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Kansas Department of Health and Environment

Integrated Assessment

Cherokee Zinc Company Site (Weir Smelter), Weir, Kansas

Bureau of Environmental Remediation

Integrated Assessment

Cherokee Zinc Company Site

(Weir Smelter)

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

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1.0 Introduction

This document presents the findings of an Integrated Assessment (IA) conducted by the Kansas Department of Health and Environment (KDHE) at the Cherokee Zinc Company site in Weir, Kansas. The assessment was conducted as part of continuing cooperative agreement with the United States 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 CRF § 300.400-300.425. This IA was initiated by the KDHE Bureau of Environmental Remediation to assess potential releases of heavy metals from a primary zinc smelter to soil, sediment, and groundwater consistent with the NCP. The investigation included review of historical information, collection of samples, and evaluation of the site using the Hazard Ranking System (HRS) guidance, and compilation of a comprehensive target survey. This site does not yet have an EPA identification number. The Cherokee Zinc Company site also has an alias site name of Weir Smelter on KDHE's Identified Sites List.

2.0 Site Information

2.1 Site Location and Description

The Cherokee Zinc Company site is located at 413 North Washington Street, Weir, Cherokee County, Kansas, 66781. The geographic coordinates of the site are 37.313778º North latitude and -94.772389º West longitude. The site includes the City of Weir public works shop and surrounding residential properties. The smelter is located in Section 27, Township 31 South, Range 24 East. The site is the former location of a primary zinc smelter. While the city shop building is commercial the surrounding properties are generally residential (References 1-5).

2.2 Site Background

The Chicago Zinc Works began smelting zinc in Weir in 1872. Chicago Zinc located the smelter in Weir due to nearby commercial coal deposits to fuel the smelter, and the proximity to the Tri-State lead and zinc mining district. Chicago Zinc abandoned the smelter and in 1896 the Cherokee Lanyon Smelter Company purchased the smelter and owned it until 1906. Other operators of the smelter included the Weir City Zinc Works, the Cherokee Zinc Company Smelter, and the Cherokee Lanyon Spelter Company. Several owners held the property until the Weir Smelting Company purchased the smelter in 1917 and sold it in 1920. It is unknown if the Weir Smelting Company actively ran the smelter, as from other historical information it appears smelting operations closed in approximately 1909 when natural gas wells in other areas of Kansas made smelter operations from coal unprofitable.

The smelter property was eventually sold in a sheriff's sale in 1948. The current owners are the City of Weir and Mary O'Malley (References 1-5). A more detailed operational history is included in Appendices 10.2- 10.5.

2.3 Previous Investigations

In March 2004 a KDHE contractor, Burns & McDonnell Engineering Company, Inc., completed a Focused Former Smelter Assessment (FFSA) under KDHE's State Water Plan program (SWP). The FFSA did not include any on-site sampling, but recommended sampling due to the historical documentation indicating smelter operations at the site, and visual observations of smelter waste during the site visit. A Phase II FFSA was recommended (Reference 1).

In November 2004 the Phase II FFSA was completed by the same KDHE contractor. During the Phase II FFSA 34 unbiased and 8 biased soil samples were collected. In addition to the on-site soil samples, six smelter waste samples, one surface water sample, two sediment samples, and eight off-site soil samples were collected. Three direct-push borings were also advanced to bedrock. Two of these yielded groundwater and were sampled. The maximum lead detection was 12,100 milligrams per kilogram (mg/kg) detected by X-ray fluorescence (XRF) in HS-8. Laboratory analyses confirmed that arsenic, cadmium, and lead were elevated above KDHE residential Tier 2 Risk-based Standards for Kansas (RSKs). The elevated arsenic and cadmium appeared to be collocated with elevated lead detections. Two of the off-site samples (PS-1 and PS-6) indicated lead above residential RSKs. Cadmium and zinc were detected above Maximum Contaminant Levels (MCLs) in both groundwater samples, and lead was detected in one sample above its MCL. Sediment samples indicated lead, arsenic, cadmium and zinc above Threshold Effect Concentrations (TECs), and zinc was detected in surface water above its Federal Aquatic Life Criteria concentration (ALC) (Reference 2).

In December 2008 another KDHE contractor, Golder Associates, Inc., completed a Site Investigation under KDHE's SWP. An additional 55 soil samples were collected and field analyzed by XRF. Six off-site samples were collected. A test trench was excavated in the former smelter works to determine the horizontal and vertical extent of waste. A total of 10 sediment and 5 surface water samples were collected from the intermittent branch of Brush Creek that flows through the site area. The maximum lead, arsenic, cadmium, and zinc concentrations in soil were 10,615 mg/kg, 143 mg/kg, 147 mg/kg, and 18,172 mg/kg, respectively. The highest concentrations were observed in the eastern portion of the site near the former railroad right-of-way. The initial waste estimation from the sampling and exploratory trench was approximately 19,000 cubic yards. Sediment and surface water were also determined to be impacted, and several samples collected in the predominant downwind directions based on historical wind roses also indicated lead and arsenic above residential RSKs, demonstrating a likely wind deposition of contamination from the smelter works. Sediment and surface water results again indicated arsenic, cadmium, lead, and zinc above TECs and zinc above its ALC (Reference 3).

In December 2011 KDHE's SWP completed a Supplemental Site Investigation (SSI). The primary purpose of the SSI was to evaluate five off-site residential properties, and to collect sediment and background soil samples. The residential yard sampling was conducted consistent with EPA's *Superfund Lead-Contaminated Residential Sites Handbook*, with each yard being subdivided into quadrants for composite sampling. The Zortz and Jones yards were determined to be impacted by lead contamination above the residential RSK. The SSI recommended additional residential yard sampling to further determine the area of contamination (Reference 4).

2.4 Hazardous Substance Characteristics

Lead, arsenic, chromium, cadmium, and zinc have been historically detected above background and/or residential RSKs (References 1-5). Hazardous substance information from the Agency for Toxic Substances and Disease Registry is included in Appendix 10.7.

3.0 Assessment Activities

3.1 Surface Soil Sample Collection

In June 2013 Burns & McDonnell Engineering Company, Inc., completed a Residential Yard Sampling Report for KDHE's SWP. The residential yard sampling was conducted in compliance with EPA's *Superfund Lead-Contaminated Residential Sites Handbook* by each yard being subdivided into quadrants for composite sampling. A total of 22 residential properties were sampled, with each residential yard being subdivided into a minimum of four quadrants. A total of 48 unbiased, 24 biased, and 98 residential quadrant samples were analyzed by XRF. Of these, 10 unbiased, 6 biased, and 36 residential quadrant samples were submitted for laboratory analysis in addition to three duplicate samples. Samples were collected into closeable plastic bags and analyzed a minimum of three times per bag by XRF (Reference 5).

3.2 Analytical Results

The Burns &McDonnell report concluded that 12 residential yards were identified with one or more quadrants impacted by lead, arsenic, or both above residential RSKs. Two additional yards were identified as unknown due to XRF malfunction during the analyses. The contamination around the former smelter works was further defined from the biased and unbiased grid sampling. The sampling was conducted in January and February, 2013. A total of 170 samples were collected for XRF analysis, and of these 52 samples and 3 field duplicates were submitted to Pace Analytical Services in Lenexa, Kansas, for metals analysis by EPA Method 6010 and EPA Method 7471 (mercury).

Impacted yards with quadrants exceeding residential RSKs are as follows, including the current owner name and referencing the maximum detection for the specific contaminant by either XRF or laboratory analysis. A total of 22 yards were identified during the IA data review with one or more quadrants above residential RSKs (Reference 5).

