0.010 | mg/L | 10/31/05 | EPA 1311 |
| Silver (Total) | 2.9 | mg/Kg | 10/28/05 | EPA 6010 |
| Sodium (Total) | 980 | mg/Kg | 10/28/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Vanadium (Total) | 52 | mg/Kg | 10/28/05 | EPA 6010 |
| Zinc (Total) | 5900 | mg/Kg | 10/28/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 11/03/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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BUREAU OF
ENVIRONMENTAL REMEDIATION

Duane R. Boline, Ph.D., Director
Laboratory Customer Service - (785) 296-1620
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CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN TRAVIS KOGL
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 462340
Site ID: 4EM80
Account Code: EP

Collection Location: WADE'S ALUMINUM PRODUCTS S-27
Collector: T. KOGL BER
Matrix: Soil
Collect Depth:
Date/Time Collected: 10/25/05 13:20
Date/Time Received: 10/26/05 11:06

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 250000 | mg/Kg | 10/28/05 | EPA 6010 |
| Antimony (Total) | 25 | mg/Kg | 10/28/05 | EPA 6010 |
| Arsenic (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Arsenic (Total) | 8.3 | mg/Kg | 10/28/05 | EPA 6010 |
| Barium (TCLP) | 6.8 | mg/L | 10/31/05 | EPA 1311 |
| Barium (Total) | 370 | mg/Kg | 10/28/05 | EPA 6010 |
| Beryllium (Total) | 9.4 | mg/Kg | 10/28/05 | EPA 6010 |
| Boron (Total) | 69 | mg/Kg | 10/28/05 | EPA 6010 |
| Cadmium (TCLP) | 0.018 | mg/L | 10/31/05 | EPA 1311 |
| Cadmium (Total) | 3.3 | mg/Kg | 10/28/05 | EPA 6010 |
| Calcium (Total) | 3700 | mg/Kg | 10/28/05 | EPA 6010 |
| Chromium (TCLP) | < 0.010 | mg/L | 10/31/05 | EPA 1311 |
| Chromium (Total) | 270 | mg/Kg | 10/28/05 | EPA 6010 |
| Cobalt (Total) | 4.8 | mg/Kg | 10/28/05 | EPA 6010 |
| Copper (Total) | 8200 | mg/Kg | 10/28/05 | EPA 6010 |
| Iron (Total) | 5100 | mg/Kg | 10/28/05 | EPA 6010 |
| Lead (TCLP) | 4.1 | mg/L | 10/31/05 | EPA 1311 |
| Lead (Total) | 2700 | mg/Kg | 10/28/05 | EPA 6010 |
| Magnesium (Total) | 17000 | mg/Kg | 10/28/05 | EPA 6010 |
| Manganese (Total) | 1100 | mg/Kg | 10/28/05 | EPA 6010 |
| Mercury (TCLP) | < 0.00050 | mg/L | 11/02/05 | EPA 1311 |
| Mercury (Total) | < 0.050 | mg/Kg | 11/02/05 | EPA 245.1 |
| Molybdenum (Total) | 20 | mg/Kg | 10/28/05 | EPA 6010 |
| Nickel (Total) | 100 | mg/Kg | 10/28/05 | EPA 6010 |
| Percent Solids | 71 | Percent | 10/28/05 | EPA 1311 |
| Potassium (Total) | 250 | mg/Kg | 10/28/05 | EPA 6010 |
| Selenium (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Selenium (Total) | < 5.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Silica (Total) | 1100 | mg/Kg | 10/28/05 | EPA 6010 |
| Silver (TCLP) | < 0.010 | mg/L | 10/31/05 | EPA 1311 |
| Silver (Total) | 5.9 | mg/Kg | 10/28/05 | EPA 6010 |
| Sodium (Total) | 130 | mg/Kg | 10/28/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Vanadium (Total) | 34 | mg/Kg | 10/28/05 | EPA 6010 |
| Zinc (Total) | 10000 | mg/Kg | 10/28/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 11/03/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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Duane R. Boline, Ph.D., Director
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CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN TRAVIS KOGL
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT  Lab Number: 462341

Site ID: 4EM80
Account Code: EP

Collection Location: WADE'S ALUMINUM PRODUCTS S-28
Collector: T. KOGL BER  Matrix: Soil  Collect Depth:
Date/Time Collected: 10/25/05 13:48  Date/Time Received: 10/26/05 11:07

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 250000 | mg/Kg | 10/28/05 | EPA 6010 |
| Antimony (Total) | 21 | mg/Kg | 10/28/05 | EPA 6010 |
| Arsenic (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Arsenic (Total) | 9.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Barium (TCLP) | 2.2 | mg/L | 10/31/05 | EPA 1311 |
| Barium (Total) | 190 | mg/Kg | 10/28/05 | EPA 6010 |
| Beryllium (Total) | 1.6 | mg/Kg | 10/28/05 | EPA 6010 |
| Boron (Total) | 36 | mg/Kg | 10/28/05 | EPA 6010 |
| Cadmium (TCLP) | < 0.0050 | mg/L | 10/31/05 | EPA 1311 |
| Cadmium (Total) | 1.9 | mg/Kg | 10/28/05 | EPA 6010 |
| Calcium (Total) | 42000 | mg/Kg | 10/28/05 | EPA 6010 |
| Chromium (TCLP) | < 0.010 | mg/L | 10/31/05 | EPA 1311 |
| Chromium (Total) | 260 | mg/Kg | 10/28/05 | EPA 6010 |
| Cobalt (Total) | 8.3 | mg/Kg | 10/28/05 | EPA 6010 |
| Copper (Total) | 3500 | mg/Kg | 10/28/05 | EPA 6010 |
| Iron (Total) | 11000 | mg/Kg | 10/28/05 | EPA 6010 |
| Lead (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Lead (Total) | 480 | mg/Kg | 10/28/05 | EPA 6010 |
| Magnesium (Total) | 12000 | mg/Kg | 10/28/05 | EPA 6010 |
| Manganese (Total) | 1400 | mg/Kg | 10/28/05 | EPA 6010 |
| Mercury (TCLP) | < 0.00050 | mg/L | 11/02/05 | EPA 1311 |
| Mercury (Total) | < 0.050 | mg/Kg | 11/02/05 | EPA 245.1 |
| Molybdenum (Total) | 16 | mg/Kg | 10/28/05 | EPA 6010 |
| Nickel (Total) | 110 | mg/Kg | 10/28/05 | EPA 6010 |
| Percent Solids | 86 | Percent | 10/28/05 | EPA 1311 |
| Potassium (Total) | 740 | mg/Kg | 10/28/05 | EPA 6010 |
| Selenium (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Selenium (Total) | < 5.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Silica (Total) | 1200 | mg/Kg | 10/28/05 | EPA 6010 |
| Silver (TCLP) | < 0.010 | mg/L | 10/31/05 | EPA 1311 |
| Silver (Total) | 6.3 | mg/Kg | 10/28/05 | EPA 6010 |
| Sodium (Total) | 270 | mg/Kg | 10/28/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Vanadium (Total) | 42 | mg/Kg | 10/28/05 | EPA 6010 |
| Zinc (Total) | 2800 | mg/Kg | 10/28/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 11/03/05
Copies To: File

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* - Holding Time Exceeded

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Duane R. Boline, Ph.D., Director
Laboratory Customer Service - (785) 296-1620
Laboratory Fax - (785) 296-1641
CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN TRAVIS KOGL
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 462342
Site ID: 4EM80
Account Code: EP

Collection Location: WADE'S ALUMINUM PRODUCTS S-29
Collector: T. KOGL BER
Matrix: Soil
Collect Depth:
Date/Time Collected: 10/25/05 14:00
Date/Time Received: 10/26/05 11:08

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 250000 | mg/Kg | 10/28/05 | EPA 6010 |
| Antimony (Total) | 25 | mg/Kg | 10/28/05 | EPA 6010 |
| Arsenic (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Arsenic (Total) | 9.5 | mg/Kg | 10/28/05 | EPA 6010 |
| Barium (TCLP) | 4.6 | mg/L | 10/31/05 | EPA 1311 |
| Barium (Total) | 320 | mg/Kg | 10/28/05 | EPA 6010 |
| Beryllium (Total) | 3.6 | mg/Kg | 10/28/05 | EPA 6010 |
| Boron (Total) | 39 | mg/Kg | 10/28/05 | EPA 6010 |
| Cadmium (TCLP) | 0.0088 | mg/L | 10/31/05 | EPA 1311 |
| Cadmium (Total) | 2.8 | mg/Kg | 10/28/05 | EPA 6010 |
| Calcium (Total) | 26000 | mg/Kg | 10/28/05 | EPA 6010 |
| Chromium (TCLP) | < 0.010 | mg/L | 10/31/05 | EPA 1311 |
| Chromium (Total) | 370 | mg/Kg | 10/28/05 | EPA 6010 |
| Cobalt (Total) | 5.7 | mg/Kg | 10/28/05 | EPA 6010 |
| Copper (Total) | 6800 | mg/Kg | 10/28/05 | EPA 6010 |
| Iron (Total) | 9300 | mg/Kg | 10/28/05 | EPA 6010 |
| Lead (TCLP) | 0.33 | mg/L | 10/31/05 | EPA 1311 |
| Lead (Total) | 460 | mg/Kg | 10/28/05 | EPA 6010 |
| Magnesium (Total) | 20000 | mg/Kg | 10/28/05 | EPA 6010 |
| Manganese (Total) | 1400 | mg/Kg | 10/28/05 | EPA 6010 |
| Mercury (TCLP) | < 0.00050 | mg/L | 11/02/05 | EPA 1311 |
| Mercury (Total) | < 0.050 | mg/Kg | 11/02/05 | EPA 245.1 |
| Molybdenum (Total) | 20 | mg/Kg | 10/28/05 | EPA 6010 |
| Nickel (Total) | 150 | mg/Kg | 10/28/05 | EPA 6010 |
| Percent Solids | 76 | Percent | 10/28/05 | EPA 1311 |
| Potassium (Total) | 580 | mg/Kg | 10/28/05 | EPA 6010 |
| Selenium (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Selenium (Total) | < 5.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Silica (Total) | 1100 | mg/Kg | 10/28/05 | EPA 6010 |
| Silver (TCLP) | < 0.010 | mg/L | 10/31/05 | EPA 1311 |
| Silver (Total) | 3.3 | mg/Kg | 10/28/05 | EPA 6010 |
| Sodium (Total) | 310 | mg/Kg | 10/28/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Vanadium (Total) | 41 | mg/Kg | 10/28/05 | EPA 6010 |
| Zinc (Total) | 5500 | mg/Kg | 10/28/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 11/03/05
Copies To: File

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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN TRAVIS KOGL
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 462343
4EM80
Site ID:
Account Code: EP

Collection Location: WADE'S ALUMINUM PRODUCTS S-30
Collector: T. KOGL BER
Matrix: Soil
Collect Depth:
Date/Time Collected: 10/25/05 14:35
Date/Time Received: 10/26/05 11:09

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 270000 | mg/Kg | 10/28/05 | EPA 6010 |
| Antimony (Total) | 23 | mg/Kg | 10/28/05 | EPA 6010 |
| Arsenic (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Arsenic (Total) | 8.7 | mg/Kg | 10/28/05 | EPA 6010 |
| Barium (TCLP) | 5.7 | mg/L | 10/31/05 | EPA 1311 |
| Barium (Total) | 540 | mg/Kg | 10/28/05 | EPA 6010 |
| Beryllium (Total) | 7.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Boron (Total) | 44 | mg/Kg | 10/28/05 | EPA 6010 |
| Cadmium (TCLP) | 0.041 | mg/L | 10/31/05 | EPA 1311 |
| Cadmium (Total) | 5.3 | mg/Kg | 10/28/05 | EPA 6010 |
| Calcium (Total) | 9100 | mg/Kg | 10/28/05 | EPA 6010 |
| Chromium (TCLP) | < 0.010 | mg/L | 10/31/05 | EPA 1311 |
| Chromium (Total) | 460 | mg/Kg | 10/28/05 | EPA 6010 |
| Cobalt (Total) | 7.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Copper (Total) | 17000 | mg/Kg | 10/28/05 | EPA 6010 |
| Iron (Total) | 6700 | mg/Kg | 10/28/05 | EPA 6010 |
| Lead (TCLP) | 35 | mg/L | 10/31/05 | EPA 1311 |
| Lead (Total) | 3600 | mg/Kg | 10/28/05 | EPA 6010 |
| Magnesium (Total) | 22000 | mg/Kg | 10/28/05 | EPA 6010 |
| Manganese (Total) | 980 | mg/Kg | 10/28/05 | EPA 6010 |
| Mercury (TCLP) | < 0.00050 | mg/L | 11/02/05 | EPA 1311 |
| Mercury (Total) | < 0.050 | mg/Kg | 11/02/05 | EPA 245.1 |
| Molybdenum (Total) | 16 | mg/Kg | 10/28/05 | EPA 6010 |
| Nickel (Total) | 560 | mg/Kg | 10/28/05 | EPA 6010 |
| Percent Solids | 81 | Percent | 10/28/05 | EPA 1311 |
| Potassium (Total) | 1100 | mg/Kg | 10/28/05 | EPA 6010 |
| Selenium (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Selenium (Total) | < 5.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Silica (Total) | 1500 | mg/Kg | 10/28/05 | EPA 6010 |
| Silver (TCLP) | < 0.010 | mg/L | 10/31/05 | EPA 1311 |
| Silver (Total) | 15 | mg/Kg | 10/28/05 | EPA 6010 |
| Sodium (Total) | 530 | mg/Kg | 10/28/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Vanadium (Total) | 44 | mg/Kg | 10/28/05 | EPA 6010 |
| Zinc (Total) | 17000 | mg/Kg | 10/28/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 11/03/05
Copies To: File

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* - Holding Time Exceeded

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CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN TRAVIS KOGL
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 462344
Site ID: 4EM80
Account Code: EP

Collection Location: WADE'S ALUMINUM PRODUCTS S-31
Collector: T. KOGL BER
Matrix: Soil
Collect Depth:
Date/Time Collected: 10/25/05 14:50
Date/Time Received: 10/26/05 11:10