201 N. Cleveland St. (M. Cashion): Quadrant 2 with cadmium at 40 mg/kg; Quadrant 4 with cadmium at 40 mg/kg.
105 E. Forest St. (Warnick): Quadrant 2 with lead at 477 mg/kg; Quadrant 4 with cadmium at 40 mg/kg.
107 E. Forest St. (City of Weir): Quadrant 2 with lead at 988 mg/kg; Quadrant 2 with arsenic at 19.1 mg/kg.
205 E. Forest St. (Reagan): Quadrant 3 with lead at 619 mg/kg; Quadrant 1 with lead at 571 mg/kg; Quadrant 3 with cadmium at 57 mg/kg.
101 W. Forest St. (Thompson): Quadrant 2 with lead at 795 mg/kg.
105 W. Forest St. (Barnasconi): Quadrant 2 with lead at 938 mg/kg; Quadrant 2 with arsenic at 45 mg/kg.
207 W. Forest St. (Donaldson): Quadrant 1 with lead at 464 mg/kg; Quadrant 2 with lead at 458 mg/kg; Quadrant 4 with arsenic at 26 mg/kg.
303 W. Forest St. (Hamblin): Quadrant 4 with lead at 890 mg/kg.
307 W. Forest St. (Parrot): Quadrant 3 with lead at 432 mg/kg; Quadrant 4 with lead at 763 mg/kg; Quadrant 4 with cadmium at 46 mg/kg.
309 W. Forest St. (Berning): Quadrant 1 with lead at 575 mg/kg; Quadrant 3 with cadmium at 41 mg/kg.
403 W. Forest St. (Dutton): Quadrant 4 with lead at 606 mg/kg; Quadrant 4 with arsenic at 20.4 mg/kg.
201 N. Jefferson St. (Thompson): Quadrant 3 with lead at 533 mg/kg; Quadrant 4 with lead at 424 mg/kg.
202 N. McKinley St. (Woodrum): Quadrant 2 with lead at 400 mg/kg; Quadrant 2 with arsenic at 31 mg/kg; Quadrant 1 with cadmium at 42 mg/kg.
206 N. McKinley St. (Woodrum): Quadrant 2 with cadmium at 44 mg/kg; Quadrant 4 with cadmium at 44 mg/kg.
211 N. McKinley St. (T. Cashion): Quadrant 3 with lead at 533 mg/kg; Quadrant 4 with arsenic at 31 mg/kg.
304 N. McKinley St. (Jones): Quadrant 3 with arsenic at 40 mg/kg; Quadrant 1 with cadmium at 41 mg/kg.
308 N. McKinley St. (Lawrence): Quadrant 2 with lead at 739 mg/kg; Quadrant 2 with arsenic at 23.9 mg/kg; Quadrant 2 with chromium at 60.5 mg; Quadrant 4 with cadmium at 43 mg/kg; Quadrant 5 with arsenic at 30 mg/kg; Quadrant 5 with chromium at 47.7 mg/Kg; Quadrant 6 with cadmium at 47 mg/kg.
206 N. Turtle St. (Fellers): Quadrant 5 with arsenic at 23 mg/kg; Quadrant 5 with cadmium at 42 mg/kg; Quadrant 6 with cadmium at 39 mg/kg.
206 E. Wood St. (Mason): Quadrant 3 with lead at 417 mg/kg; Quadrant 3 with cadmium at 41mg/kg; Quadrant 4 with cadmium at 45 mg/kg.
208 E. Wood St. (Ross): Quadrant 1 with lead at 545 mg/kg.
301 E. Wood St. (Herrelson): Quadrant 1 with cadmium at 42 mg/kg.
307 E. Wood St. (Humble): Quadrant 2 with lead at 847 mg/kg; Quadrant 2 with arsenic at 44 mg/kg; Quadrant with cadmium at 40 mg/kg.

Of these, the 12 residences with laboratory confirmation only with one or more metals above residential RSKs were (1) 105 E. Forest Street; (2) 107 E. Forest Street; (3) 205 E.

Forest Street; (4) 101 W. Forest Street; (5) 105 W. Forest Street; (6) 303 W. Forest Street; (7) 307 W. Forest Street; (8) 403 W. Forest Street; (9) 201 N. Jefferson Street; (10) 211 N. McKinley Street; (11) 307 E. Wood Street;, and (12) 308 N. McKinley Street. All of the above except (12) had lead laboratory detections between 405 mg/Kg and 890 mg/Kg.

The 308 E. Wood yard had lead below 400 mg/Kg but had chromium in laboratory analysis above residential RSKs and above apparent background concentrations (Reference 5). Appendix 10.6 contains greater detail regarding the residential yard sampling and results.

3.3 Quality Assurance/Quality Control Procedures

A Quality Assurance Project Plan was developed by the contractor for the site-specific activities (Reference 5). Three duplicate samples were collected and submitted to Pace Analytical Services during collection of samples. Replication for most parameters except cadmium and zinc were within acceptable limits, and the higher zinc and cadmium variability was only noticed in one sample of the three duplicates.

Method 6200 recommends both precision and accuracy be determined for field-portable XRF analysis (Reference 6). A National Institute of Standards and Technology standard was not analyzed by the KDHE contractor during the residential yard sampling. A percent difference was therefore not calculated for accuracy.

For precision, a relative percent difference was calculated by determining the standard deviation of seven replicate analyses divided by the mean expressed as a percentage consistent with EPA Method 6200 (Reference 6). A relative standard deviation was not calculated by the KDHE contractor.

A linear regression was calculated to compare the XRF and laboratory analysis. The linear regression between the XRF and laboratory data yielded a coefficient of determination (r^2) of 0.92851 (Reference 5). In the 1998 edition of EPA Method 6200, EPA recommended the r^2 be between 0.7 and 0.9 for the data to be considered quantitative screening quality, and an r^2 above 0.9 could be definitive quantitative level quality (Reference 6).

In the 2007 revision of EPA Method 6200, the coefficient of correlation (r) is referred to in regards to data usability ranges rather than r^2. Since the precision and accuracy data were not provided by the KDHE contractor, the data cannot be assumed to be definitive level data even though the r^2 exceeds 0.9. Thus the XRF data can only be assumed to be of qualitative level data because of the lack of necessary data to evaluate precision and accuracy of XRF analytical data.

4.0 Groundwater Pathway

4.1 Site Geology

The Cherokee County soil survey indicates that the site is underlain by the Dennis silt loam; the Parsons silt loam; the Kanima silty clay loam; and the Bates-Collinsville complex. These are silty loam to silty clay soils formed in shale residuum. The Dennis, Parsons and Kanima soils generally extend to 80 inches or deeper and are primarily silty clay loam and silty clay with a low to moderate vertical permeability of 0.06 to 0.20 inches per hour (Reference 7). The Bates-Collinsville soils are typically underlain by shale bedrock at depths of 39 inches or less.

Borings drilled at the site indicate coal and shale bedrock at 15-20 feet in most places in the site area. The upper bedrock formations at the site consist of the Weir-Pittsburg coal and the Cherokee Shale formations of Pennsylvanian age. Shallow bedrock formations generally yield little water and water that is present is often heavily mineralized (Reference 8).

The Weir public water supply well obtains approximately one half of its water from a deep Cambrian-Ordovician well located near the water tower at the site. Depth to groundwater was last measured be 229 feet by the Kansas Geological Survey, and the total depth of the well is estimated to be over 1,000 feet (Reference 8). A well log was not available for the Weir public water supply well, but the Crawford Rural Water District #4 well located approximately 2.5 miles northwest of the site had a total depth of 950 feet and terminated in the Upper Gasconade Dolomite of Ordovician age (Reference 8).

4.2 Groundwater Targets

The groundwater exposure pathway under the HRS is evaluated in part by calculating the number of residents, students, and workers served by water wells located within four miles of the site and determining whether these people are actually or potentially exposed to hazardous substances (Reference 9).

A well survey identified one public water supply well for Weir, and the Crawford Rural Water District #4 wells within the target distance limit of four miles. No other domestic or public water supply wells were identified. The 2011 census value for Weir is 679 persons, and apportioning 50% of the water supply yields 340 potential groundwater targets for the Weir public water supply well.

The Crawford Rural Water District #4 serves approximately 1,580 customers and relies on water from three wells, two of which are outside of the target distance limit. Apportioning 1/3 of the customers to the well within the target distance limit gives an additional 527 potential targets. The total number of potential groundwater targets identified is 1,206 persons (References 8, 10, and 11).

4.3 Groundwater Pathway Conclusions

A release of metals above MCLs has not been documented in the deeper aquifers supplying water to the Weir and Crawford Rural Water District #4 public water supply systems. Background data is scarce for the deeper aquifer, and from the existing data a release to groundwater cannot be attributed from the site. Shallow groundwater is sporadic in occurrence at the site. Insufficient data is present to evaluate if the levels identified in the limited groundwater sampling conducted in previous investigations is above a three times background threshold necessary to demonstrate an observed release to groundwater.

5.0 Surface Water Pathway

5.1 Hydrologic Settings

Surface water runoff from the site flows into an unnamed tributary of Brush Creek which is within 500 feet of the former smelter. This unnamed tributary discharges into Brush Creek approximately 1.75 miles from the site. Brush Creek discharges into Cow Creek approximately six miles from the site. Cow Creek enters the Spring River approximately 13 miles downstream from the site.

The City of Weir obtains approximately 50% of its water supply from Bone Creek approximately 18 miles north of Weir outside of the Brush Creek drainage (Reference 11). Brush Creek is designated by the Kansas Surface Water Register as a food procurement stream. Cow Creek and the Spring River are designated by the Kansas Surface Water Register as contact recreation, domestic water supply, food procurement, groundwater recharge, industrial water supply use, irrigation use, and livestock watering use streams (Reference 12).

All three streams are classified for special aquatic life use water, and general purpose waters. The average annual rainfall for Cherokee County is approximately 30 inches (Reference 7).

5.2 Surface Water Targets

The surface water exposure pathway under HRS is evaluated in part by calculating the number of residents, students, and workers served by surface water intakes located within 15 miles downstream of the site and whether these people are actually or potentially exposed to hazardous substances (Reference 9).

The City of Weir uses groundwater wells and surface water upstream and in a different drainage system for the public water supply. No surface water intakes for drinking water are known to exist within 15 miles downstream of the site (Reference 8). The Spring River Public Wholesale Water District intake near Galena is beyond the 15-mile target

distance limit, and the only other documented water diversions along the target distance limit are for irrigation (Reference 13).

5.3 Surface Water Pathway Conclusions

An observed release of lead, arsenic, cadmium, and zinc to sediment has been documented above background and TECs in the unnamed tributary of Brush Creek. An observed release of zinc to surface water has historically been detected above background and ALCs in the same unnamed tributary. No additional downstream surface water or sediment samples have been collected more than ½ mile downstream of the site (References 1-5).

6.0 Soil Exposure and Air Pathways

6.1 Physical Conditions

The Cherokee Zinc Company site is currently a vacant lot. The city shop is located on one of the parcels owned by the City of Weir. The former smelter works are surrounded by residential and agricultural properties. Weir is a rural community of approximately 679 persons (Reference 14).

6.2 Soil Exposure and Air Pathway Targets

The soil exposure pathway under HRS assesses the risks associated with existing surficial contamination (0-2 feet below ground surface) at properties on which people live or work (Reference 9). The entire population of Weir lives within a four-mile radius of the site (Reference 14). Three residences are estimated to be present within 200 feet of the site, giving an estimated resident population of eight persons. A total of 12 residences are considered Level I targets from laboratory data with a population estimate of 32 persons. From XRF data alone, a total of 22 residences with a population estimate of 58 persons would be considered Level I targets. An additional eight residences with a population estimate of 21 persons were identified as having Level II concentrations from laboratory data. The entire population of Weir are potential targets (References 1-5, 9, and 14).

6.3 Soil Exposure and Air Pathway Conclusions

The HRS soil and air pathways pose an actual or potential threat of exposure at the site. A release of hazardous substances to surface soils has been documented through sampling (References 1-5). A release to air has been documented through sample results of potential depositional contamination from historical air releases (Reference 4). Lead, arsenic, cadmium, and chromium were detected above Tier 2 residential RSKs and zinc below residential RSKs either on the smelter works or on adjacent properties.

7.0 Removal Considerations

A total of 22 residential yards were identified as having one or more quadrants in excess of residential RSKs either by XRF, laboratory, or both. A total of 12 yards were confirmed above RSKs by laboratory data only. These yards are specified in Section 3.2 above.

In addition to the residential yards, exploratory trenches and mapping of the extent of smelter waste at the site has provided an estimate of approximately 19,000 cubic yards of potential waste at the former smelter works. This estimate does not include the residential yards or any adjacent soils that may also need to be removed with the waste within the smelter works area. Limited Toxicity Characteristic Leachate Procedure (TCLP) data is present, and some of the waste may fail TCLP for lead based on historical results from other Kansas smelters compared with the analytical results from the Cherokee Zinc Company site.

The following conditions consistent with §300.415(b)(1) of the NCP were identified to warrant further removal action consideration: (i) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants; (iv) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate, and (vii), the availability of other appropriate federal or state response mechanisms to respond to the release (Reference 15). KDHE has not conducted a responsible party search for this site.

8.0 Summary and Conclusions

The Cherokee Zinc Company site is located on North Washington Street Weir, Cherokee County, Kansas. The site is an abandoned primary zinc smelter which operated from the 1870s through the early 1900s. Legacy contamination from this smelter has impacted multiple residential yards. Lead is the primary metal of concern above residential RSKS but arsenic, cadmium, and chromium also appear to be present above RSKs (References 1-5). A removal action consistent with the NCP is recommended to remove, consolidate and/or stabilize waste and contaminated soils present at the site above residential RSKs. KDHE is referring this site to EPA for the removal action, and will conduct a post-removal site assessment consistent with the NCP upon completion of the removal action. Impacts to sediments above TECs should also be addressed in site-wide removal actions.

9.0 References

1) Kansas Department of Health and Environment, *Focused Former Smelter Assessment of the Former Cherokee Zinc Company Smelter*, prepared by Burns & McDonnell Engineering Company, Inc., March 2004.

2) Kansas Department of Health and Environment, *Phase II Focused Former Smelter Assessment of the Former Cherokee Zinc Company Smelter*, prepared by Burns & McDonnell Engineering Company, Inc., November 2004.

3) Kansas Department of Health and Environment, *Report on Site Investigation Activities of Former Cherokee Zinc Company, Weir, Kansas* prepared by Golder Associates, Inc., December 2008.

4) Kansas Department of Health and Environment, *Supplemental Site Investigation*, December 2011.

5) Kansas Department of Health and Environment, *Residential Yard Sampling Report, Former Cherokee Zinc Company, Weir, Kansas*, prepared by Burns & McDonnell Engineering Company, Inc., June 2013.

6) U.S. EPA, Solid Waste SW-846 Methods: Method 6200, *Field Portable X-ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment*, January 1998 and revised February 2007.

7) U.S. Department of Agriculture, http://websoilsurvey.nrcs.usda.gov/app/ WebSoilSurvey.aspx, accessed June 21, 2013.

8) Water well completion records forms, WWC-5, and other geological and hydrological information available at: http://www.kgs.ku.edu/, accessed June 21, 2013.

9) United States Environmental Protection Agency, November 1992, *The Hazard Ranking System Guidance Manual*, Publication 9345.1-07.

10) Kansas Rural Water Association, 2013.

11) KDHE, Public Water Supply Section Fact Sheets.

12) Kansas Department of Health and Environment, *Surface Water Register*, 2004.

13) Kansas Division of Water Resources, 2013.

14) United States Census Bureau State and County Quick Facts available at: http://quickfacts.census.gov/gfd/, accessed June 20, 2013.

15) National Oil and Hazardous Substances Pollution Contingency Plan, Code of Federal Regulations Part 300, 1990.

16) Kansas Department of Health and Environment, *Risk-based Standards for Kansas,* 2010.

17) United States Environmental Protection Agency, *Superfund Lead-Contaminated Residential Sites Handbook,* August 2003.

18) U.S. Environmental Protection Agency, *Guidance for Performing Preliminary Assessments under CERCLA,* EPA 540/G-91/013, 1991.

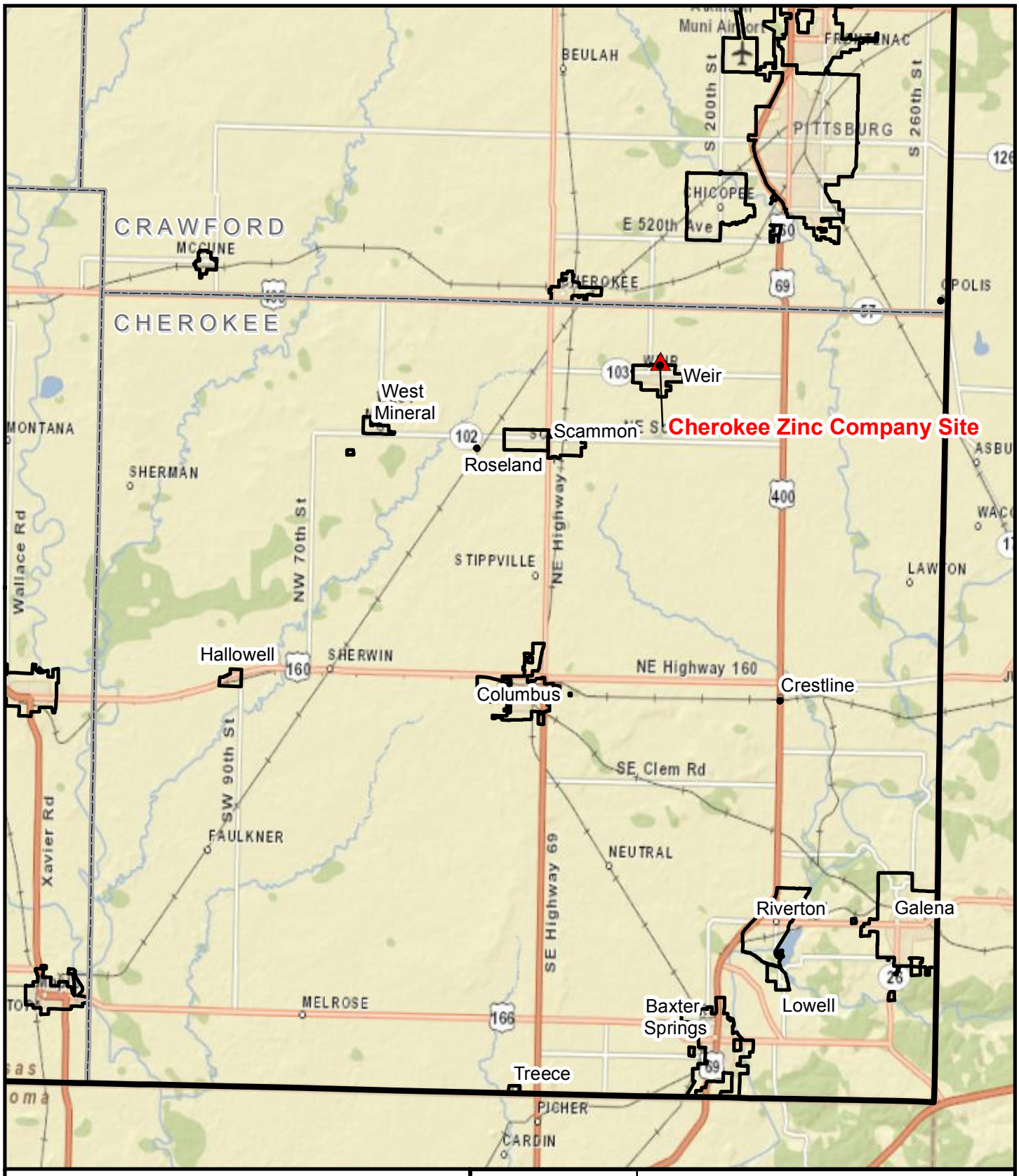
19) U.S. Environmental Protection Agency, *Hazard Evaluation Manual: A Guide to Removal Actions,* EPA Region III, 1993.