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum (Total) | 250000 | mg/Kg | 10/28/05 | EPA 6010 |
| Antimony (Total) | 33 | mg/Kg | 10/28/05 | EPA 6010 |
| Arsenic (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Arsenic (Total) | 8.8 | mg/Kg | 10/28/05 | EPA 6010 |
| Barium (TCLP) | 4.8 | mg/L | 10/31/05 | EPA 1311 |
| Barium (Total) | 320 | mg/Kg | 10/28/05 | EPA 6010 |
| Beryllium (Total) | 5.4 | mg/Kg | 10/28/05 | EPA 6010 |
| Boron (Total) | 38 | mg/Kg | 10/28/05 | EPA 6010 |
| Cadmium (TCLP) | 0.051 | mg/L | 10/31/05 | EPA 1311 |
| Cadmium (Total) | 5.8 | mg/Kg | 10/28/05 | EPA 6010 |
| Calcium (Total) | 16000 | mg/Kg | 10/28/05 | EPA 6010 |
| Chromium (TCLP) | < 0.010 | mg/L | 10/31/05 | EPA 1311 |
| Chromium (Total) | 520 | mg/Kg | 10/28/05 | EPA 6010 |
| Cobalt (Total) | 7.2 | mg/Kg | 10/28/05 | EPA 6010 |
| Copper (Total) | 14000 | mg/Kg | 10/28/05 | EPA 6010 |
| Iron (Total) | 8900 | mg/Kg | 10/28/05 | EPA 6010 |
| Lead (TCLP) | 9.0 | mg/L | 10/31/05 | EPA 1311 |
| Lead (Total) | 1400 | mg/Kg | 10/28/05 | EPA 6010 |
| Magnesium (Total) | 13000 | mg/Kg | 10/28/05 | EPA 6010 |
| Manganese (Total) | 1100 | mg/Kg | 10/28/05 | EPA 6010 |
| Mercury (TCLP) | < 0.00050 | mg/L | 11/02/05 | EPA 1311 |
| Mercury (Total) | < 0.050 | mg/Kg | 11/02/05 | EPA 245.1 |
| Molybdenum (Total) | 22 | mg/Kg | 10/28/05 | EPA 6010 |
| Nickel (Total) | 460 | mg/Kg | 10/28/05 | EPA 6010 |
| Percent Solids | 78 | Percent | 10/28/05 | EPA 1311 |
| Potassium (Total) | 930 | mg/Kg | 10/28/05 | EPA 6010 |
| Selenium (TCLP) | < 0.050 | mg/L | 10/31/05 | EPA 1311 |
| Selenium (Total) | < 5.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Silica (Total) | 1500 | mg/Kg | 10/28/05 | EPA 6010 |
| Silver (TCLP) | < 0.010 | mg/L | 10/31/05 | EPA 1311 |
| Silver (Total) | 8.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Sodium (Total) | 400 | mg/Kg | 10/28/05 | EPA 6010 |
| Thallium (Total) | < 5.0 | mg/Kg | 10/28/05 | EPA 6010 |
| Vanadium (Total) | 43 | mg/Kg | 10/28/05 | EPA 6010 |
| Zinc (Total) | 9200 | mg/Kg | 10/28/05 | EPA 6010 |

Analytical Comments:
Results for total metals are expressed on a dry weight basis.

Reporting Analyst: JAB
Date Reported: 11/03/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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Duane R. Boline, Ph.D., Director
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CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES

**Kansas Department of Health and Environment**
**Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001**

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459648
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products W-1
Collector: T. Kogl - KDHE/BER
Matrix: Water
Collect Depth: 0000
Date/Time Collected: 08/31/05 14:35
Date/Time Received: 09/01/05 11:22

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Antimony | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Arsenic | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Barium | 0.53 | mg/L | 09/09/05 | EPA 200.7 |
| Beryllium | < 0.0010 | mg/L | 09/09/05 | EPA 200.7 |
| Boron | 0.37 | mg/L | 09/09/05 | EPA 200.7 |
| Cadmium | < 0.0050 | mg/L | 09/09/05 | EPA 200.7 |
| Calcium | 320 | mg/L | 09/09/05 | EPA 200.7 |
| Chromium | < 0.010 | mg/L | 09/09/05 | EPA 200.7 |
| Cobalt | < 0.010 | mg/L | 09/09/05 | EPA 200.7 |
| Copper | 0.13 | mg/L | 09/09/05 | EPA 200.7 |
| Iron | 0.23 | mg/L | 09/09/05 | EPA 200.7 |
| Lead | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Magnesium | 110 | mg/L | 09/09/05 | EPA 200.7 |
| Manganese | 1.2 | mg/L | 09/09/05 | EPA 200.7 |
| Mercury | < 0.50 | ug/L | 09/09/05 | EPA 245.1 |
| Molybdenum | 0.044 | mg/L | 09/09/05 | EPA 200.7 |
| Nickel | 0.0096 | mg/L | 09/09/05 | EPA 200.7 |
| Potassium | 4500 | mg/L | 09/09/05 | EPA 200.7 |
| Selenium | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Silica | 9.9 | mg/L | 09/09/05 | EPA 200.7 |
| Silver | < 0.010 | mg/L | 09/09/05 | EPA 200.7 |
| Sodium | 6700 | mg/L | 09/09/05 | EPA 200.7 |
| Thallium | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Vanadium | < 0.0050 | mg/L | 09/09/05 | EPA 200.7 |
| Zinc | 0.042 | mg/L | 09/09/05 | EPA 200.7 |

Reporting Analyst: JAB
Date Reported: 09/15/05
Copies To: File

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* - Holding Time Exceeded

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Duane R. Boline, Ph.D., Director
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CLIA No. 17D0648254

# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459647
Site ID: 4EM80
Account Code: EP

Collection Location: Wade's Aluminum Products W-2
Collector: T. Kogl - KDHE/BER
Matrix: Water
Collect Depth: 0000
Date/Time Collected: 08/31/05 14:45
Date/Time Received: 09/01/05 11:22

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum | 1.2 | mg/L | 09/09/05 | EPA 200.7 |
| Antimony | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Arsenic | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Barium | 0.093 | mg/L | 09/09/05 | EPA 200.7 |
| Beryllium | < 0.0010 | mg/L | 09/09/05 | EPA 200.7 |
| Boron | 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Cadmium | < 0.0050 | mg/L | 09/09/05 | EPA 200.7 |
| Calcium | 76 | mg/L | 09/09/05 | EPA 200.7 |
| Chromium | < 0.010 | mg/L | 09/09/05 | EPA 200.7 |
| Cobalt | < 0.010 | mg/L | 09/09/05 | EPA 200.7 |
| Copper | 0.011 | mg/L | 09/09/05 | EPA 200.7 |
| Iron | 0.97 | mg/L | 09/09/05 | EPA 200.7 |
| Lead | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Magnesium | 12 | mg/L | 09/09/05 | EPA 200.7 |
| Manganese | 0.32 | mg/L | 09/09/05 | EPA 200.7 |
| Mercury | < 0.50 | ug/L | 09/09/05 | EPA 245.1 |
| Molybdenum | < 0.020 | mg/L | 09/09/05 | EPA 200.7 |
| Nickel | 0.017 | mg/L | 09/09/05 | EPA 200.7 |
| Potassium | 64 | mg/L | 09/09/05 | EPA 200.7 |
| Selenium | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Silica | 18 | mg/L | 09/09/05 | EPA 200.7 |
| Silver | < 0.010 | mg/L | 09/09/05 | EPA 200.7 |
| Sodium | 110 | mg/L | 09/09/05 | EPA 200.7 |
| Thallium | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Vanadium | < 0.0050 | mg/L | 09/09/05 | EPA 200.7 |
| Zinc | 0.024 | mg/L | 09/09/05 | EPA 200.7 |

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

< - Not Detected at Indicated Level
* - Holding Time Exceeded

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# DIVISION OF HEALTH & ENVIRONMENTAL LABORATORIES
## Kansas Department of Health and Environment
## Forbes Field, Bldg. 740, Topeka, Kansas 66620-0001

## REPORT OF ANALYSIS

### INORGANIC CHEMISTRY

Report To: BUREAU OF ENV REMEDIATION
ATTN: Travis Kogl
CURTIS SOB SUITE 410
TOPEKA KS 66612

Analysis Code: PT
Lab Number: 459649
4EM80
Site ID:
Account Code: EP

Collection Location: Wade's Aluminum Products W-3
Collector: T. Kogl - KDHE/BER
Matrix: Water
Collect Depth: 0000
Date/Time Collected: 08/31/05 14:55
Date/Time Received: 09/01/05 11:22

Sample Comments:

| Parameter | Analytical Result | Units | Analysis Date | Analytical Method |
|---|---|---|---|---|
| Aluminum | 1.2 | mg/L | 09/09/05 | EPA 200.7 |
| Antimony | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Arsenic | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Barium | 0.090 | mg/L | 09/09/05 | EPA 200.7 |
| Beryllium | < 0.0010 | mg/L | 09/09/05 | EPA 200.7 |
| Boron | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Cadmium | < 0.0050 | mg/L | 09/09/05 | EPA 200.7 |
| Calcium | 64 | mg/L | 09/09/05 | EPA 200.7 |
| Chromium | < 0.010 | mg/L | 09/09/05 | EPA 200.7 |
| Cobalt | < 0.010 | mg/L | 09/09/05 | EPA 200.7 |
| Copper | < 0.010 | mg/L | 09/09/05 | EPA 200.7 |
| Iron | 0.85 | mg/L | 09/09/05 | EPA 200.7 |
| Lead | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Magnesium | 6.9 | mg/L | 09/09/05 | EPA 200.7 |
| Manganese | 0.12 | mg/L | 09/09/05 | EPA 200.7 |
| Mercury | < 0.50 | ug/L | 09/09/05 | EPA 245.1 |
| Molybdenum | < 0.020 | mg/L | 09/09/05 | EPA 200.7 |
| Nickel | 0.0064 | mg/L | 09/09/05 | EPA 200.7 |
| Potassium | 16 | mg/L | 09/09/05 | EPA 200.7 |
| Selenium | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Silica | 18 | mg/L | 09/09/05 | EPA 200.7 |
| Silver | < 0.010 | mg/L | 09/09/05 | EPA 200.7 |
| Sodium | 19 | mg/L | 09/09/05 | EPA 200.7 |
| Thallium | < 0.050 | mg/L | 09/09/05 | EPA 200.7 |
| Vanadium | < 0.0050 | mg/L | 09/09/05 | EPA 200.7 |
| Zinc | 0.0076 | mg/L | 09/09/05 | EPA 200.7 |

Reporting Analyst: JAB
Date Reported: 09/14/05
Copies To: File

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# APPENDIX B

# SITE PHOTOGRAPHS

**Wade's Aluminum Products**
**Preliminary Removal Evaluation/Site Inspection**
**December 2005**

Photo 1
View: South
Date: 8/31/2005
Photo by: Travis Kogl
Comments: The photo shows the general nature of waste piles at the site. The pink flag in the photo is sample location S-14.

Photo 2
View: East
Date: 8/31/2005
Photo by: Travis Kogl
Comments: Photo shows the nature of blue and white crystalline component of waste piles.

**Wade's Aluminum Products**
**Preliminary Removal Evaluation/Site Inspection**
**December 2005**

Photo 3
View: West
Date: 8/31/2005
Photo by: Travis Kogl
Comments: The photo shows sample location S-18. A former dross storage shed is visible in the background.

Photo 4
View: North
Date: 8/31/2005
Photo by: Travis Kogl
Comments: This photo is a general view of the site. Note standing water in the center of the photo.

**Wade's Aluminum Products**
**Preliminary Removal Evaluation/Site Inspection**
**December 2005**

Photo 5
View: West
Date: 8/31/2005
Photo by: Travis Kogl
Comments: A former dross storage shed.

Photo 6
View: South
Date: 8/31/2005
Photo by: Travis Kogl
Comments: This photo is a large structure that was part of a cement operation. Note piles of crushed limestone, which are difficult to distinguish from dross waste piles.

# APPENDIX C

# TOXIC SUBSTANCES FACTS SHEETS

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

# ALUMINUM
## CAS # 7429-90-5

Agency for Toxic Substances and Disease Registry ToxFAQs June 1999

**This fact sheet answers the most frequently asked health questions (FAQs) about aluminum. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**HIGHLIGHTS: Everyone is exposed to low levels of aluminum from food, air, and water. Exposure to high levels of aluminum may result in respiratory problems. Aluminum has been found in at least 427 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).**

### What is aluminum?

(Pronounced ə-lōō′mə-nəm)

Aluminum occurs naturally and makes up about 8% of the surface of the earth. It is always found combined with other elements such as oxygen, silicon, and fluorine.

Aluminum metal is silver-white and flexible. It is often used in cooking utensils, containers, appliances, and building materials. It is also used in paints and fireworks; to produce glass, rubber, and ceramics; and in consumer products such as antacids, astringents, buffered aspirin, food additives, and antiperspirants.

### What happens to aluminum when it enters the environment?

- It binds to particles in the air.
- It can dissolve in lakes, streams, and rivers depending on the quality of the water.
- Acid rain may dissolve aluminum from soil and rocks.
- It can be taken up into some plants from soil.
- It is not known to bioconcentrate up the food chain.

### How might I be exposed to aluminum?

- Eating small amounts of aluminum in food.
- Breathing higher levels of aluminum dust in workplace air.
- Drinking water with high levels of aluminum near waste sites, manufacturing plants, or areas naturally high in aluminum.
- Eating substances containing high levels of aluminum (such as antacids) especially when eating or drinking citrus products at the same time.
- Very little enters your body from aluminum cooking utensils.

### How can aluminum affect my health?

Low-level exposure to aluminum from food, air, water, or contact with skin is not thought to harm your health. Aluminum, however, is not a necessary substance for our bodies and too much may be harmful.

People who are exposed to high levels of aluminum in air may have respiratory problems including coughing and asthma from breathing dust.

Some studies show that people with Alzheimer's disease have more aluminum than usual in their brains. We do not know whether aluminum causes the disease or whether the buildup of aluminum happens to people who already have the disease. Infants and adults who received large doses of aluminum as a treatment for another problem developed bone

diseases, which suggests that aluminum may cause skeletal problems. Some sensitive people develop skin rashes from using aluminum chlorohydrate deodorants.

## How likely is aluminum to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the EPA have not classified aluminum for carcinogenicity. Aluminum has not been shown to cause cancer in animals.

## How can aluminum affect children?

Children with kidney problems who were given aluminum in their medical treatments developed bone diseases. Other health effects of aluminum on children have not been studied. It is not known whether aluminum affects children differently than adults, or what the long-term effects might be in adults exposed as children. Large amounts of aluminum have been shown to be harmful to unborn and developing animals because it can cause delays in skeletal and neurological development. Aluminum has been shown to cause lower birthweights in some animals.