20) U.S. Environmental Protection Agency, *Quality Assurance/Quality Control Guidance for Removal Activities under CERCLA*, EPA 540/G-90/004, April, 1990.

21) Agency for Toxic Substances and Disease Registry, *ToxFacts,* 2013.

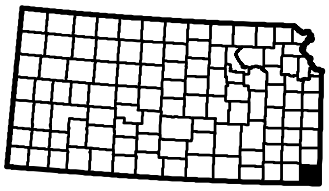
10.0 Appendices

10.1 Figures



LEGEND

Cherokee County



Map Source: Aerial Photograph 2010 National Geographic Society (NGS)

Kansas Department of Health and Environment

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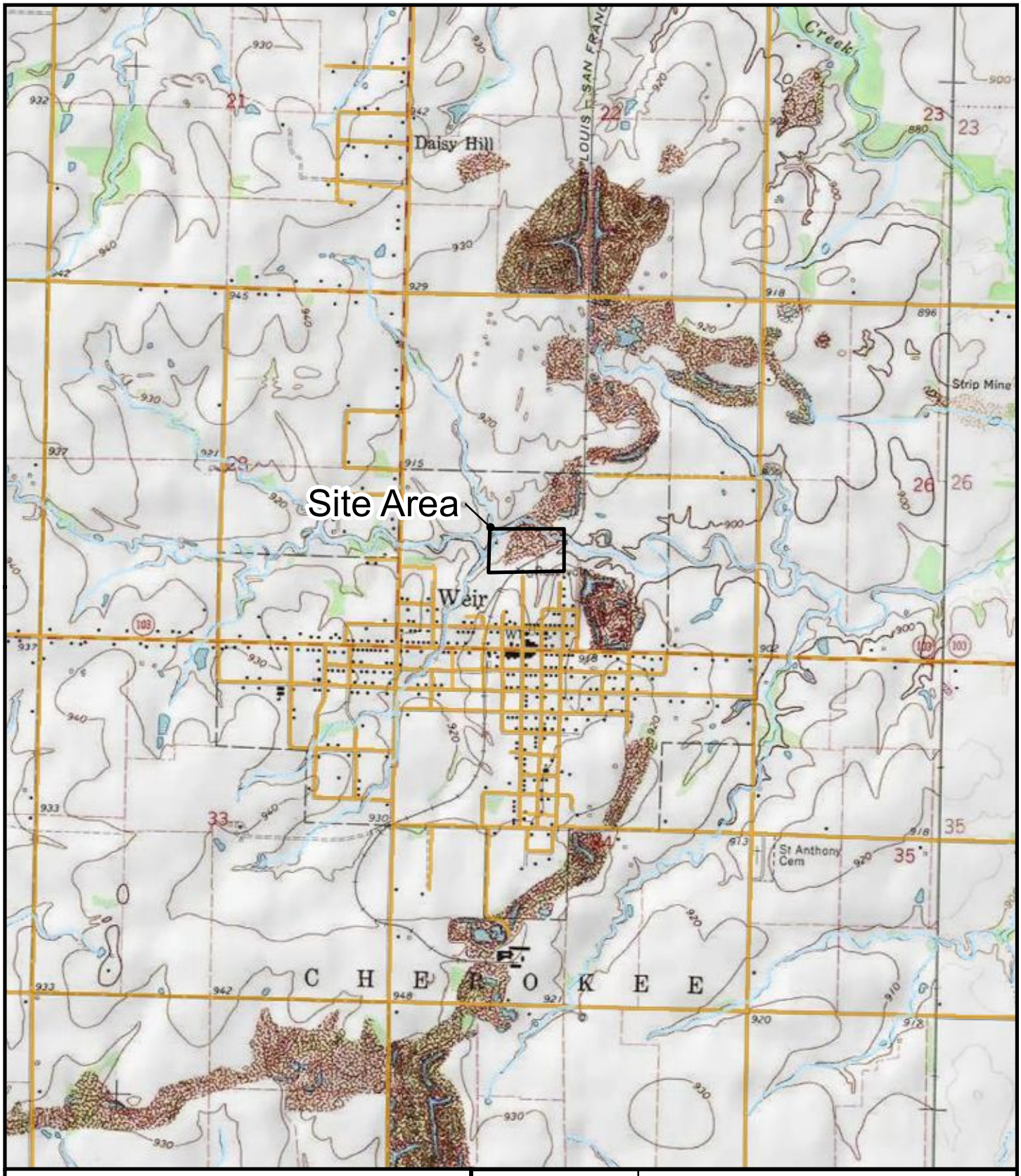
BASEMAP DATE:	2012
CHECKED BY: TW	6/19/13
Figure 1	



LEGEND

Local Roads

Stream

N

0 0.25 0.5 1 Miles

Map Source: Aerial Photograph 2010 National Geographic Society (NGS)

Kansas Department of Health and Environment

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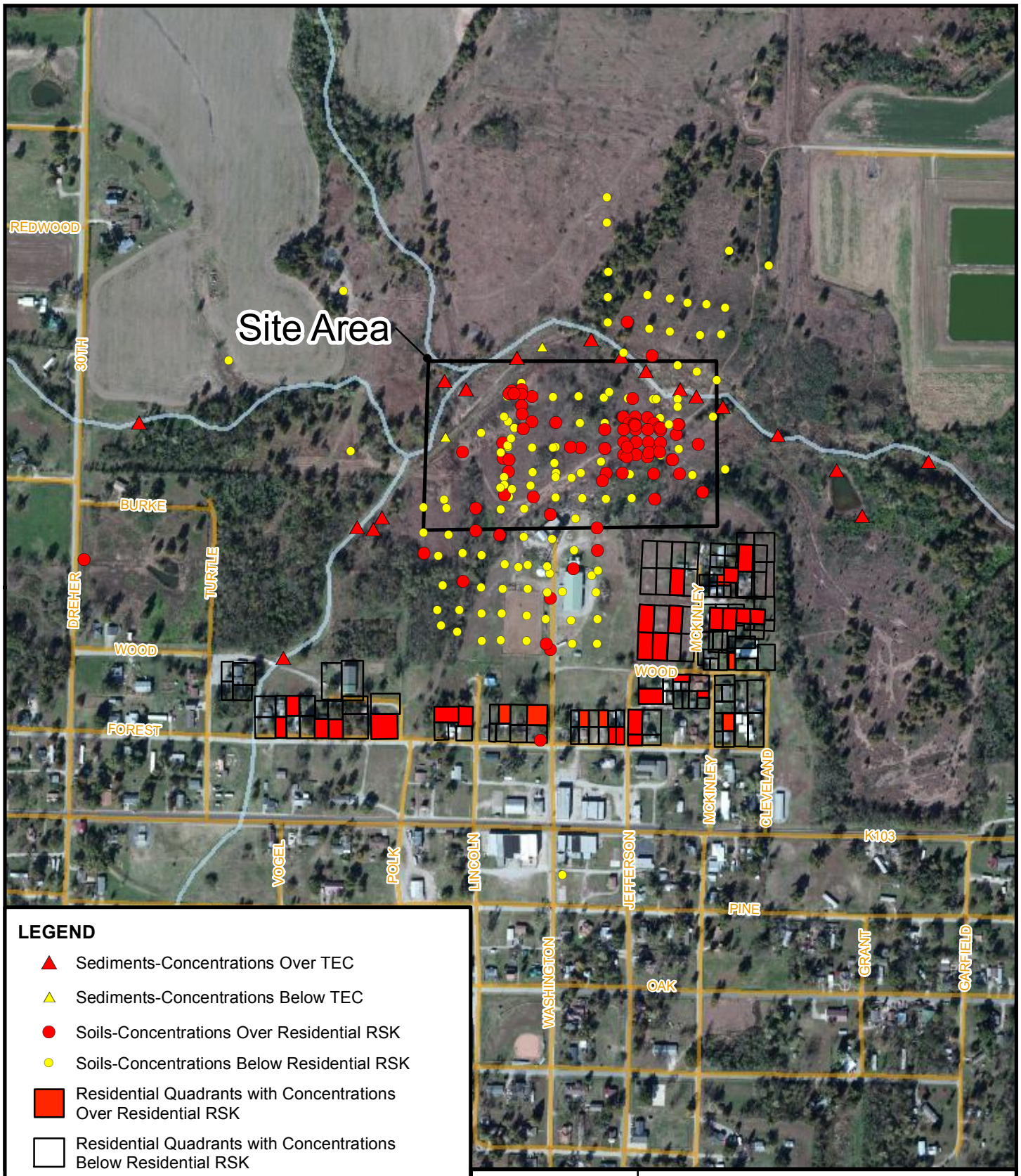