## How can families reduce the risk of exposure to aluminum?

The most important way families can lower exposure to aluminum is to know about the sources of aluminum and lessen exposure to these sources. Since aluminum is so common and widespread in the environment, families cannot avoid exposure to aluminum. Exposure to the low levels of aluminum that are naturally present in food and water and the forms of aluminum present in dirt and aluminum cookware is generally not harmful. The best way to reduce exposure to aluminum is to avoid taking large quantities of soluble forms of aluminum such as aluminum-containing antacids and buffered aspirin. Make sure these products have child-proof caps so children will not accidentally eat them. Some soy-based formulas may contain high levels of aluminum, so parents may want to consult with their physician when choosing an infant formula.

## Is there a medical test to show whether I've been exposed to aluminum?

There are tests to measure aluminum in blood, urine, and feces. The amount in your urine can tell you whether you have been exposed to higher than normal levels of aluminum. Tests can also detect aluminum in your hair and fingernails. Not all of these tests are routinely performed at your doctor's office, but your doctor can take samples and send them to a testing laboratory.

## Has the federal government made recommendations to protect human health?

EPA requires that spills or accidental releases of 5,000 pounds or more of aluminum sulfate be reported. Special regulations are set for aluminum phosphide because it is a pesticide.

EPA recommends that the concentration of aluminum in drinking water not exceed 0.2 parts of aluminum per million parts of water (0.2 ppm) because of aesthetic effects, such as taste and odor problems.

The Food and Drug Administration (FDA) has determined that aluminum cooking utensils, aluminum foil, antiperspirants, antacids, and other aluminum products are generally safe.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for aluminum. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

# ANTIMONY
## CAS # 7440-36-0

Agency for Toxic Substances and Disease Registry ToxFAQs September 1995

**This fact sheet answers the most frequently asked health questions (FAQs) about antimony. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**SUMMARY: Exposure to antimony occurs in the workplace or from skin contact with soil at hazardous waste sites. Breathing high levels of antimony for a long time can irritate the eyes and lungs, and can cause problems with the lungs, heart, and stomach. This chemical has been found in at least 403 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.**

### What is antimony?

(Pronounced ăn′tə-mō′nē)

Antimony is a silvery-white metal that is found in the earth's crust. Antimony ores are mined and then mixed with other metals to form antimony alloys or combined with oxygen to form antimony oxide.

Little antimony is currently mined in the United States. It is brought into this country from other countries for processing. However, there are companies in the United States that produce antimony as a by-product of smelting lead and other metals.

Antimony isn't used alone because it breaks easily, but when mixed into alloys, it is used in lead storage batteries, solder, sheet and pipe metal, bearings, castings, and pewter. Antimony oxide is added to textiles and plastics to prevent them from catching fire. It is also used in paints, ceramics, and fireworks, and as enamels for plastics, metal, and glass.

### What happens to antimony when it enters the environment?

- Antimony is released to the environment from natural sources and from industry.
- In the air, antimony is attached to very small particles that may stay in the air for many days.
- Most antimony ends up in soil, where it attaches strongly to particles that contain iron, manganese, or aluminum.
- Antimony is found at low levels in some rivers, lakes, and streams.

### How might I be exposed to antimony?

- Because antimony is found naturally in the environment, the general population is exposed to low levels of it every day, primarily in food, drinking water, and air.
- It may be found in air near industries that process or release it, such as smelters, coal-fired plants, and refuse incinerators.
- In polluted areas containing high levels of antimony, it may be found in the air, water, and soil.
- Workers in industries that process it or use antimony ore may be exposed to higher levels.

### How can antimony affect my health?

Exposure to antimony at high levels can result in a variety of adverse health effects.

Breathing high levels for a long time can irritate your eyes and lungs and can cause heart and lung problems, stomach pain, diarrhea, vomiting, and stomach ulcers.

In short-term studies, animals that breathed very high levels of antimony died. Animals that breathed high levels

had lung, heart, liver, and kidney damage. In long-term studies, animals that breathed very low levels of antimony had eye irritation, hair loss, lung damage, and heart problems. Problems with fertility were also noted. In animal studies, problems with fertility have been seen when rats breathed very high levels of antimony for a few months.

Ingesting large doses of antimony can cause vomiting. We don't know what other effects may be caused by ingesting it. Long-term animal studies have reported liver damage and blood changes when animals ingested antimony. Antimony can irritate the skin if it is left on it.

Antimony can have beneficial effects when used for medical reasons. It has been used as a medicine to treat people infected with parasites.

## How likely is antimony to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified antimony as to its human carcinogenicity.

Lung cancer has been observed in some studies of rats that breathed high levels of antimony. No human studies are available. We don't know whether antimony will cause cancer in people.

## Is there a medical test to show whether I've been exposed to antimony?

Tests are available to measure antimony levels in the body. Antimony can be measured in the urine, feces, and blood for several days after exposure. However, these tests cannot tell you how much antimony you have been exposed to or whether you will experience any health effects. Some tests are not usually performed in most doctors' offices and may require special equipment to conduct them.

## Has the federal government made recommendations to protect human health?

The EPA allows 0.006 parts of antimony per million parts of drinking water (0.006 ppm). The EPA requires that discharges or spills into the environment of 5,000 pounds or more of antimony be reported.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 0.5 milligrams of antimony per cubic meter of air (0.5 $mg/m^3$) for an 8-hour workday, 40-hour workweek.

The American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) currently recommend the same guidelines for the workplace as OSHA.

## Glossary

Carcinogenicity: Ability to cause cancer.
CAS: Chemical Abstracts Service.
Ingestion: Taking food or drink into your body.
Long-term: Lasting one year or more.
Milligram (mg): One thousandth of a gram.
Parasite: An organism living in or on another organism.
ppm: Parts per million.
Short-term: Lasting 14 days or less.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological profile for antimony. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

# BERYLLIUM

CAS #7440-41-7

Division of Toxicology ToxFAQs™ September 2002

**This fact sheet answers the most frequently asked health questions (FAQs) about beryllium. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**HIGHLIGHTS: People working or living near beryllium industries have the greatest potential for exposure to beryllium. Lung damage has been observed in people exposed to high levels of beryllium in the air. About 1-15% of all people occupationally-exposed to beryllium in air become sensitive to beryllium and may develop chronic beryllium disease (CBD), an irreversible and sometimes fatal scarring of the lungs. CBD may be completely asymptomatic or begin with coughing, chest pain, shortness of breath, weakness, and/or fatigue. Beryllium has been found in at least 535 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).**

## What is beryllium?

Beryllium is a hard, grayish metal naturally found in mineral rocks, coal, soil, and volcanic dust. Beryllium ore is mined, and the beryllium is purified for use in nuclear weapons and reactors, aircraft and space vehicle structures, instruments, x-ray machines, and mirrors. Beryllium oxide is used to make speciality ceramics for electrical and high-technology applications. Beryllium alloys are used in automobiles, computers, sports equipment (golf clubs), and dental bridges.

## What happens to beryllium when it enters the environment?

❑ Beryllium dust enters the air from burning coal and oil. This beryllium dust will eventually settle over the land and water.

❑ It enters water from erosion of rocks and soil, and from industrial waste. Some beryllium compounds will dissolve in water, but most stick to particles and settle to the bottom.

❑ Most beryllium in soil does not dissolve in water and remains bound to soil.

❑ Beryllium does not accumulate in the food chain.

## How might I be exposed to beryllium?

❑ The general population is normally exposed to low levels of beryllium in air, food, and water.

❑ People working in industries where beryllium is mined, processed, machined, or converted into metal, alloys, and other chemicals may be exposed to high levels of beryllium. People living near these industries may also be exposed to higher than normal levels of beryllium in air.

❑ People living near uncontrolled hazardous waste sites may be exposed to higher than normal levels of beryllium.

## How can beryllium affect my health?

Beryllium can be harmful if you breathe it. The effects depend on how much you are exposed to, for how long, and individual susceptibility. If beryllium air levels are high enough (greater than 1000 ug/m$^3$), an acute condition can result. This condition resembles pneumonia and is called acute beryllium disease Occupational and community air standards are effective in preventing acute lung damage.

Some exposed workers (1-15%) become sensitive to beryllium. These individuals may develop an inflammatory reaction in the respiratory system. This condition is called chronic beryllium disease (CBD), and can occur years after exposure to higher than normal levels of beryllium (greater than 0.2 ug/m$^3$). This disease can make you feel weak and tired, and can cause difficulty in breathing. It can also result in anorexia, weight loss, and may also lead to right side heart

enlargement and heart disease in advanced cases. Some people who are sensitized to beryllium may not have any symptoms. The general population is unlikely to develop chronic beryllium disease because ambient air levels of beryllium are normally very low (0.00003-0.0002 ug/m$^3$).

Swallowing beryllium has not been reported to cause effects in humans because very little beryllium is absorbed from the stomach and intestines. Ulcers have been seen in dogs ingesting beryllium in the diet. Beryllium contact with skin that has been scraped or cut may cause rashes or ulcers.

## How likely is beryllium to cause cancer?

Long term exposure to beryllium can increase the risk of developing lung cancer in people.

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have determined that beryllium is a human carcinogen. The EPA has determined that beryllium is a probable human carcinogen. EPA has estimated that lifetime exposure to 0.04 ug/m$^3$ beryllium can result in a one in a thousand chance of developing cancer.

## How can beryllium affect children?

It is likely that the health effects seen in children exposed to beryllium will be similar to the effects seen in adults. We do not know whether children differ from adults in their susceptibility to beryllium.

We do not know if exposure to beryllium will result in birth defects or other developmental effects in people. The studies on developmental effects in animals are not conclusive.

## How can families reduce the risk of exposure to beryllium?

❑ Individuals working at facilities that use beryllium should make sure that contaminated clothing and objects are not brought home.

❑ Children should avoid playing in soils near uncontrolled hazardous waste sites where beryllium may have been discarded.

## Is there a medical test to show whether I've been exposed to beryllium?

Beryllium can be measured in samples from your blood, urine, skin, or lungs. These tests are rarely done because they are not reliable measures of your exposure over time. Also, these tests do not show if you have become sensitized to beryllium.

Another test, the beryllium lymphocyte proliferation test (BeLPT), can help your doctor decide if you are sensitized to beryllium. This test is only done in a few specialized laboratories, but doctors familiar with the test can collect blood samples and send them for testing by overnight carrier. The BeLPT is most often done for people who work with beryllium. It is also useful for separating chronic beryllium disease from diagnoses that resemble it (for example, sarcoidosis). Depending on your exposure history, clinical findings, and test results, your doctor may also recommend additional specialized testing.

## Has the federal government made recommendations to protect human health?

The EPA restricts the amount of beryllium that industries may release into the air to 0.01 ug/m$^3$, averaged over a 30-day period.

The Occupational Safety and Health Administration (OSHA) sets a limit of 2 ug/m$^3$ for an 8-hour work shift measured as a personal sample.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for Beryllium Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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# BORON
## CAS # 7440-42-8

Agency for Toxic Substances and Disease Registry ToxFAQs September 1995

**This fact sheet answers the most frequently asked health questions (FAQs) about boron. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**SUMMARY: Exposure to boron occurs in the workplace or from using certain consumer products. Breathing moderate levels of boron irritates the nose, throat, and eyes. This chemical has been found in at least 142 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.**

### What is boron?
(Pronounced bôr′ŏn′)

Boron is a compound that occurs in nature. It is often found combined with other substances to form compounds called borates. Common borate compounds include boric acid, salts of borates, and boron oxide.

Several companies in the United States produce most of the world's borates by processing boron compounds. Borates are used mostly to produce glass. They are also used in fire retardants, leather tanning industries, cosmetics, photographic materials, soaps and cleaners, and for high-energy fuel. Some pesticides used for cockroach control and some wood preservatives also contain borates.

### What happens to boron when it enters the environment?

- Boron is released to the environment from natural sources such as oceans, volcanoes, and geothermal steam.
- Boron is also released from industries that use it.
- No information is available on how long boron remains in air, water, or soil.
- Boron does not appear to accumulate in fish or other organisms in water.
- Boron accumulates in plants and is found in foods, mainly fruits and vegetables.

### How might I be exposed to boron?

- In air, water, and food at low levels.
- Drinking water that contains it from areas where boron is found naturally at high levels in the earth.
- Eating foods containing high levels.
- Working in borax mining and refining plants and at sites where boric acid is manufactured.
- Using consumer products that contain it, such as cosmetics and laundry products.

### How can boron affect my health?

There is little information on the health effects of long-term exposure to boron. Most of the studies are on short-term exposures.

Breathing moderate levels of boron can result in irritation of the nose, throat, and eyes. Reproductive effects, such as low sperm count, were seen in men exposed to boron over the long-term. Animal studies have shown effects on the lungs from breathing high levels of boron.

Ingesting large amounts of boron over short periods of time can harm the stomach, intestines, liver, kidney, and

brain. Animal studies of ingestion of boron found effects on the testes in male animals. Birth defects were also seen in the offspring of female animals exposed during pregnancy.

We don't know what the effects are in people from skin contact with boron. Animal studies have found skin irritation when boron was applied directly to the skin.

## How likely is boron to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified boron as to its human carcinogenicity.

One animal study found no evidence of cancer after lifetime exposure to boric acid in food. No human studies are available.

## Is there a medical test to show whether I've been exposed to boron?

Tests are available to measure boron levels in blood and urine. These tests must be done shortly after exposure, because most excess boron leaves the body through the urine within a few days of exposure.

These tests are not usually performed in doctors' offices because special equipment is needed to conduct them. It is not known whether boron levels measured in the body can be used to predict whether health problems will occur.

## Has the federal government made recommendations to protect human health?

The EPA allows no more than 30 parts of boron per million parts of cottonseed oil (30 ppm) and 8 ppm of boron in or on citrus fruits.

The EPA requires that discharges or spills into the environment of 100 pounds of more of boron trichloride and boron trifluoride be reported.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 15 milligrams per cubic meter (15 $mg/m^3$) for boron oxide dust in workplace air for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) currently recommends an occupational exposure limit of 10 $mg/m^3$ for boron oxide dust.

NIOSH also recommends that 25 ppm boron trifluoride be considered immediately dangerous to life and health. This is the exposure level of a chemical that is likely to cause permanent health problems or death.

The Food and Drug Administration (FDA) allows no more than 310 ppm of boron as a food additive.

## Glossary

Carcinogenicity: Ability to cause cancer.

Ingesting: Taking food or drink into your body.

Long-term: Lasting one year or longer.

Milligram (mg): One thousandth of a gram.

Pesticides: Chemicals used to kill pests.

ppm: Parts per million.

Short-term: Lasting 14 days or less.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological profile for boron. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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# CADMIUM
## CAS # 7440-43-9

Agency for Toxic Substances and Disease Registry ToxFAQs June 1999

**This fact sheet answers the most frequently asked health questions (FAQs) about cadmium. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**HIGHLIGHTS: Exposure to cadmium happens mostly in the workplace where cadmium products are made. The general population is exposed from breathing cigarette smoke or eating cadmium contaminated foods. Cadmium damages the lungs, can cause kidney disease, and may irritate the digestive tract. This substance has been found in at least 776 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).**

### What is cadmium?

(Pronounced kăd′mē-əm)

Cadmium is a natural element in the earth's crust. It is usually found as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide).

All soils and rocks, including coal and mineral fertilizers, contain some cadmium. Most cadmium used in the United States is extracted during the production of other metals like zinc, lead, and copper. Cadmium does not corrode easily and has many uses, including batteries, pigments, metal coatings, and plastics.

### What happens to cadmium when it enters the environment?

- Cadmium enters air from mining, industry, and burning coal and household wastes.
- Cadmium particles in air can travel long distances before falling to the ground or water.
- It enters water and soil from waste disposal and spills or leaks at hazardous waste sites.
- It binds strongly to soil particles.
- Some cadmium dissolves in water.
- It doesn't break down in the environment, but can change forms.
- Fish, plants, and animals take up cadmium from the environment.
- Cadmium stays in the body a very long time and can build up from many years of exposure to low levels.

### How might I be exposed to cadmium?

- Breathing contaminated workplace air (battery manufacturing, metal soldering or welding).
- Eating foods containing it; low levels in all foods (highest in shellfish, liver, and kidney meats).
- Breathing cadmium in cigarette smoke (doubles the average daily intake).
- Drinking contaminated water.
- Breathing contaminated air near the burning of fossil fuels or municipal waste.

### How can cadmium affect my health?

Breathing high levels of cadmium severely damages the lungs and can cause death. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea. Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease.

Other long-term effects are lung damage and fragile bones. Animals given cadmium in food or water had high blood pressure, iron-poor blood, liver disease, and nerve or brain damage.

We don't know if humans get any of these diseases from eating or drinking cadmium. Skin contact with cadmium is not known to cause health effects in humans or animals.

## How likely is cadmium to cause cancer?

The Department of Health and Human Services (DHHS) has determined that cadmium and cadmium compounds may reasonably be anticipated to be carcinogens.

## How can cadmium affect children?

The health effects in children are expected to be similar to those in adults (kidney, lung and intestinal damage).

We don't know if cadmium causes birth defects in people. Cadmium does not readily go from a pregnant woman's body into the developing child, but some portion can cross the placenta. It can also be found in breast milk. The babies of animals exposed to high levels of cadmium during pregnancy had changes in behavior and learning ability. Cadmium may also affect birth weight and the skeleton in developing animals.

Animal studies also indicate that more cadmium is absorbed into the body if the diet is low in calcium, protein, or iron, or is high in fat. A few studies show that younger animals absorb more cadmium and are more likely to lose bone and bone strength than adults.

## How can families reduce the risk of exposure to cadmium?

In the home, store substances that contain cadmium safely, and keep nickel-cadmium batteries out of reach of young children. If you work with cadmium, use all safety precautions to avoid carrying cadmium-containing dust home from work on your clothing, skin, hair, or tools.

A balanced diet can reduce the amount of cadmium taken into the body from food and drink.

## Is there a medical test to show whether I've been exposed to cadmium?

Tests are available in some medical laboratories that measure cadmium in blood, urine, hair, or nails. Blood levels show recent exposure to cadmium, and urine levels show both recent and earlier exposure. The reliability of tests for cadmium levels in hair or nails is unknown.

## Has the federal government made recommendations to protect human health?

The EPA has set a limit of 5 parts of cadmium per billion parts of drinking water (5 ppb). EPA doesn't allow cadmium in pesticides.

The Food and Drug Administration (FDA) limits the amount of cadmium in food colors to 15 parts per million (15 ppm).

The Occupational Safety and Health Administration (OSHA) limits workplace air to 100 micrograms cadmium per cubic meter (100 $\mu g/m^3$) as cadmium fumes and 200 $\mu g$ cadmium/$m^3$ as cadmium dust.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for cadmium. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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# CALCIUM HYPOCHLORITE
CAS #7778-54-3
# SODIUM HYPOCHLORITE
CAS #7681-52-9

Division of Toxicology ToxFAQs™ April 2002

**This fact sheet answers the most frequently asked health questions (FAQs) about sodium and calcium hypochlorite. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**HIGHLIGHTS: The general public can be exposed to small amounts of sodium and calcium hypochlorite by using household products that contain these chemicals. Workers in occupations that use these chemicals have the highest risk of being exposed. Sodium and calcium hypochlorite can cause irritation of the eyes, skin, respiratory and gastrointestinal tract. Exposure to high levels can result in severe corrosive damage to the eyes, skin, respiratory and gastrointestinal tissues and can be fatal. Sodium and calcium hypochlorite have been found 6 times each in the 1,585 National Priorities List sites identified by the Environmental Protection Agency (EPA).**

## What are sodium and calcium hypochlorite?

Sodium hypochlorite is generally used dissolved in water at various concentrations. Although available, solid sodium hypochlorite is not commercially used. Sodium hypochlorite solutions are clear, greenish to yellow liquids with an odor of chlorine. Calcium hypochlorite is a white solid that readily decomposes in water releasing oxygen and chlorine. It also has a strong chlorine odor. Neither compound occur naturally in the environment.

Sodium and calcium hypochlorite are used primarily as bleaching agents or disinfectants. They are components of commercial bleaches, cleaning solutions, and disinfectants for drinking water and waste water purification systems and swimming pools.

## What happens to sodium and calcium hypochlorite when they enter the environment?

❑ When released to air, sodium and calcium hypochlorite are broken down by sunlight and compounds commonly found in the air.
❑ In water and soil, sodium and calcium hypochlorite separate into sodium, calcium and hypochlorite ions (an ion is an electrically charged atom or molecule). These ions may react with other substances found in the water.
❑ Sodium and calcium hypochlorite do not accumulate in the food chain.

## How might I be exposed to sodium and calcium hypochlorite?

❑ You can be exposed to low levels of sodium and calcium hypochlorite if you use disinfectants like household bleach.
❑ You can also be exposed by swimming in pools where these chemicals were added to kill bacteria.
❑ Drinking water from public drinking water supplies where these chemicals were added to kill bacteria.
❑ Workers employed in occupations where these compounds are used to bleach paper and textiles may be subject to slightly higher levels of exposure.

## How can sodium and calcium hypochlorite affect my health?

The toxic effects of sodium and calcium hypochlorite are due primarily to the corrosive properties of hypochlorite. If you ingest a small amount of household bleaches (3-6%

hypochlorite) you may experience gastrointestinal irritation. If you ingest a more concentrated commercial bleach (10% or higher hypochlorite) or hypochlorite powder you may suffer severe corrosive injuries to the mouth, throat, esophagus and stomach with bleeding, perforation, and eventually death. Permanent scars and narrowing of the esophagus may occur in survivors of severe intoxication.

If you inhale chlorine gas released from concentrated hypochlorite solutions you may experience nasal irritation, sore throat, and coughing. Contact of strong hypochlorite solutions with your skin may cause burning pain, inflammation, and blisters. Contact of the eye with mild bleach solutions may cause mild and transitory irritation. More concentrated solutions may cause severe eye injuries. Long-term exposure to low levels of hypochlorite can cause dermal irritation.

We do not know if exposure to chlorine can result in reproductive effects.

## How likely are sodium and calcium hypochlorite to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that hypochlorite salts are not classifiable as to their carcinogenicity to humans.

## How can sodium and calcium hypochlorite affect children?

Children are probably affected by exposure to sodium and calcium hypochlorite in the same ways as adults. We do not know whether children differ from adults in their susceptibility to sodium and calcium hypochlorite. In general, children may be more vulnerable to corrosive agents than adults because of the smaller diameter of their airways.

We do not know if exposure to sodium and calcium hypochlorite can result in birth defects or other developmental effects.

## How can families reduce the risk of exposure to sodium and calcium hypochlorite?

❑ Most families will not be exposed to high levels of sodium or calcium hypochlorite.
❑ Household products containing sodium or calcium hypochlorite should be stored in safe locations, out of the reach of children.

## Is there a medical test to show whether I've been exposed to sodium and calcium hypochlorite?

Specific tests for the presence of sodium, calcium or chlorine in the blood or urine are not generally useful. If a severe exposure has occurred, blood and urine analyses and other tests may show whether damage has occurred to the lungs and gastrointestinal tract. Some of these tests can be performed in a doctor's office. Some testing may require hospital facilities.

## Has the federal government made recommendations to protect human health?

The Food and Drug Administration (FDA) has set a limit for chlorine, as sodium hypochlorite or calcium hypochlorite, not to exceed 0.0082 or 0.0.036 pounds, respectively, of chlorine per pound of dry food starch.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

hypochlorite) you may experience gastrointestinal irritation. If you ingest a more concentrated commercial bleach (10% or higher hypochlorite) or hypochlorite powder you may suffer severe corrosive injuries to the mouth, throat, esophagus and stomach with bleeding, perforation, and eventually death. Permanent scars and narrowing of the esophagus may occur in survivors of severe intoxication.

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We do not know if exposure to chlorine can result in reproductive effects.

## How likely are sodium and calcium hypochlorite to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that hypochlorite salts are not classifiable as to their carcinogenicity to humans.

## How can sodium and calcium hypochlorite affect children?

Children are probably affected by exposure to sodium and calcium hypochlorite in the same ways as adults. We do not know whether children differ from adults in their susceptibility to sodium and calcium hypochlorite. In general, children may be more vulnerable to corrosive agents than adults because of the smaller diameter of their airways.

We do not know if exposure to sodium and calcium hypochlorite can result in birth defects or other developmental effects.

## How can families reduce the risk of exposure to sodium and calcium hypochlorite?

❑ Most families will not be exposed to high levels of sodium or calcium hypochlorite.
❑ Household products containing sodium or calcium hypochlorite should be stored in safe locations, out of the reach of children.

## Is there a medical test to show whether I've been exposed to sodium and calcium hypochlorite?

Specific tests for the presence of sodium, calcium or chlorine in the blood or urine are not generally useful. If a severe exposure has occurred, blood and urine analyses and other tests may show whether damage has occurred to the lungs and gastrointestinal tract. Some of these tests can be performed in a doctor's office. Some testing may require hospital facilities.

## Has the federal government made recommendations to protect human health?

The Food and Drug Administration (FDA) has set a limit for chlorine, as sodium hypochlorite or calcium hypochlorite, not to exceed 0.0082 or 0.0.036 pounds, respectively, of chlorine per pound of dry food starch.

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# CHROMIUM
## CAS # 7440-47-3

Division of Toxicology ToxFAQs™ February 2001

**This fact sheet answers the most frequently asked health questions (FAQs) about chromium. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**HIGHLIGHTS: Exposure to chromium occurs from ingesting contaminated food or drinking water or breathing contaminated workplace air. Chromium(VI) at high levels can damage the nose and can cause cancer. Chromium has been found at 1,036 of the 1,591 National Priority List sites identified by the Environmental Protection Agency (EPA).**

### What is chromium?

Chromium is a naturally occurring element found in rocks, animals, plants, soil, and in volcanic dust and gases. Chromium is present in the environment in several different forms. The most common forms are chromium(0), chromium(III), and chromium(VI). No taste or odor is associated with chromium compounds.

Chromium(III) occurs naturally in the environment and is an essential nutrient. Chromium(VI) and chromium(0) are generally produced by industrial processes.

The metal chromium, which is the chromium(0) form, is used for making steel. Chromium(VI) and chromium(III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.

### What happens to chromium when it enters the environment?

- Chromium enters the air, water, and soil mostly in the chromium(III) and chromium(VI) forms.
- In air, chromium compounds are present mostly as fine dust particles which eventually settle over land and water.
- Chromium can strongly attach to soil and only a small amount can dissolve in water and move deeper in the soil to underground water.
- Fish do not accumulate much chromium in their bodies from water.

### How might I be exposed to chromium?

- Eating food containing chromium(III).
- Breathing contaminated workplace air or skin contact during use in the workplace.
- Drinking contaminated well water.
- Living near uncontrolled hazardous waste sites containing chromium or industries that use chromium.

### How can chromium affect my health?

Chromium(III) is an essential nutrient that helps the body use sugar, protein, and fat.

Breathing high levels of chromium(VI) can cause irritation to the nose, such as runny nose, nosebleeds, and ulcers and holes in the nasal septum.

Ingesting large amounts of chromium(VI) can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death.

Skin contact with certain chromium(VI) compounds can cause skin ulcers. Some people are extremely sensitive to chromium(VI) or chromium(III). Allergic reactions consisting of severe redness and swelling of the skin have been noted.

## How likely is chromium to cause cancer?

Several studies have shown that chromium(VI) compounds can increase the risk of lung cancer. Animal studies have also shown an increased risk of cancer.

The World Health Organization (WHO) has determined that chromium(VI) is a human carcinogen.

The Department of Health and Human Services (DHHS) has determined that certain chromium(VI) compounds are known to cause cancer in humans.

The EPA has determined that chromium(VI) in air is a human carcinogen.

## How can chromium affect children?

We do not know if exposure to chromium will result in birth defects or other developmental effects in people. Birth defects have been observed in animals exposed to chromium(VI).

It is likely that health effects seen in children exposed to high amounts of chromium will be similar to the effects seen in adults.

## How can families reduce the risk of exposure to chromium?

❑ Children should avoid playing in soils near uncontrolled hazardous waste sites where chromium may have been discarded.

❑ Although chromium(III) is an essential nutrient, you should avoid excessive use of dietary supplements containing chromium.

## Is there a medical test to show whether I've been exposed to chromium?

Since chromium(III) is an essential element and naturally occurs in food, there will always be some level of chromium in your body. There are tests to measure the level of chromium in hair, urine, and blood. These tests are most useful for people exposed to high levels. These tests cannot determine the exact levels of chromium that you may have been exposed to or predict how the levels in your tissues will affect your health.

## Has the federal government made recommendations to protect human health?

EPA has set a limit of 100 μg chromium(III) and chromium(VI) per liter of drinking water (100 μg/L).