Kansas Department of Health and Environment

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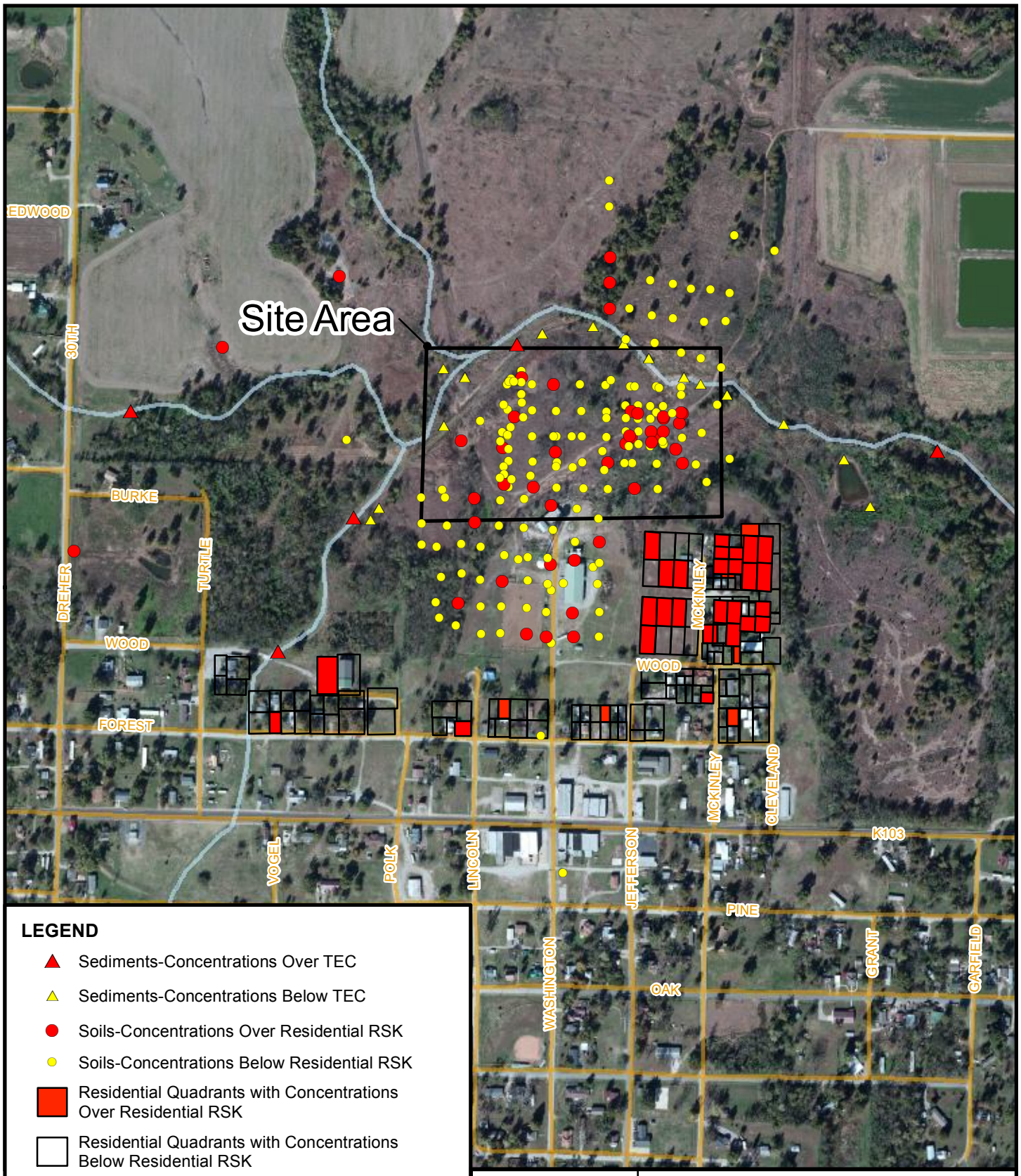

Kansas Department of Health and Environment

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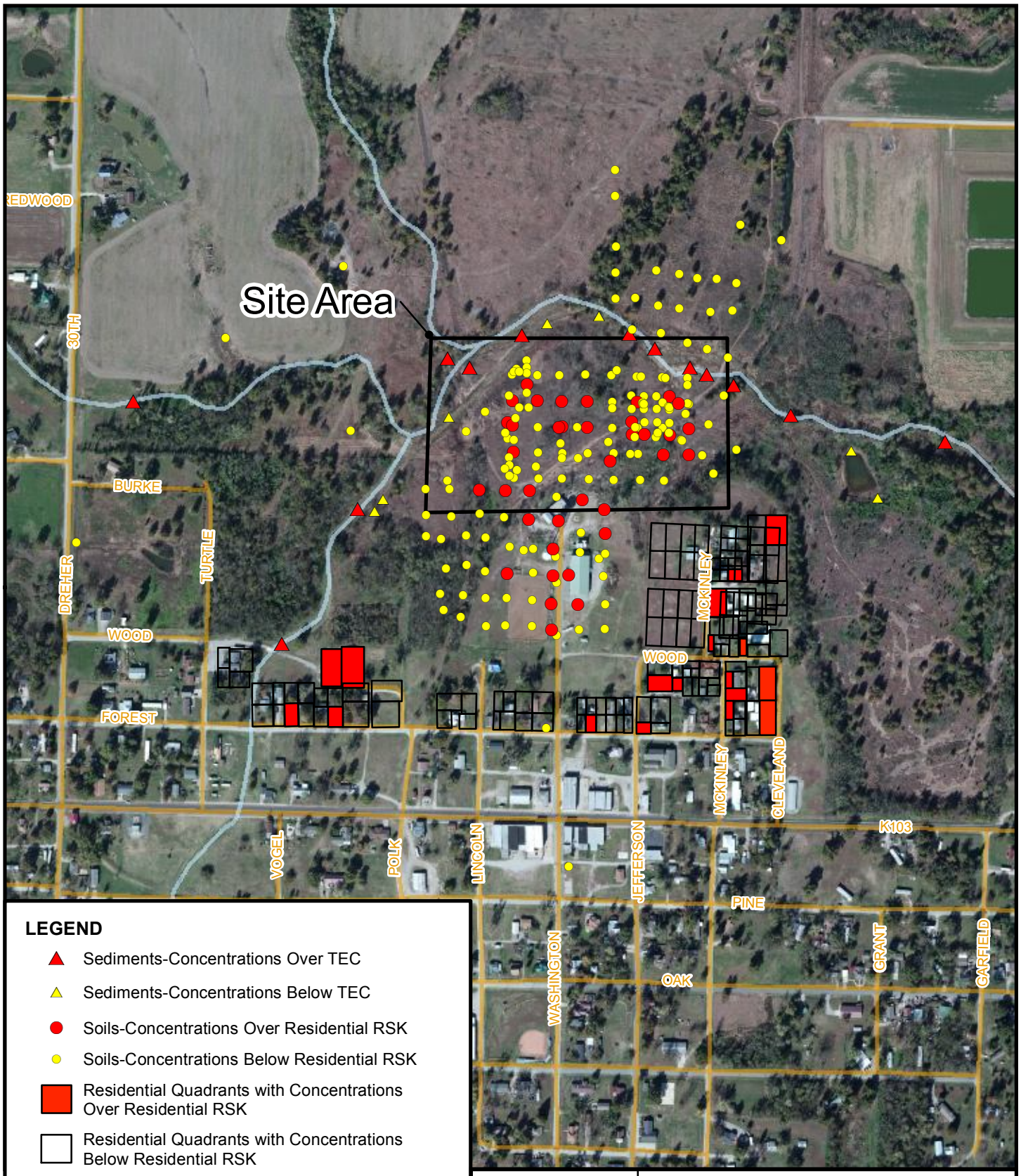