The Occupational Safety and Health Administration (OSHA) has set limits of 500 μg water soluble chromium(III) compounds per cubic meter of workplace air (500 $\mu g/m^3$), 1,000 $\mu g/m^3$ for metallic chromium(0) and insoluble chromium compounds, and 52 $\mu g/m^3$ for chromium(VI) compounds for 8-hour work shifts and 40-hour work weeks.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Chromium. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

# COPPER

## CAS # 7440-50-8

Division of Toxicology ToxFAQs™ September 2004

**This fact sheet answers the most frequently asked health questions (FAQs) about copper. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**HIGHLIGHTS: Copper is a metal that occurs naturally in the environment, and also in plants and animals. Low levels of copper are essential for maintaining good health. High levels can cause harmful effects such as irritation of the nose, mouth and eyes, vomiting, diarrhea, stomach cramps, nausea, and even death. Copper has been found in at least 906 of the 1,647 National Priority Sites identified by the Environmental Protection Agency (EPA).**

### What is copper?

Copper is a metal that occurs naturally throughout the environment, in rocks, soil, water, and air. Copper is an essential element in plants and animals (including humans), which means it is necessary for us to live. Therefore, plants and animals must absorb some copper from eating, drinking, and breathing.

Copper is used to make many different kinds of products like wire, plumbing pipes, and sheet metal. U.S. pennies made before 1982 are made of copper, while those made after 1982 are only coated with copper. Copper is also combined with other metals to make brass and bronze pipes and faucets.

Copper compounds are commonly used in agriculture to treat plant diseases like mildew, for water treatment and, as preservatives for wood, leather, and fabrics.

### What happens to copper when it enters the environment?

❑ Copper is released into the environment by mining, farming, and manufacturing operations and through waste water releases into rivers and lakes. Copper is also released from natural sources, like volcanoes, windblown dusts, decaying vegetation, and forest fires.

❑ Copper released into the environment usually attaches to particles made of organic matter, clay, soil, or sand.

❑ Copper does not break down in the environment. Copper compounds can break down and release free copper into the air, water, and foods.

### How might I be exposed to copper?

❑ You may be exposed to copper from breathing air, drinking water, eating foods, or having skin contact with copper, particulates attached to copper, or copper-containing compounds.

❑ Drinking water may have high levels of copper if your house has copper pipes and acidic water.

❑ Lakes and rivers that have been treated with copper compounds to control algae, or that receive cooling water from power plants, can have high levels of copper. Soils can also contain high levels of copper, especially if they are near copper smelting plants.

❑ You may be exposed to copper by ingesting copper-containing fungicides, or if you live near a copper mine or where copper is processed into bronze or brass.

❑ You may be exposed to copper if you work in copper mines or if you grind metals containing copper.

### How can copper affect my health?

Everyone must absorb small amounts of copper every day because copper is essential for good health. High levels of copper can be harmful. Breathing high levels of copper can cause irritation of your nose and throat. Ingesting high levels of copper can cause nausea, vomiting, and diarrhea. Very-high doses of copper can cause damage to your liver and kidneys, and can even cause death.

## How likely is copper to cause cancer?

We do not know whether copper can cause cancer in humans. The EPA has determined that copper is not classifiable as to human carcinogenicity.

## How can copper affect children?

Exposure to high levels of copper will result in the same type of effects in children and adults. We do not know if these effects would occur at the same dose level in children and adults. Studies in animals suggest that the young children may have more severe effects than adults, but we don't know if this would also be true in humans. There is a very small percentage of infants and children who are unusually sensitive to copper.

We do not know if copper can cause birth defects or other developmental effects in humans. Studies in animals suggest that high levels of copper may cause a decrease in fetal growth.

## How can families reduce the risk of exposure to copper?

The most likely place to be exposed to copper is through drinking water, especially if your water is corrosive and you have copper pipes in your house. The best way to lower the level of copper in your drinking water is to let the water run for at least 15 seconds first thing in the morning before drinking or using it. This reduces the levels of copper in tap water dramatically.

If you work with copper, wear the necessary protective clothing and equipment, and always follow safety procedures. Shower and change your clothes before going home each day.

## Is there a medical test to show whether I've been exposed to copper?

Copper is found throughout the body; in hair, nails, blood, urine, and other tissues. High levels of copper in these samples can show that you have been exposed to higher-than normal levels of copper. These tests cannot tell whether you will experience harmful effects. Tests to measure copper levels in the body are not usually available at a doctor's office because they require special equipment, but the doctor can send samples to a specialty laboratory.

## Has the federal government made recommendations to protect human health?

The EPA requires that levels of copper in drinking water be less than 1.3 mg of copper per one liter of drinking water (1.3 mg/L).

The U.S. Department of Agriculture has set the recommended daily allowance for copper at 900 micrograms of copper per day (μg/day) for people older than eight years old.

The Occupational Safety and Health Administration (OSHA) requires that levels of copper in the air in workplaces not exceed 0.1 mg of copper fumes per cubic meter of air (0.1 $mg/m^3$) and 1.0 $mg/m^3$ for copper dusts.

## Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2004. Toxicological Profile for Copper. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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# PUBLIC HEALTH STATEMENT
## Lead
CAS#: 7439-92-1

Division of Toxicology and Environmental Medicine September 2005

This Public Health Statement is the summary chapter from the Toxicological Profile for Lead. It is one in a series of Public Health Statements about hazardous substances and their health effects. A shorter version, the ToxFAQs™, is also available. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present. For more information, call the ATSDR Information Center at 1-888-422-8737.

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This public health statement tells you about lead and the effects of exposure to it.

The Environmental Protection Agency (EPA) identifies the most serious hazardous waste sites in the nation. These sites are then placed on the National Priorities List (NPL) and are targeted for long-term federal clean-up activities. Lead has been found in at least 1,280 of the 1,662 current or former NPL sites. Although the total number of NPL sites evaluated for this substance is not known, the possibility exists that the number of sites at which lead is found may increase in the future as more sites are evaluated. This information is important because these sites may be sources of exposure and exposure to this substance may harm you.

When a substance is released either from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment. Such a release does not always lead to exposure. You can be exposed to a substance only when you come in contact with it. You may be exposed by breathing, eating, or drinking the substance, or by skin contact.

If you are exposed to lead, many factors will determine whether you will be harmed. These factors include the dose (how much), the duration (how long), and how you come in contact with it. You must also consider any other chemicals you are exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

## 1.1 WHAT IS LEAD?

Lead is a heavy, low melting, bluish-gray metal that occurs naturally in the Earth's crust. However, it is rarely found naturally as a metal. It is usually found combined with two or more other elements to form lead compounds.

Metallic lead is resistant to corrosion (i.e., not easily attacked by air or water). When exposed to air or water, thin films of lead compounds are formed that protect the metal from further attack. Lead is easily molded and shaped. Lead can be combined with other metals to form alloys. Lead and lead alloys are commonly found in pipes, storage batteries, weights, shot and ammunition, cable covers, and sheets used to shield us from radiation. The largest use for lead is in storage batteries in cars and other vehicles.

Lead compounds are used as a pigment in paints, dyes, and ceramic glazes and in caulk. The amount of lead used in these products has been reduced in recent years to minimize lead's harmful effect on people and animals. Tetraethyl lead and tetramethyl lead were once used in the United States as gasoline

additives to increase octane rating. However, their use was phased out in the United States in the 1980s, and lead was banned for use in gasoline for motor vehicles beginning January 1, 1996. Tetraethyl lead may still be used in gasoline for off-road vehicles and airplanes. It is also still used in a number of developing countries. Lead used in ammunition, which is the largest non-battery end-use, has remained fairly constant in recent years. However, even the use of lead in bullets and shot as well as in sinkers is being reduced because of its harm to the environment.

Most lead used by industry comes from mined ores ("primary") or from recycled scrap metal or batteries ("secondary"). Lead is mined in the United States, primarily in Alaska and Missouri. However, most lead today is "secondary" lead obtained from lead-acid batteries. It is reported that 97% of these batteries are recycled.

## 1.2 WHAT HAPPENS TO LEAD WHEN IT ENTERS THE ENVIRONMENT?

Lead occurs naturally in the environment. However, most of the high levels found throughout the environment come from human activities. Environmental levels of lead have increased more than 1,000-fold over the past three centuries as a result of human activity. The greatest increase occurred between the years 1950 and 2000, and reflected increasing worldwide use of leaded gasoline. Lead can enter the environment through releases from mining lead and other metals, and from factories that make or use lead, lead alloys, or lead compounds. Lead is released into the air during burning coal, oil, or waste. Before the use of leaded gasoline was banned, most of the lead released into the U.S. environment came from vehicle exhaust. In 1979, cars released 94.6 million kilograms (kg; 1 kg equals 2.2 pounds) of lead into the air in the United States. In 1989, when the use of lead was limited but not banned, cars released only 2.2 million kg to the air. Since EPA banned the use of leaded gasoline for highway transportation in 1996, the amount of lead released into the air has decreased further. Before the 1950s, lead was used in pesticides applied to fruit orchards. Once lead gets into the atmosphere, it may travel long distances if the lead particles are very small. Lead is removed from the air by rain and by particles falling to land or into surface water.

Sources of lead in dust and soil include lead that falls to the ground from the air, and weathering and chipping of lead-based paint from buildings, bridges, and other structures. Landfills may contain waste from lead ore mining, ammunition manufacturing, or other industrial activities such as battery production. Disposal of lead-containing products contribute to lead in municipal landfills. Past uses of lead such as its use in gasoline are a major contributor to lead in soil, and higher levels of lead in soil are found near roadways. Most of the lead in inner city soils comes from old houses with paint containing lead and previous automotive exhaust emitted when gasoline contained lead.

Once lead falls onto soil, it sticks strongly to soil particles and remains in the upper layer of soil. That is why past uses of lead such as lead in gasoline, house paint, and pesticides are so important in the amount of lead found in soil.

Small amounts of lead may enter rivers, lakes, and streams when soil particles are moved by rainwater.

Small amounts of lead from lead pipe or solder may be released into water when the water is acidic or "soft". Lead may remain stuck to soil particles or sediment in water for many years. Movement of lead from soil particles into groundwater is unlikely unless the rain falling on the soil is acidic or "soft". Movement of lead from soil will also depend on the type of lead salt or compound and on the physical and chemical characteristics of the soil.

Sources of lead in surface water or sediment include deposits of lead-containing dust from the atmosphere, waste water from industries that handle lead (primarily iron and steel industries and lead producers), urban runoff, and mining piles.

Some lead compounds are changed into other forms of lead by sunlight, air, and water. However, elemental lead cannot be broken down.

The levels of lead may build up in plants and animals from areas where air, water, or soil are contaminated with lead. If animals eat contaminated plants or animals, most of the lead that they eat will pass through their bodies.

## 1.3 HOW MIGHT I BE EXPOSED TO LEAD?

Lead is commonly found in soil especially near roadways, older houses, old orchards, mining areas, industrial sites, near power plants, incinerators, landfills, and hazardous waste sites. People living near hazardous waste sites may be exposed to lead and chemicals that contain lead by breathing air, drinking water, eating foods, or swallowing dust or dirt that contain lead. People may be exposed to lead by eating food or drinking water that contains lead. Drinking water in houses containing lead pipes may contain lead, especially if the water is acidic or "soft". If one is not certain whether an older building contains lead pipes, it is best to let the water run a while before drinking it so that any lead formed in the pipes can be flushed out. People living in areas where there are old houses that have been painted with lead paint may be exposed to higher levels of lead in dust and soil. Similarly, people who live near busy highways or on old orchard land where lead arsenate pesticides were used in the past may be exposed to higher levels of lead. People may also be exposed to lead when they work in jobs where lead is used or have hobbies in which lead is used, such as making stained glass.

Foods may contain small amounts of lead. However, since lead solder is no longer used in cans, very little lead is found in food. Leafy fresh vegetables may have lead-containing dust on them and should be washed well before consuming. Lead may also enter foods if they are put into improperly glazed pottery or ceramic dishes and from leaded-crystal glassware. Illegal whiskey made using stills that contain lead-soldered parts (such as truck radiators) may also contain lead. Cigarette smoke may also contain small amounts of lead. The amount of lead found in canned foods decreased 87% from 1980 to 1988 in the United States, which indicates that the chance of exposure to lead in canned food from lead-soldered containers has been greatly reduced. Lead-soldered cans are still used in some other nations. In the most recent studies, lead was not detectable in most foods and the average dietary intake of lead was about 1 microgram (a microgram is a millionth of a gram) per kilogram of body weight/day. Children may be

exposed to lead by hand-to-mouth contact after exposure to lead-containing soil or dust.

In general, very little lead is found in lakes, rivers, or groundwater used to supply the public with drinking water. More than 99% of all publicly supplied drinking water contains less than 0.005 parts of lead per million parts of water (ppm). However, the amount of lead taken into your body through drinking water can be higher in communities with acidic water supplies. Acidic water makes it easier for the lead found in pipes, leaded solder, and brass faucets to be dissolved and to enter the water we drink. Public water treatment systems are now required to use control measures to make water less acidic. Plumbing that contains lead may be found in public drinking water systems, and in houses, apartment buildings, and public buildings that are more than 20 years old. However, as buildings age, mineral deposits form a coating on the inside of the water pipes that insulates the water from lead in the pipe or solder, thus reducing the amount of lead that can leach into the water. Since 1988, regulations require that drinking water coolers must not contain lead in parts that come into contact with drinking water.

Breathing in, or swallowing airborne dust and dirt, is another way you can be exposed to lead. In 1984, burning leaded gasoline was the single largest source of lead emissions. Very little lead in the air comes from gasoline now because EPA has banned its use in gasoline for motor vehicles. Other sources of lead in the air include releases to the air from industries involved in iron and steel production, lead-acid-battery manufacturing, and non-ferrous (brass and bronze) foundries. Lead released into air may also come from burning of solid waste that contains lead, windblown dust, volcanoes, exhaust from workroom air, burning or weathering of lead-painted surfaces, fumes and exhaust from leaded gasoline, and cigarette smoke.

Skin contact with dust and dirt containing lead occurs every day. Recent data have shown that inexpensive cosmetic jewelry pieces sold to the general public may contain high levels of lead which may be transferred to the skin through routine handling. However, not much lead can get into your body through your skin.

In the home, you or your children may be exposed to lead if you take some types of home remedy medicines that contain lead compounds. Lead compounds are in some non-Western cosmetics, such as surma and kohl. Some types of hair colorants, cosmetics, and dyes contain lead acetate. Read the labels on hair coloring products, use them with caution, and keep them away from children.

People who are exposed at work are usually exposed by breathing in air that contains lead particles. Exposure to lead occurs in many jobs. People who work in lead smelting and refining industries, brass/bronze foundries, rubber products and plastics industries, soldering, steel welding and cutting operations, battery manufacturing plants, and lead compound manufacturing industries may be exposed to lead. Construction and demolition workers and people who work at municipal waste incinerators, pottery and ceramics industries, radiator repair shops, and other industries that use lead solder may also be exposed. Painters who sand or scrape old paint may be exposed to lead in dust. Between 0.5 and 1.5 million workers are exposed to lead in the workplace. In California alone, more than 200,000 workers are exposed to lead. Families of workers may be exposed to higher levels of lead

when workers bring home lead dust on their work clothes.

You may also be exposed to lead in the home if you work with stained glass as a hobby, make lead fishing weights or ammunition, or if you are involved in home renovation that involves the removal of old lead-based paint.

## 1.4 HOW CAN LEAD ENTER AND LEAVE MY BODY?

Some of the lead that enters your body comes from breathing in dust or chemicals that contain lead. Once this lead gets into your lungs, it goes quickly to other parts of the body in your blood.

Larger particles that are too large to get into your lungs can be coughed up and swallowed. You may also swallow lead by eating food and drinking liquids that contain it. Most of the lead that enters your body comes through swallowing, even though very little of the amount you swallow actually enters your blood and other parts of your body. The amount that gets into your body from your stomach partially depends on when you ate your last meal. It also depends on how old you are and how well the lead particles you ate dissolved in your stomach juices. Experiments using adult volunteers showed that, for adults who had just eaten, the amount of lead that got into the blood from the stomach was only about 6% of the total amount taken in. In adults who had not eaten for a day, about 60–80% of the lead from the stomach got into their blood. In general, if adults and children swallow the same amount of lead, a bigger proportion of the amount swallowed will enter the blood in children than in adults. Children absorb about 50% of ingested lead.

Dust and soil that contain lead may get on your skin, but only a small portion of the lead will pass through your skin and enter your blood if it is not washed off. You can, however, accidentally swallow lead that is on your hands when you eat, drink, smoke, or apply cosmetics (for example, lip balm). More lead can pass through skin that has been damaged (for example, by scrapes, scratches, and wounds). The only kinds of lead compounds that easily penetrate the skin are the additives in leaded gasoline, which is no longer sold to the general public. Therefore, the general public is not likely to encounter lead that can enter through the skin.

Shortly after lead gets into your body, it travels in the blood to the "soft tissues" and organs (such as the liver, kidneys, lungs, brain, spleen, muscles, and heart). After several weeks, most of the lead moves into your bones and teeth. In adults, about 94% of the total amount of lead in the body is contained in the bones and teeth. About 73% of the lead in children's bodies is stored in their bones. Some of the lead can stay in your bones for decades; however, some lead can leave your bones and reenter your blood and organs under certain circumstances (e.g., during pregnancy and periods of breast feeding, after a bone is broken, and during advancing age).

Your body does not change lead into any other form. Once it is taken in and distributed to your organs, the lead that is not stored in your bones leaves your body in your urine or your feces. About 99% of the amount of lead taken into the body of an adult will leave in the waste within a couple of

weeks, but only about 32% of the lead taken into the body of a child will leave in the waste. Under conditions of continued exposure, not all of the lead that enters the body will be eliminated, and this may result in accumulation of lead in body tissues, especially bone.

## 1.5 HOW CAN LEAD AFFECT MY HEALTH?

Scientists use many tests to protect the public from harmful effects of toxic chemicals and to find ways for treating persons who have been harmed.

One way to learn whether a chemical will harm people is to determine how the body absorbs, uses, and releases the chemical. For some chemicals, animal testing may be necessary. Animal testing may also help identify health effects such as cancer or birth defects. Without laboratory animals, scientists would lose a basic method for getting information needed to make wise decisions that protect public health. Scientists have the responsibility to treat research animals with care and compassion. Scientists must comply with strict animal care guidelines because laws today protect the welfare of research animals.

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

We have no conclusive proof that lead causes cancer (is carcinogenic) in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services (DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens based on limited evidence from studies in humans and sufficient evidence from animal studies, and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans. IARC determined that organic lead compounds are not classifiable as to their carcinogenicity in humans based on inadequate evidence from studies in humans and in animals. See Chapters 2 and 3 for more information on the health effects of lead.

## 1.6 HOW CAN LEAD AFFECT CHILDREN?

This section discusses potential health effects in humans from exposures during the period from conception to maturity at 18 years of age. Potential effects on children resulting from exposures of the parents are also considered.

Studies carried out by the Centers for Disease Control and Prevention (CDC) show that the levels of lead in the blood of U.S. children have been getting lower and lower. This result is because lead is banned from gasoline, residential paint, and solder used for food cans and water pipes. However, about 310,000 U.S. children between the ages of 1 and 5 years are believed to have blood lead levels equal or greater than 10 μg/dL, the level targeted for elimination among young children in the Unites States by 2010.

Children are more vulnerable to lead poisoning than adults. Children are exposed to lead all through their lives. They can be exposed to lead in the womb if their mothers have lead in their bodies. Babies can swallow lead when they breast feed, or eat other foods, and drink water that contains lead. Babies and children can swallow and breathe lead in dirt, dust, or sand while they play on the floor or ground. These activities make it easier for children to be exposed to lead than adults. The dirt or dust on their hands, toys, and other items may have lead particles in it. In some cases, children swallow nonfood items such as paint chips; these may contain very large amounts of lead, particularly in and around older houses that were painted with lead-based paint. The paint in these houses often chips off and mixes with dust and dirt. Some old paint contains as much as 50% lead. Also, compared with adults, a bigger proportion of the amount of lead swallowed will enter the blood in children.

Children are more sensitive to the health effects of lead than adults. No safe blood lead level in children has been determined. Lead affects children in different ways depending on how much lead a child swallows. A child who swallows large amounts of lead may develop anemia, kidney damage, colic (severe "stomach ache"), muscle weakness, and brain damage, which ultimately can kill the child. In some cases, the amount of lead in the child's body can be lowered by giving the child certain drugs that help eliminate lead from the body. If a child swallows smaller amounts of lead, such as dust containing lead from paint, much less severe but still important effects on blood, development, and behavior may occur. In this case, recovery is likely once the child is removed from the source of lead exposure, but there is no guarantee that the child will completely avoid all long-term consequences of lead exposure. At still lower levels of exposure, lead can affect a child's mental and physical growth. Fetuses exposed to lead in the womb, because their mothers had a lot of lead in their bodies, may be born prematurely and have lower weights at birth. Exposure in the womb, in infancy, or in early childhood also may slow mental development and cause lower intelligence later in childhood. There is evidence that these effects may persist beyond childhood.

Children with high blood lead levels do not have specific symptoms. However, health workers can find out whether a child may have been exposed to harmful levels of lead by taking a blood sample. They can also find out how much lead is in a child's bones by taking a special type of X-ray of the finger, knee, or elbow. This type of test, however, is not routine.

## 1.7 HOW CAN FAMILIES REDUCE THE RISK OF EXPOSURE TO LEAD?

If your doctor finds that you have been exposed to substantial amounts of lead, ask whether your children might also have been exposed. Your doctor might need to ask your state health department to investigate.

The most important way families can lower exposures to lead is to know about the sources of lead in their homes and avoid exposure to these sources. Some homes or day-care facilities may have more lead in them than others. Families who live in or visit these places may be exposed to higher amounts of lead. These include homes built before 1978 that may have been painted with paint that contains lead (lead-based paint). If you are buying a home that was built before 1978, you may want to know if it contains lead based paint. Federal government regulations require a person selling a home to tell the real estate agent or person buying the home of any known lead-based hazards on the property. Adding lead to paint is no longer allowed. If your house was built before 1978, it may have been painted with lead-based paint. This lead may still be on walls, floors, ceilings, and window sills, or on the outside walls of the house. The paint may have been scraped off by a previous owner, but paint chips and lead-containing dust may still be in the yard soil. Decaying, peeling, or flaking paint can introduce lead into household dust and the area where this is occurring should be repainted. If your paint is decaying or your child has symptoms of lead poisoning, you may want to have your house tested for lead. In some states, homeowners can have the paint in their homes tested for lead by their local health departments. The National Lead Information Center (1-800-532-3394) has a listing of approved risk assessors (people who have met certain criteria and are qualified to assess the potential risks of a site) and of approved testing laboratories (for soil, paint, and dust).

Sanding surfaces painted with lead-based paint or using heat to peel the paint may cause exposure to high levels of lead. Many cases of lead poisoning have resulted from do-it-yourself home renovations. Therefore, any renovations should be performed by a licensed contractor who will minimize exposure to household members. It is important for the area being renovated to be isolated from the rest of the house because of lead-containing dust. The federal government requires that contractors who test for or remove lead must be certified by the EPA or an EPA-approved state program. Ask to see certifications of potential contractors. Your state health department or environmental protection division should be able to identify certified contractors for you. The National Lead Abatement Council (P.O. Box 535; Olney, MD 20932; telephone 301-924-5490) can also send you a list of certified contractors.

Families can lower the possibility of children swallowing paint chips by discouraging their children from chewing or putting these painted surfaces in their mouths and making sure that they wash their hands often, especially before eating. Lead can be found in dirt and dust. Areas where levels of lead in dirt might be especially high are near old houses, highways, or old orchards. Some children have the habit of eating dirt (the term for this activity is pica). Discourage your children from eating dirt and other hand-to-mouth activity.

Non-Western folk remedies used to treat diarrhea or other ailments may contain substantial amounts of lead. Examples of these include: Alarcon, Ghasard, Alkohl, Greta, Azarcon, Liga, Bali Goli, Pay-loo-ah, Coral, and Rueda. If you give your children these substances or if you are pregnant or nursing, you may expose your children to lead. It is wise to know the ingredients of any medicines that you or your children use.

Older homes that have plumbing containing lead may have higher amounts of lead in drinking water. Inside plumbing installed before 1930 is most likely to contain high levels of lead. Copper pipes have replaced lead pipes in most residential plumbing. You cannot see, taste, or smell lead in water, and boiling your water will not get rid of lead. If you have a water-lead problem, EPA recommends that anytime water in a particular faucet has not been used for 6 hours or longer, you should flush your cold water pipes by running water until it is cold (5 seconds–2 minutes). Because lead dissolves more easily in warm water than in cold water, you should only use cold water for drinking, cooking, and preparing baby formula. You can contact your local health department or water supplier to find out about testing your water for lead. If your water tests indicate a significant presence of lead, consult your water supplier or local health department about possible remedies.

You can bring lead home in the dust on your hands or clothes if lead is used in the place where you work. Lead dust is likely to be found in places where lead is mined or smelted, where car batteries are made or recycled, where electric cable sheathing is made, where fine crystal glass is made, or where certain types of ceramic pottery are made. Pets can also bring lead into the home in dust or dirt on their fur or feet if they spend time in places that have high levels of lead in the soil.

Swallowing of lead in house dust or soil is a very important exposure pathway for children. This problem can be reduced in many ways. Regular hand and face washing to remove lead dusts and soil, especially before meals, can lower the possibility that lead on the skin is accidentally swallowed while eating. Families can lower exposures to lead by regularly cleaning the home of dust and tracked in soil. Door mats can help lower the amount of soil that is tracked into the home; removing your shoes before entering the home will also help. Planting grass and shrubs over bare soil areas in the yard can lower contact that children and pets may have with soil and the tracking of soil into the home.

Families whose members are exposed to lead dusts at work can keep these dusts out of reach of children by showering and changing clothes before leaving work, and bagging their work clothes before they are brought into the home for cleaning. Proper ventilation and cleaning—during and after hobby activities, home or auto repair activities, and hair coloring with products that contain lead—will decrease the possibility of exposure.

Lead-containing dust may be deposited on plant surfaces and lead may be taken up in certain edible plants from the soil by the roots; therefore, home gardening may also contribute to exposure if the produce is grown in soils that have high lead concentrations. Vegetables should be well washed before eating to remove surface deposits. Certain hobbies and home or car repair activities like radiator repair can add lead to the home as well. These include soldering glass or metal, making

bullets or slugs, or glazing pottery. Some types of paints and pigments that are used as facial make-up or hair coloring contain lead. Cosmetics that contain lead include surma and kohl, which are popular in certain Asian countries. Read the labels on hair coloring products, and keep hair dyes that contain lead acetate away from children. Do not allow children to touch hair that has been colored with lead-containing dyes or any surfaces that have come into contact with these dyes because lead compounds can rub off onto their hands and be transferred to their mouths.

It is important that children have proper nutrition and eat a balanced diet of foods that supply adequate amounts of vitamins and minerals, especially calcium and iron. Good nutrition lowers the amount of swallowed lead that passes to the bloodstream and also may lower some of the toxic effects of lead.

## 1.8 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO LEAD?

The amount of total lead in the blood can be measured to determine if exposure to lead has occurred. This test shows if you have been recently exposed to lead. Lead can be measured in teeth or bones by X-ray techniques, but these methods are not widely available. These tests show long-term exposures to lead. The primary screening method is measurement of blood lead. Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (μg/dL). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

## 1.9 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?

The federal government develops regulations and recommendations to protect public health. Regulations *can* be enforced by law. The EPA, the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA) are some federal agencies that develop regulations for toxic substances. Recommendations provide valuable guidelines to protect public health, but *cannot* be enforced by law. The Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH) are two federal organizations that develop recommendations for toxic substances.

Regulations and recommendations can be expressed as "not-to-exceed" levels, that is, levels of a toxic substance in air, water, soil, or food that do not exceed a critical value that is usually based on levels that affect animals; they are then adjusted to levels that will help protect humans. Sometimes these not-to-exceed levels differ among federal organizations because they used different exposure times (an 8-hour workday or a 24-hour day), different animal studies, or other factors.

Recommendations and regulations are also updated periodically as more information becomes available. For the most current information, check with the federal agency or organization that provides it. Some regulations and recommendations for lead include the following:

CDC recommends that states develop a plan to find children who may be exposed to lead and have their blood tested for lead. CDC recommends that the states test children:

- at ages 1 and 2 years;
- at ages 3–6 years if they have never been tested for lead;
- if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children;
- if they live in a building or frequently visit a house built before 1950;
- if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or
- if they have a brother, sister, or playmate who has had lead poisoning.

CDC considers children to have an elevated level of lead if the amount of lead in the blood is at least 10 μg/dL. Many states or local programs provide intervention to individual children with blood lead levels equal to or greater than 10 μg/dL. Medical evaluation and environmental investigation and remediation should be done for all children with blood lead levels equal to or greater than 20 μg/dL. Medical treatment (i.e., chelation therapy) may be necessary in children if the lead concentration in blood is higher than 45 μg/dL.