Kansas Department of Health and Environment

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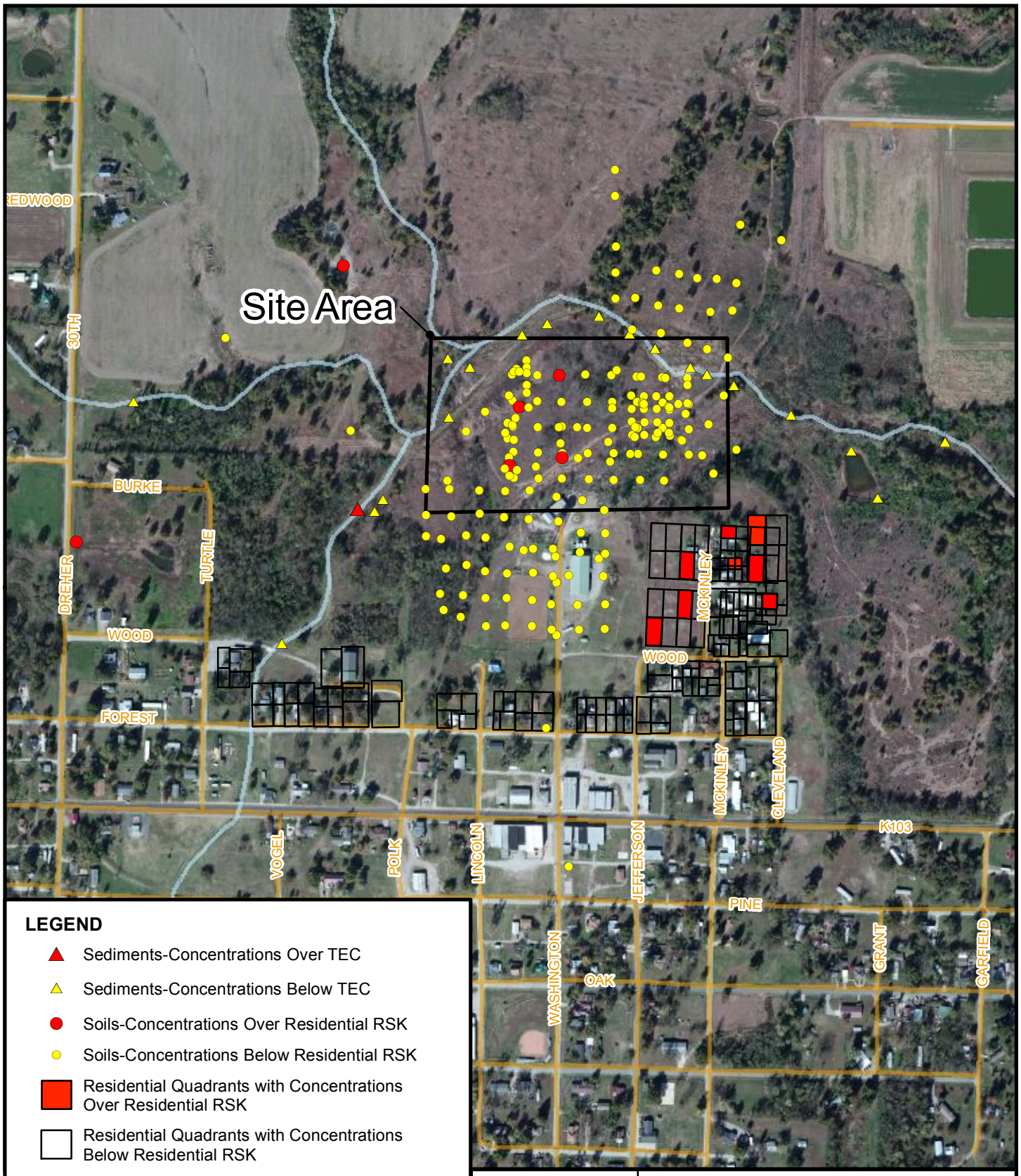

LEGEND

- Sediments-Concentrations Over TEC
- Sediments-Concentrations Below TEC
- Soils-Concentrations Over Residential RSK
- Soils-Concentrations Below Residential RSK
- Residential Quadrants with Concentrations Over Residential RSK
- Residential Quadrants with Concentrations Below Residential RSK
- Local Roads
- Stream

RSK-Risk-based Standards for Kansas

TEC-Threshold Effect Concentration

N

0 250 500 1,000 Feet

Map Source: Aerial Photograph 2010 National Geographic Society (NGS)

Kansas Department of Health and Environment

SITE:	**Cherokee Zinc Company Site Weir, Kansas**
TITLE:	**Chromium: XRF and/or Laboratory Detections**
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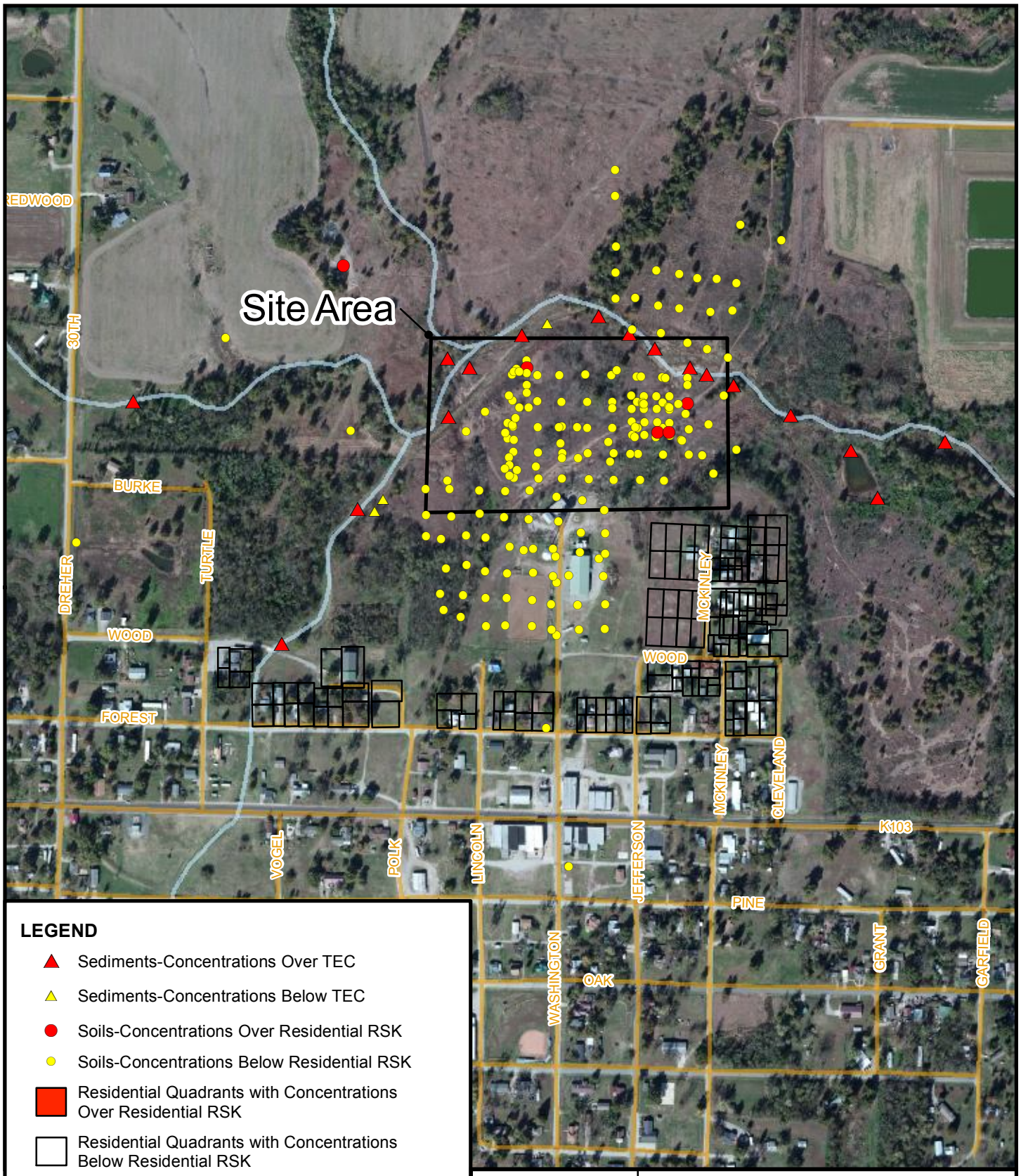
CHECKED BY: TW	6/18/13
	Figure 6



LEGEND

- Sediments-Concentrations Over TEC
- Sediments-Concentrations Below TEC
- Soils-Concentrations Over Residential RSK
- Soils-Concentrations Below Residential RSK
- Residential Quadrants with Concentrations Over Residential RSK
- Residential Quadrants with Concentrations Below Residential RSK
- Local Roads
- Stream

RSK-Risk-based Standards for Kansas

TEC-Threshold Effect Concentration

N

0 250 500 1,000 Feet

Map Source: Aerial Photograph 2010 National Geographic Society (NGS)

Kansas Department of Health and Environment

SITE:	**Cherokee Zinc Company Site Weir, Kansas**			
TITLE:	**Zinc: XRF and/or Laboratory Detections**			
PROJECT PHASE:	EPA Referral			
DRAWN BY:	TW	6/18/13	BASEMAP DATE:	2012
CHECKED BY:	TW	6/18/13	**Figure 7**	

10.2 Focused Former Smelter Assessment Report, March 2004 (Bound Separately)

10.3 Phase II Focused Former Smelter Assessment Report, November 2004 (Bound Separately)

10.4 Site Investigation Activities Report, December 2008 (Bound Separately)

10.5 Supplemental Site Investigation Report, December 2011 (Bound Separately)

10.6 Residential Yard Sampling Report, June 2013
(Bound Separately)

10.7 Hazardous Substance Information

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ARSENIC

CAS # 7440-38-2

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, call the ATSDR Information Center at 1-800-232-4636. 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: Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 1,149 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenate (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

What happens to arsenic when it enters the environment?

❑ Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
❑ Arsenic cannot be destroyed in the environment. It can only change its form.
❑ Rain and snow remove arsenic dust particles from the air.
❑ Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
❑ Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

How might I be exposed to arsenic?