EPA requires that the concentration of lead in air that the public breathes be no higher than 1.5 micrograms per cubic meter ($\mu g/m^3$) averaged over 3 months. EPA regulations no longer allow lead in gasoline. The Clean Air Act Amendments (CAAA) of 1990 banned the sale of leaded gasoline as of December 31, 1995.

EPA regulations also limit lead in drinking water to 0.015 milligrams per liter (mg/L), although the goal is that drinking water be free of lead. The 1988 Lead Contamination Control Act requires the Consumer Product Safety Commission (CPSC), EPA, and the states to recall or repair water coolers containing lead. This law also requires new coolers to be lead-free. In addition, drinking water in schools must be tested for lead, and the sources of lead in this water must be removed.

To help protect small children, CPSC requires that the concentration of lead in most paints available through normal consumer channels be not more than 0.06%. The Federal Hazardous Substance Act (FHSA) bans children's products containing hazardous amounts of lead.

The Department of Housing and Urban Development (HUD) develops recommendations and regulations to prevent exposure to lead. HUD requires that federally funded housing and renovations, Public and Indian housing be tested for lead-based paint hazards and that such hazards be fixed by covering the paint or removing it. When determining whether lead-based paint applied to interior or exterior painted surfaces of dwellings

should be removed, the standard used by EPA and HUD is that paint with a lead concentration equal to or greater than 1.0 milligram per square centimeter ($mg/cm^2$) of surface area should be removed or otherwise treated. HUD is carrying out demonstration projects to determine the best ways of covering or removing lead-based paint in housing.

EPA has developed standards for lead-paint hazards, lead in dust, and lead in soil. To educate parents, homeowners, and tenants about lead hazards, lead poisoning prevention in the home, and the lead abatement process, EPA has published several general information pamphlets. Copies of these pamphlets can be obtained from the National Lead Information Center or from various Internet sites, including http://www.epa.gov/opptintr/lead.

OSHA regulations limit the concentration of lead in workroom air to 50 $\mu g/m^3$ for an 8-hour workday. If a worker has a blood lead level of 50 µg/dL or higher, then OSHA requires that the worker be removed from the workroom where lead exposure is occurring.

FDA includes lead on its list of poisonous and deleterious substances. FDA considers foods packaged in cans containing lead solders to be unsafe. Tin-coated lead foil has been used as a covering applied over the cork and neck areas of wine bottles for decorative purposes and to prevent insect infestations. Because it can be reasonably expected that lead could become a component of the wine, the use of such foil is also a violation of the Federal Food, Drug, and Cosmetic Act. FDA has reviewed several direct human food ingredients (i.e., food dyes) and has determined them to be "generally recognized as safe" when used in accordance with current good manufacturing practices. Some of these ingredients contain allowable lead concentrations that range from 0.1 to 10 ppm.

## 1.10 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns, please contact your community or state health or environmental quality department, your regional Nuclear Regulatory Commission office, or contact ATSDR at the address and phone number below.

ATSDR can also tell you the location of occupational and environmental health clinics. These clinics specialize in recognizing, evaluating, and treating illnesses resulting from exposure to hazardous substances.

Toxicological profiles are also available on-line at www.atsdr.cdc.gov and on CD-ROM. You may request a copy of the ATSDR ToxProfiles CD-ROM by calling the information and technical assistance toll-free number at 1-888-42ATSDR (1-888-422-8737), by email at atsdric@cdc.gov, or by writing to:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE
Mailstop F-32
Atlanta, GA 30333
Fax: 1-770-488-4178

For-profit organizations may request a copy of final profiles from the following:

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Phone: 1-800-553-6847 or 1-703-605-6000

Web site: http://www.ntis.gov/

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

# MANGANESE
## CAS # 127-18-4

Division of Toxicology ToxFAQs™ February 2001

**This fact sheet answers the most frequently asked health questions (FAQs) about manganese. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**HIGHLIGHTS: Manganese is a trace element and eating a small amount from food or water is needed to stay healthy. Exposure to excess levels of manganese may occur from breathing air, particularly where manganese is used in manufacturing, and from drinking water and eating food. At high levels, it can cause damage to the brain, liver, kidneys, and the developing fetus. This chemical has been found in at least 603 of 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).**

### What is manganese?
(Pronounced măng′ gə-nēz′)

Manganese is a naturally occurring metal that is found in many types of rocks. Pure manganese is silver-colored, but does not occur naturally. It combines with other substances such as oxygen, sulfur, or chlorine. Manganese can also be combined with carbon to make organic manganese compounds. Common organic manganese compounds include pesticides, such as maneb or mancozeb, and methylcyclopentadienyl manganese tricarbonyl (MMT), a fuel additive in some gasolines. Manganese is an essential trace element and is necessary for good health. Manganese can be found in several food items, including grains and cereals, and is found in high amounts in other foods, such as tea.

### What happens to manganese when it enters the environment?

❑ Manganese can enter the air from iron, steel, and power plants, coke ovens, and from dust from mining operations.
❑ It can enter the water and soil from natural deposits, disposal of wastes or deposits from airborne sources.
❑ Manganese exists naturally in rivers, lakes, and under-ground water.
❑ Plants in the water can take up some of the manganese from water and concentrate it.

### How might I be exposed to manganese?

❑ Everyone is exposed to small amounts of manganese in air, water, and food.
❑ Individuals who work in occupations that mine or use manganese are likely to be exposed to excess levels in their work environment.
❑ People who improperly use pesticides such as maneb and mancozeb, may be exposed to excess levels.

### How can manganese affect my health?

Some individuals exposed to very high levels of manganese for long periods of time in their work developed mental and emotional disturbances and slow and clumsy body movements.
This combination of symptoms is a disease called "manganism." Workers usually do not develop symptoms of manganism unless they have been exposed to manganese for many months or years. Manganism occurs because too much manganese injures a part of the brain that helps control body movements.

Exposure to high levels of airborne manganese, such as in a manganese foundry or battery plant, can affect motor skills such as holding one's hand steady, performing fast hand movements, and maintaining balance. Exposure to high levels of the metal may also cause respiratory problems and sexual dysfunction.

## How likely is manganese to cause cancer?

There are no human cancer data available for manganese. Exposure to high levels of manganese in food resulted in a slightly increased incidence of pancreatic tumors in male rats and thyroid tumors in male and female mice.

The EPA has determined that manganese is not classifiable as to human carcinogenicity.

## How can manganese affect children?

Daily intake of small amounts of manganese is needed for growth and good health in children. Manganese is constantly present in the mother and is available to the developing fetus during pregnancy. Manganese is also transferred from a nursing mother to her infant in breast milk at levels that are appropriate for proper development.

Children, as well as adults, who lose the ability to remove excess manganese from their bodies develop nervous system problems. Because at certain ages children take in more than adults, there is concern that children may be more susceptible to the toxic effects of excess manganese.

Animal studies indicate that exposure to high levels of manganese can cause birth defects in the unborn. There is no information on whether mothers exposed to excess levels of manganese can transfer the excess to their developing fetus during pregnancy or to their nursing infant in breast milk.

## How can families reduce the risk of exposure to manganese?

In most situations, there is no need to reduce one's exposure to manganese because it is an essential nutrient for good health.

Excess levels of manganese may be present in soils, especially at or near hazardous waste sites. Therefore, it is important to discourage hand-to-mouth activity in young children, especially near hazardous waste sites or in areas that may have increased manganese levels in the soil.

Manganese is also present in pesticides that may be used around the home. These pesticides should be used in a manner consistent with manufacturer's instructions.

## Is there a medical test to show whether I've been exposed to manganese?

Tests are available that show levels of manganese in different body fluids. Measurements of manganese in blood, urine, feces, and scalp hair can be used to determine exposure to excess levels of manganese by testing whether levels of the metal in your body tissues are greater than normal. However, these tests cannot predict how the levels in your tissues will affect your health. Your doctor can take samples and send them to a testing laboratory.

## Has the federal government made recommendations to protect human health?

The EPA has set a non-enforceable guideline for the level of manganese in drinking water at 0.05 milligrams per liter (0.05 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 5 milligrams manganese per cubic meter (5 mg/m 3 ) of workplace air for the average amount of manganese during an 8-hour workday, 40-hour workweek.

The National Research Council has recommended safe and adequate daily intake levels for manganese that range from 0.3 to 1 mg/day for children up to 1 year, 1 to 2 mg/day for children up to age 10, and 2 to 5 mg/day for children 10 and older.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for manganese. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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# MERCURY
## CAS # 7439-97-6

Agency for Toxic Substances and Disease Registry ToxFAQs April 1999

**This fact sheet answers the most frequently asked health questions (FAQs) about mercury. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**HIGHLIGHTS: Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List sites identified by the Environmental Protection Agency.**

### What is mercury?
(Pronounced mŭr′kyə-rē)

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

### What happens to mercury when it enters the environment?

- ❑ Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.
- ❑ It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.
- ❑ Methylmercury may be formed in water and soil by small organisms called bacteria.
- ❑ Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

### How might I be exposed to mercury?

- ❑ Eating fish or shellfish contaminated with methylmercury.
- ❑ Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels.
- ❑ Release of mercury from dental work and medical treatments.
- ❑ Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- ❑ Practicing rituals that include mercury.

### How can mercury affect my health?

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea,

vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

## How likely is mercury to cause cancer?

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

## How can mercury affect children?

Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also can pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

## How can families reduce the risk of exposure to mercury?

Carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, because it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Teach children not to play with shiny, silver liquids.

Properly dispose of older medicines that contain mercury. Keep all mercury-containing medicines away from children.

Pregnant women and children should keep away from rooms where liquid mercury has been used.

Learn about wildlife and fish advisories in your area from your public health or natural resources department.

## Is there a medical test to show whether I've been exposed to mercury?

Tests are available to measure mercury levels in the body. Blood or urine samples are used to test for exposure to metallic mercury and to inorganic forms of mercury. Mercury in whole blood or in scalp hair is measured to determine exposure to methylmercury. Your doctor can take samples and send them to a testing laboratory.

## Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb).

The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 $mg/m^3$) and 0.05 $mg/m^3$ of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for mercury. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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# NICKEL

## CAS # 7440-02-0

Division of Toxicology ToxFAQs™ September 2003

**This fact sheet answers the most frequently asked health questions (FAQs) about nickel. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**HIGHLIGHTS: Nickel is a naturally occurring element. Pure nickel is a hard, silvery-white metal used to make stainless steel and other metal alloys. Skin effects are the most common effects in people who are sensitive to nickel. Workers who breathed very large amounts of nickel compounds developed chronic bronchitis and lung and nasal sinus cancers. Ingesting large amounts of nickel affected the reproduction and development in rats and mice. Nickel has been found in at least 862 of the 1,636 National Priority List sites identified by the Environmental Protection Agency (EPA).**

### What is nickel?

Nickel is a very abundant natural element. Pure nickel is a hard, silvery-white metal. Nickel can be combined with other metals, such as iron, copper, chromium, and zinc, to form alloys. These alloys are used to make coins, jewelry, and items such as valves and heat exchangers. Most nickel is used to make stainless steel.

Nickel can combine with other elements such as chlorine, sulfur, and oxygen to form nickel compounds. Many nickel compounds dissolve fairly easy in water and have a green color. Nickel compounds are used for nickel plating, to color ceramics, to make some batteries, and as substances known as catalysts that increase the rate of chemical reactions. Nickel is found in all soil and is emitted from volcanoes. Nickel is also found in meteorites and on the ocean floor. Nickel and its compounds have no characteristic odor or taste.

### What happens to nickel when it enters the environment?

- Nickel is released into the atmosphere by industries that make or use nickel, nickel alloys, or nickel compounds. It is also released into the atmosphere by oil-burning power plants, coal-burning power plants, and trash incinerators.
- In the air, it attaches to small particles of dust that settle to the ground or are taken out of the air in rain or snow; this usually takes many days.
- Nickel released in industrial waste water ends up in soil or sediment where it strongly attaches to particles containing iron or manganese.
- Nickel does not appear to accumulate in fish or in other animals used as food.

### How might I be exposed to nickel?

- By eating food containing nickel, which is the major source of exposure for most people.
- By skin contact with soil, bath or shower water, or metals containing nickel, as well as by handling coins or touching jewelry containing nickel.
- By drinking water that contains small amounts of nickel.
- By breathing air or smoking tobacco containing nickel.
- Higher exposure may occur if you work in industries that process or use nickel.

### How can nickel affect my health?

The most common harmful health effect of nickel in humans is an allergic reaction. Approximately 10-15% of the population is sensitive to nickel. People can become sensitive to nickel when jewelry or other things containing it are in direct contact with the skin. Once a person is sensitized to nickel, further contact with the metal will produce a reaction. The most common reaction is a skin rash at the site of contact. The skin rash may also occur at

a site away from the site of contact. Less frequently, some people who are sensitive to nickel have asthma attacks following exposure to nickel. Some sensitized people react when they eat nickel in food or water or breathe dust containing it.

People working in nickel refineries or nickel-processing plants have experienced chronic bronchitis and reduced lung function. These persons breathed amounts of nickel much higher than levels found in the environment. Workers who drank water containing high amounts of nickel had stomach aches and suffered adverse effects to their blood and kidneys.

Damage to the lung and nasal cavity has been observed in rats and mice breathing nickel compounds. Eating or drinking large amounts of nickel has caused lung disease in dogs and rats and has affected the stomach, blood, liver, kidneys, and immune system in rats and mice, as well as their reproduction and development.

## How likely is nickel to cause cancer?

Cancers of the lung and nasal sinus have resulted when workers breathed dust containing high levels of nickel compounds while working in nickel refineries or nickel processing plants. The Department of Health and Human Services (DHHS) has determined that nickel metal may reasonably be anticipated to be a carcinogen and that nickel compounds are known human carcinogens. The International Agency for Research on Cancer (IARC) has determined that some nickel compounds are carcinogenic to humans and that metallic nickel may possibly be carcinogenic to humans. The EPA has determined that nickel refinery dust and nickel subsulfide are human carcinogens.

## How can nickel affect children?

It is likely that the health effects seen in children exposed to nickel will be similar to those seen in adults. We do not know whether children differ from adults in their susceptibility to nickel. Human studies that examined whether nickel can harm the fetus are inconclusive. Animal studies have found increases in newborn deaths and decreased newborn weight after ingesting very high amounts of nickel. Nickel can be transferred from the mother to an infant in breast milk and can cross the placenta.