❑ Ingesting small amounts present in your food and water or breathing air containing arsenic.
❑ Breathing sawdust or burning smoke from wood treated with arsenic.
❑ Living in areas with unusually high natural levels of arsenic in rock.
❑ Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys

How likely is arsenic to cause cancer?

Several studies have shown that ingestion of inorganic arsenic can increase the risk of skin cancer and cancer in the liver, bladder, and lungs. Inhalation of inorganic arsenic can cause increased risk of lung cancer. The Department of Health and Human Services (DHHS) and the EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic arsenic is carcinogenic to humans.

How can arsenic affect children?

There is some evidence that long-term exposure to arsenic in children may result in lower IQ scores. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant females, can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk.

How can families reduce the risks of exposure to arsenic?

❑ If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.

❑ If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.

❑ If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on your clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

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

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict whether the arsenic levels in your body will affect your health.

Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air (10 $\mu g/m^3$) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Arsenic (Update). Atlanta, GA: U.S. Department of Public 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 and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, 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

CADMIUM

CAS # 7440-43-9

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2008**

This fact sheet answers the most frequently asked health questions (FAQs) about cadmium. For more information, call the ATSDR Information Center at 1-800-232-4636. 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: 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 kidneys, lungs, and bones. Cadmium has been found in at least 1,014 of the 1,669 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is cadmium?

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 soil, water, and air from mining, industry, and burning coal and household wastes.
- ❏ Cadmium does not break down in the environment, but can change forms.
- ❏ Cadmium particles in air can travel long distances before falling to the ground or water.
- ❏ Some forms of cadmium dissolve in water.
- ❏ Cadmium binds strongly to soil particles.
- ❏ Fish, plants, and animals take up cadmium from the environment.

How might I be exposed to cadmium?

- ❏ Eating foods containing cadmium; low levels are found in all foods (highest levels are found in shellfish, liver, and kidney meats).
- ❏ Smoking cigarettes or breathing cigarette smoke.
- ❏ Breathing contaminated workplace air.
- ❏ Drinking contaminated water.
- ❏ Living near industrial facilities which release cadmium into the air.

How can cadmium affect my health?

Breathing high levels of cadmium can severely damage the lungs. 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.

How likely is cadmium to cause cancer?

The Department of Health and Human Services (DHHS) has determined that cadmium and cadmium compounds are known human carcinogens.

How can cadmium affect children?

The health effects in children are expected to be similar to the effects seen in adults (kidney, lung, and bone damage depending on the route of exposure).

A few studies in animals indicate that younger animals absorb more cadmium than adults. Animal studies also indicate that the young are more susceptible than adults to a loss of bone and decreased bone strength from exposure to cadmium.

We don't know if cadmium causes birth defects in people. The babies of animals exposed to high levels of cadmium during pregnancy had changes in behavior and learning ability. There is also some information from animal studies that high enough exposures to cadmium before birth can reduce body weights and affect the skeleton in the developing young.

How can families reduce the risks of exposure to cadmium?

❑ In the home, store substances that contain cadmium safely, and keep nickel-cadmium batteries out of reach of young children.
❑ Cadmium is a component of tobacco smoke. Avoid smoking in enclosed spaces like inside the home or car in order to limit exposure to children and other family members.
❑ 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 determine whether I've been exposed to cadmium?

Cadmium can be measured in blood, urine, hair, or nails. Urinary cadmium has been shown to accurately reflect the amount of cadmium in the body.

The amount of cadmium in your blood shows your recent exposure to cadmium. The amount of cadmium in your urine shows both your recent and your past exposure.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to cadmium in drinking water at concentrations of 0.04 ppm for up to 10 days is not expected to cause any adverse effects in a child.

The EPA has determined that lifetime exposure to 0.005 ppm cadmium is not expected to cause any adverse effects.

The FDA has determined that the cadmium concentration in bottled drinking water should not exceed 0.005 ppm.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 5 $\mu g/m^3$ for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2008. Toxicological Profile for Cadmium (Draft for Public Comment). Atlanta, GA: U.S. Department of Public 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 and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, 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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AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

CHROMIUM

CAS # 7440-47-3

Division of Toxicology and Human Health Sciences ToxFAQs™ **October 2012**

This fact sheet answers the most frequently asked health questions (FAQs) about chromium. For more information, call the ATSDR Information Center at 1-800-232-4636. 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: 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 cause cancer. Ingesting high levels of chromium(VI) may result in anemia or damage to the stomach or intestines. Chromium(III) is an essential nutrient. Chromium has been found in at least 1,127 of the 1,669 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is chromium?

Chromium is a naturally occurring element found in rocks, animals, plants, and soil. It can exist in several different forms. Depending on the form it takes, it can be a liquid, solid, or gas. The most common forms are chromium(0), chromium(III), and chromium(VI). No taste or odor is associated with chromium compounds.

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 can be found in air, soil, and water after release from the manufacture, use, and disposal of chromium-based products, and during the manufacturing process.
- Chromium does not usually remain in the atmosphere, but is deposited into the soil and water.
- Chromium can easily change from one form to another in water and soil, depending on the conditions present.
- 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 lining of the nose, nose ulcers, runny nose, and breathing problems, such as asthma, cough, shortness of breath, or wheezing. The concentrations of chromium in air that can cause these effects may be different for different types of chromium compounds, with effects occurring at much lower concentrations for chromium(VI) compared to chromium(III).

The main health problems seen in animals following ingestion of chromium(VI) compounds are irritation and ulcers in the stomach and small intestine and anemia. Chromium(III) compounds are much less toxic and do not appear to cause these problems.

Sperm damage and damage to the male reproductive system have also been seen in laboratory animals exposed to chromium(VI).

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaqs/index.asp

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?

The Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC), and the EPA have determined that chromium(VI) compounds are known human carcinogens.

In workers, inhalation of chromium(VI) has been shown to cause lung cancer. Chromium(VI) also causes lung cancer in animals. An increase in stomach tumors was observed in humans and animals exposed to chromium(VI) in drinking water.

How can chromium affect children?

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

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

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.
- Chromium is a component of tobacco smoke. Avoid smoking in enclosed spaces like inside the home or car in order to limit exposure to children and other family members.
- Although chromium(III) is an essential nutrient, you should avoid excessive use of dietary supplements containing chromium.

Is there a medical test to determine 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. Chromium can be measured in hair, urine, and blood.

Higher than normal levels of chromium in blood or urine may indicate that a person has been exposed to chromium. However, increases in blood and urine chromium levels cannot be used to predict the kind of health effects that might develop from that exposure.

Has the federal government made recommendations to protect human health?

The EPA has established a maximum contaminant level of 0.1 mg/L for total chromium in drinking water.

The FDA has determined that the chromium concentration in bottled drinking water should not exceed 0.1 mg/L.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 0.005 mg/m^3 chromium(VI), 0.5 mg/m^3 chromium(III), and 1.0 mg/m^3 chromium(0) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2012. Toxicological Profile for Chromium. Atlanta, GA: U.S. Department of Public 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 and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp. 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

LEAD

CAS # 7439-92-1

Division of Toxicology and Environmental Medicine ToxFAQs™ **September 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about lead. 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: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,280 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years.

What happens to lead when it enters the environment?

❑ Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.

❑ When lead is released to the air, it may travel long distances before settling to the ground.

❑ Once lead falls onto soil, it usually sticks to soil particles.

❑ Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

❑ Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.

❑ Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.

❑ Working in a job where lead is used or engaging in certain hobbies in which lead is used, such stained glass.

❑ Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It 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 and can cause anemia. Exposure to high lead levels 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.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer 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 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 and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

❏ Avoid exposure to sources of lead.

❏ Do not allow children to chew or mouth painted surfaces that may have been painted with lead-based paint.

❏ If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.

❏ Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children

❏ If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

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

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. 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.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested 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 a lead level of 10 µg/dL to be a level of concern for children.

EPA limits lead in drinking water to 15 µg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for lead (Draft for Public Comment). Atlanta, GA: U.S. Department of Public 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 and Environmental Medicine, 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

ZINC
CAS # 7440-66-6

Division of Toxicology ToxFAQs™ **August 2005**

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 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: Zinc is a naturally occurring element. Exposure to high levels of zinc occurs mostly from eating food, drinking water, or breathing workplace air that is contaminated. Low levels of zinc are essential for maintaining good health. Exposure to large amounts of zinc can be harmful. It can cause stomach cramps, anemia, and changes in cholesterol levels. Zinc has been found in at least 985 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is zinc?

Zinc is one of the most common elements in the earth's crust. It is 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, dyes, 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 human activities 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.
❏ Depending on the type of soil, some zinc compounds can move into the groundwater and into lakes, streams, and rivers.
❏ Most of the zinc in soil stays bound to soil particles and does not dissolve in water.
❏ It builds up in fish and other organisms, but it does not build up in plants.

How might I be exposed to zinc?

❏ Ingesting small amounts present in your food and water.
❏ 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.
❏ Working on any of the following jobs: construction, painting, automobile mechanics, mining, smelting, and welding; manufacture of brass, bronze, or other zinc-containing alloys; manufacture of galvanized metals; and manufacture of machine parts, rubber, paint, linoleum, oilcloths, batteries, some kind of glass, ceramics, and dyes.