## How can families reduce the risks of exposure to nickel?

- Avoiding jewelry containing nickel will eliminate risks of exposure to this source of the metal.
- Exposures of the general population from other sources, such as foods and drinking water, are almost always too low to be of concern.

## Is there a medical test to determine whether I've been exposed to nickel?

There are tests available to measure nickel in your blood, feces, and urine. More nickel was measured in the urine of workers who were exposed to nickel compounds that dissolve easily in water than in the urine of workers exposed to nickel compounds that are hard to dissolve. This means that it is easier to tell if you have been exposed to soluble nickel compounds than less-soluble compounds. The nickel measurements do not accurately predict potential health effects from exposure to nickel.

## Has the federal government made recommendations to protect human health?

The EPA recommends that drinking water should contain no more than 0.7 milligrams of nickel per liter of water (0.7 mg/L). To protect workers, the Occupational Safety and Health Administration (OSHA) has set a limit of 1 mg of nickel per cubic meter of air (1 $mg/m^3$) for metallic nickel and nickel compounds in workplace air during an 8-hour workday, 40-hour workweek

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 2003. Toxicological Profile for Nickel (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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# SILVER
## CAS # 7440-22-4

Agency for Toxic Substances and Disease Registry ToxFAQs July 1999

**This fact sheet answers the most frequently asked health questions (FAQs) about silver. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**HIGHLIGHTS: Silver is an element found naturally in the environment. At very high levels, it may cause argyria, a blue-gray discoloration of the skin and other organs. This chemical has been found in at least 27 of the 1,177 National Priorities List sites identified by the Environmental Protection Agency (EPA).**

### What is silver?
(Pronounced sĭl′vər)

Silver is a naturally occurring element. It is found in the environment combined with other elements such as sulfide, chloride, and nitrate. Pure silver is "silver" colored, but silver nitrate and silver chloride are powdery white and silver sulfide and silver oxide are dark-gray to black. Silver is often found as a by-product during the retrieval of copper, lead, zinc, and gold ores.

Silver is used to make jewelry, silverware, electronic equipment, and dental fillings. It is also used to make photographs, in brazing alloys and solders, to disinfect drinking water and water in swimming pools, and as an antibacterial agent. Silver has also been used in lozenges and chewing gum to help people stop smoking.

### What happens to silver when is enters the environment?

- ❑ Silver may be released into the air and water through natural processes such as the weathering of rocks.
- ❑ Human activities such as the processing of ores, cement manufacture, and the burning of fossil fuel may release silver into the air.
- ❑ It may be released into water from photographic processing.
- ❑ Rain may wash silver out of soil into the groundwater.
- ❑ Silver does not appear to concentrate to a significant extent in aquatic animals.

### How might I be exposed to silver?

- ❑ Breathing low levels in air.
- ❑ Swallowing it in food or drinking water.
- ❑ Carrying out activities such as jewelry-making, soldering, and photography.
- ❑ Using anti-smoking lozenges or other medicines containing it.

### How can silver affect my health?

Exposure to high levels of silver for a long period of time may result in a condition called arygria, a blue-gray discoloration of the skin and other body tissues. Lower-level exposures to silver may also cause silver to be deposited in the skin and other parts of the body; however, this is not known to be harmful. Argyria is a permanent effect, but it appears to be a cosmetic problem that may not be otherwise harmful to health.

Exposure to high levels of silver in the air has resulted in breathing problems, lung and throat irritation, and stomach pains. Skin contact with silver can cause mild allergic reactions such as rash, swelling, and inflammation in some people.

Animal studies have shown that swallowing silver results in the deposit of silver in the skin. One study in mice found that the animals exposed to silver in drinking water were less active than unexposed animals.

No studies are available on whether silver affects reproduction or causes developmental problems in people.

## How likely is silver to cause cancer?

No studies are available on whether silver may cause cancer in people. The only available animal studies showed both positive and negative results when silver was implanted under the skin.

The EPA has determined that silver is not classifiable as to human carcinogenicity.

## Is there a medical test to show whether I've been exposed to silver?

Silver can be measured in the blood, urine, feces, and body tissues of exposed people. Silver builds up in the body, and the best way to learn if past exposure has occurred is to look for silver in samples of skin. Tests for silver are not commonly done at a doctor's office because they require special equipment. Although doctors can find out if a person has been exposed to silver by doing these tests, they cannot tell whether any health effects will occur.

## Has the federal government made recommendations to protect human health?

The EPA recommends that the concentration of silver in drinking water not exceed 0.10 milligrams per liter of water (0.10 mg/L) because of the skin discoloration that may occur.

The EPA requires that spills or accidental releases of 1,000 pounds or more of silver be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) limits silver in workplace air to 0.01 milligrams per cubic meter (0.01 $mg/m^3$) for an 8-hour workday, 40-hour workweek. The National Institute of Occupational Safety and Health (NIOSH) also recommends that workplace air contain no more that 0.01 $mg/m^3$ silver.

The American Conference of Governmental Industrial Hygienists (ACGIH) recommends that workplace air contain no more than 0.1 $mg/m^3$ silver metal and 0.01 $mg/m^3$ soluble silver compounds.

The federal recommendations have been updated as of July 1999.

## Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemcial Abstracts Service.

Milligram (mg): One thousandth of a gram.

National Priorities List: A list of the nation's worst hazardous waste sites.

Soluble: Capable of being dissolved in water.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 1990. Toxicological profile for silver. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

# VANADIUM
## CAS # 7440-62-2

Agency for Toxic Substances and Disease Registry ToxFAQs September 1995

**This fact sheet answers the most frequently asked health questions (FAQs) about vanadium. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**SUMMARY: Everyone is exposed to low levels of vanadium in air, water, and food; however, most people are exposed mainly from food. Breathing high levels of vanadium may cause lung irritation, chest pain, coughing, and other effects. This chemical has been found in at least 385 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.**

### What is vanadium?
(Pronounced və-nā′dē-əm)

Vanadium is a compound that occurs in nature as a white-to-gray metal, and is often found as crystals. Pure vanadium has no smell. It usually combines with other elements such as oxygen, sodium, sulfur, or chloride. Vanadium and vanadium compounds can be found in the earth's crust and in rocks, some iron ores, and crude petroleum deposits.

Vanadium is mostly combined with other metals to make special metal mixtures called alloys. Vanadium in the form of vanadium oxide is a component in special kinds of steel that is used for automobile parts, springs, and ball bearings. Most of the vanadium used in the United States is used to make steel. Vanadium oxide is a yellow-orange powder, dark-gray flakes, or yellow crystals. Vanadium is also mixed with iron to make important parts for aircraft engines.

Small amounts of vanadium are used in making rubber, plastics, ceramics, and other chemicals.

### What happens to vanadium when it enters the environment?

- Vanadium mainly enters the environment from natural sources and from the burning of fuel oils.
- It stays in the air, water, and soil for a long time.
- It does not dissolve well in water.
- It combines with other elements and particles.
- It sticks to soil sediments.
- Low levels have been found in plants, but it is not likely to build up in the tissues of animals.

### How might I be exposed to vanadium?

- Exposure to very low levels in air, water, and food.
- Eating higher levels of it in certain foods.
- Breathing air near an industry that burns fuel oil or coal; these industries release vanadium oxide into the air.
- Working in industries that process it or make products containing it.
- Breathing contaminated air or drinking contaminated water near waste sites or landfills containing vanadium.
- Vanadium is not readily absorbed by the body from the stomach, gut, or contact with the skin.

### How can vanadium affect my health?

Exposure to high levels of vanadium can cause harmful health effects. The major effects from breathing high levels of vanadium are on the lungs, throat, and eyes. Workers who breathed it for short and long periods sometimes had lung irritation, coughing, wheezing, chest pain, runny nose, and a

sore throat. These effects stopped soon after they stopped breathing the contaminated air. Similar effects have been observed in animal studies. No other significant health effects of vanadium have been found in people.

We do not know the health effects in people of ingesting vanadium. Animals that ingested very large doses have died. Lower, but still high levels of vanadium in the water of pregnant animals resulted in minor birth defects. Some animals that breathed or ingested vanadium over a long term had minor kidney and liver changes.

The amounts of vanadium given in these animal studies that resulted in harmful effects are much higher than those likely to occur in the environment.

## How likely is vanadium to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified vanadium as to its human carcinogenicity.

No human studies are available on the carcinogenicity of vanadium. No increase in tumors was noted in a long-term animal study where the animals were exposed to vanadium in the drinking water.

## Is there a medical test to show whether I've been exposed to vanadium?

There are medical tests available to measure levels of vanadium in urine and blood. These tests are not routinely performed at doctors' offices because they require special equipment, but your doctor can take samples and send them to a testing laboratory. These tests can't determine if harmful health effects will occur from the exposure to vanadium.

Another indicator of high vanadium exposure in people is that their tongues may have a green color on top.

## Has the federal government made recommendations to protect human health?

The EPA requires discharges or spills of 1,000 pounds or more of vanadium into the environment to be reported.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 0.05 milligrams per cubic meter (0.05 $mg/m^3$) for vanadium pentoxide dust and 0.1 $mg/m^3$ for vanadium pentoxide fumes in workplace air for an 8-hour workday, 40-hour workweek.

The American Conference of Governmental Industrial Hygienists (ACGIH) has recommended an occupational exposure limit of 0.05 $mg/m^3$ for vanadium pentoxide.

The National Institute for Occupational Safety and Health (NIOSH) has recommended that 35 $mg/m^3$ of vanadium be considered immediately dangerous to life and health. This is the exposure level of a chemical that is likely to cause permanent health problems or death.

## Glossary

Carcinogenicity: Ability to cause cancer.

Ingesting: Taking food or drink into your body.

Long-term: Lasting one year or longer.

Milligram (mg): One thousandth of a gram.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological profile for vanadium. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

**Where can I get more information?** For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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# ZINC
## CAS # 7440-66-6

Agency for Toxic Substances and Disease Registry ToxFAQs September 1995

**This fact sheet answers the most frequently asked health questions (FAQs) about zinc. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.**

**SUMMARY: Exposure to high levels of zinc occurs mostly from eating food, drinking water, or breathing workplace air that is contaminated. Exposure to large amounts of zinc can be harmful. However, zinc is an essential element for our bodies, so too little zinc can also be harmful. This chemical has been found in at least 801 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.**

### What is zinc?
(Pronounced zĭngk)

Zinc is one of the most common elements in the earth's crust. It's found in air, soil, and water, and is present in all foods. Pure zinc is a bluish-white shiny metal.

Zinc has many commercial uses as coatings to prevent rust, in dry cell batteries, and mixed with other metals to make alloys like brass and bronze. A zinc and copper alloy is used to make pennies in the United States.

Zinc combines with other elements to form zinc compounds. Common zinc compounds found at hazardous waste sites include zinc chloride, zinc oxide, zinc sulfate, and zinc sulfide. Zinc compounds are widely used in industry to make paint, rubber, dye, wood preservatives, and ointments.

### What happens to zinc when it enters the environment?

- Some is released into the environment by natural processes, but most comes from activities of people like mining, steel production, coal burning, and burning of waste.
- It attaches to soil, sediments, and dust particles in the air.
- Rain and snow remove zinc dust particles from the air.
- Zinc compounds can move into the groundwater and into lakes, streams, and rivers.
- Most of the zinc in soil stays bound to soil particles.
- It builds up in fish and other organisms, but it doesn't build up in plants.

### How might I be exposed to zinc?

- Ingesting small amounts present in your food and water.
- Drinking contaminated water near manufacturing or waste sites.
- Drinking contaminated water or a beverage that has been stored in metal containers or flows through pipes that have been coated with zinc to resist rust.
- Eating too many dietary supplements that contain zinc.
- Breathing zinc particles in the air at manufacturing sites.

### How can zinc affect my health?

Zinc is an essential element in our diet. **Too** little zinc can cause health problems, but too much zinc is also harmful.

The recommended dietary allowance (RDA) for zinc is 15 milligrams a day for men (15 mg/day); 12 mg/day for women; 10 mg/day for children; and 5 mg/day for infants. Not enough zinc in your diet can result in a loss of appetite, a decreased sense of taste and smell, slow wound healing and

skin sores, or a damaged immune system. Young men who don't get enough zinc may have poorly developed sex organs and slow growth. If a pregnant woman doesn't get enough zinc, her babies may have growth retardation.

Too much zinc, however, can also be damaging to your health. Harmful health effects generally begin at levels from 10-15 times the RDA (in the 100 to 250 mg/day range). Eating large amounts of zinc, even for a short time, can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia, pancreas damage, and lower levels of high density lipoprotein cholesterol (the good form of cholesterol).

Breathing large amounts of zinc (as dust or fumes) can cause a specific short-term disease called metal fume fever. This is believed to be an immune response affecting the lungs and body temperature. We do not know the long-term effects of breathing high levels of zinc.

It is not known if high levels of zinc affect human reproduction or cause birth defects. Rats that were fed large amounts of zinc became infertile or had smaller babies. Irritation was also observed on the skin of rabbits, guinea pigs, and mice when exposed to some zinc compounds. Skin irritation will probably occur in people.

## How likely is zinc to cause cancer?

The Department of Health and Human Services, the International Agency for Research on Cancer, and the Environmental Protection Agency (EPA) have not classified zinc for carcinogenicity.

## Is there a medical test to show whether I've been exposed to zinc?

Zinc can be measured in your blood or feces. This can tell you how much zinc you have been exposed to. Zinc can also be measured in urine, saliva, and hair. The amount of zinc in your hair tells us something about long-term exposure, but the relationship between levels in your hair and the amount that you were exposed to is not clear. These tests are not routinely performed at doctors' offices, but your doctor can take samples and send them to a testing laboratory.

## Has the federal government made recommendations to protect human health?

EPA recommends that there be no more than 5 parts of zinc in 1 million parts of drinking water (5 ppm) because of taste. EPA also requires that releases of more than 1,000 (or in some cases 5,000) pounds of zinc or its compounds into the environment be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum concentration limit for zinc chloride fumes in workplace air of 1 milligram of zinc per cubic meter of air (1 $mg/m^3$) for an 8-hour workday over a 40-hour work week and 5 $mg/m^3$ for zinc oxide fumes. The National Institute for Occupational Safety and Health (NIOSH) has set the same standards for up to a 10-hour workday over a 40-hour workweek.

## Glossary

Anemia: A decreased ability of the blood to transport oxygen.

Carcinogenicity: Ability to cause cancer.

Milligram (mg): One thousandth of a gram.

## References

Agency for Toxic Substances and Disease Registry (ATSDR). 1994. Toxicological profile for zinc. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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