How can zinc affect my health?

Zinc is an essential element in our diet. Too little zinc can cause problems, but too much zinc is also harmful.

Harmful effects generally begin at levels 10-15 times higher than the amount needed for good health. Large doses taken by mouth even for a short time can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia and decrease the levels of your good cholesterol. We do not know if high levels of zinc affect reproduction in humans. Rats that were fed large amounts of zinc became infertile.

Inhaling large amounts of zinc (as dusts or fumes) can cause a specific short-term disease called metal fume fever. We do not know the long-term effects of breathing high levels of zinc.

Putting low levels of zinc acetate and zinc chloride on the skin of rabbits, guinea pigs, and mice caused skin irritation. Skin irritation will probably occur in people.

How likely is zinc to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified zinc for carcinogenicity. Based on incomplete information from human and animal studies, the EPA has determined that zinc is not classifiable as to its human carcinogenicity.

How can zinc affect children?

Zinc is essential for proper growth and development of young children. It is likely that children exposed to very high levels of zinc will have similar effects as adults. We do not know whether children are more susceptible to the effects of excessive intake of zinc than the adults.

We do not know if excess zinc can cause developmental effects in humans. Animal studies have found decreased weight in the offspring of animals that ingested very high amounts of zinc.

How can families reduce the risks of exposure to zinc?

❑ Children living near waste sites that contain zinc may be exposed to higher levels of zinc through breathing contaminated air, drinking contaminated drinking water, touching or eating contaminated soil.

❑ Discourage your children from eating soil or putting their hands in their mouths and teach them to wash their hands frequently and before eating.

❑ If you use medicines or vitamin supplements containing zinc, make sure you use them appropriately and keep them out of the reach of children.

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

There are tests available to measure zinc in your blood, urine, hair, saliva, and feces. These tests are not usually done in the doctor's office because they require special equipment. High levels of zinc in the feces can mean high recent zinc exposure. High levels of zinc in the blood can mean high zinc consumption and/or high exposure. Tests to measure zinc in hair may provide information on long-term zinc exposure; however, the relationship between levels in your hair and the amount of zinc you were exposed to is not clear.

Has the federal government made recommendations to protect human health?

The EPA recommends that drinking water should contain no more than 5 milligrams per liter of water (5 mg/L) because of taste. The EPA requires that any release of 1,000 pounds (or in some cases 5,000 pounds) into the environment be reported to the agency.

To protect workers, the Occupational Safety and Health Administration (OSHA) has set an average limit of 1 mg/m^3 for zinc chloride fumes and 5 mg/m^3 for zinc oxide (dusts and fumes) in workplace air during an 8-hour workday, 40-hour workweek.

Similarly, 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.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Zinc (Update). Atlanta, GA: U.S. Department of Public 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.

10.8 Integrated Site Evaluation Form

Kansas Department of Health and Environment
Integrated Site Evaluation Form

I. Site Information

Site Name: Cherokee Zinc Company Site			
Address or location: 413 North Washington Street			
City: Weir	County: Cherokee	State: Kansas	ZIP: 66781
Telephone:	Fax:		
Directions to Site: Located north of City Shop in Weir.			
Map attached? ☒ Yes - see Integrated Assessment Report			
Requested by: KDHE	Agency/Office: State Water Plan		
Address: 1000 SW Jackson, Ste. 410		Date of Request: 06/15/2013	
City: Topeka	State: Kansas	ZIP: 66612	
Phone:785.296.1673	E-mail:	Fax: 785.296.7030	
Site Contact: Randy Brown/KDHE			
Address: 1000 SW. Jackson, Suite 410			
City: Topeka	State: Kansas	ZIP: 66612-1367	
Phone: 785-296-8065	E-mail: rbrown@kdheks.gov	Fax: 785-296-7030	

II. CERCLA Site Screening Response Criteria (see Section V for definitions)

A. Is there a release or threat of release as defined by the NCP?			Yes ☒	No ☐
Explain: Lead, cadmium, chromium, and arsenic have been detected at the site above residential Tier 2 Risk-based Standards for Kansas (RSKs).				
B. Is the source a facility or vessel as defined by the NCP?			Yes ☒	No ☐
Explain: The site is an abandoned primary zinc smelter.				
C. Does the release or threat of release involve a hazardous substance, pollutant, or contaminant as defined by the NCP?			Yes ☒	No ☐
Explain: Lead, cadmium, chromium, and arsenic are hazardous substance as defined by the NCP.				
D. Is the release subject to the limitations on response?			Yes ☐	No ☒
Explain: No release limitations appear to exist.				
E. Does the quantity or concentration warrant response?			**Yes** ☒	No ☐
Explain: Lead and /or cadmium, chromium and arsenic are elevated above residential RSK levels in residential yards.				
F. Has a PRP been identified?			Yes ☐	No ☒
Name:		Telephone:		
Address:	City:	State:	Zip:	
G. Document operational and regulatory history: see attached report ☒				
H. What is the current land use around the facility? Check all that apply: Residential ☒ Industrial ☐ Commercial ☐ Agricultural ☒ Recreational ☐				
I. Is there an actual or potential exposure to hazardous substances, pollutants or contaminants:				
Ground Water: Yes ☐ No ☐ Potential ☒ Receptor: Municipal water supplies Explain: The Weir city well is located at the site but has not indicated elevated metals.				
Surface Water: Yes ☒ No ☐ Potential ☐ Receptor: Environmental targets Explain: Sediment and surface water are impacted with heavy metals above Threshold Effect Concentrations and/or Aquatic Life Criteria.				
Soil: Yes ☒ No ☐ Potential ☐ Receptor: Residents Explain: Soil contamination is present with high levels of lead and cadmium, chromium, and arsenic in residential yards above residential RSKs. .				
Waste: Yes ☒ No ☐ Potential ☐ Receptor: workers Explain: Visible smelter waste is present at the site.				
Air: Yes ☒ No ☐ Potential ☐ Receptor: Residents (fugitive dust) Explain: Previous investigations have shown air emissions potentially causing depositional contamination.				
J. Is there an actual or a potential for contamination of a drinking water well? Yes ☐ No ☐ Potential ☒ Explain: The Weir city well did not indicate elevated metals but is located within the smelter site.				

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Integrated Site Evaluation Form

K. Are there hazardous substances, pollutants, or contaminants in drums, barrels, bulk storage containers, or tanks? Yes ☐ No ☒
Explain:

L. Are there high levels of hazardous substances in:
Near-surface soils (< 2 feet below surface)? Yes ☒ No ☐ Unknown ☐
Subsurface soils (> 2 feet below surface)? Yes ☒ No ☐ Unknown ☐
Surficial Waste present? Yes ☒ No ☐ Unknown ☐
Site Accessibility: Secure ☐ Access limited ☐ Readily accessible ☒ Worker population: 3-5
Further explanation: High concentrations of lead, cadmium, chromium, and arsenic are present near the smelter or in adjacent residential yards.

M. Are there conditions on site that may be susceptible to impact from adverse weather? Yes ☐ No ☒
Explain: There are no apparent conditions susceptible to adverse weather impacts.

N. Is there a threat of fire or explosion? Yes ☐ No ☒
Explain

O. Is there a potential for other federal or state response programs? Yes ☐ No ☒
The site qualifies for evaluation of a removal action to address lead, cadmium, chromium, and arsenic-impacted residential yards and smelter waste. Sediments are also impacted above TECs.

P. Are there endangered species habitats, wetlands, or other sensitive environments nearby which may be adversely impacted by the site? Yes ☒ No ☐
Explain: Cow Creek and the Spring River are designated as special aquatic life streams.

Q. Are there other situations or factors that warrant further CERCLA response? Yes ☒ No ☐
Explain: There are no State mechanisms to further evaluate lead-impacted soils at the site.

R. Document economic conditions surrounding the site: The site is situated in a residential area of Weir, Kansas.

III. CERCLA Site Screening Findings and Recommendations

A. CERCLA Eligible?

☒ Yes – further CERCLA evaluation is recommended. Cite applicable factors from Section III:
- ☒ A release of a hazardous substance, pollutant or contaminant has occurred;
- ☒ CERCLA Limitations on Response provisions do not apply;
- ☒ No responsible parties are willing/capable to respond at this time;
- ☐ Drums, barrels, and/or containers are, or may be present at the site;
- ☐ The site is susceptible to impact from adverse weather;
- ☒ No other federal or state response mechanisms were identified;
- ☒ The source is a facility as defined by the NCP;
- ☒ Contamination may be presenting sufficient quantity and/or concentration;
- ☒ There is an actual or potential exposure threat;
- ☐ There is, or may be, a threat of fire or explosion;
- ☒ There are, or may be, high concentrations of contaminants in surficial soils;
- ☒ There are endangered species, wetlands, or other sensitive environments or receptors that may be impacted by the site.

If necessary, explain:
Lead, cadmium, chromium, and arsenic-impacted soils are present in residential yards and at the former smelter.

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☐ No - further CERCLA evaluation is not recommended. Cite appropriate factors from Section III:

- ☐ No release has occurred;
- ☐ Not a hazardous substance, pollutant or contaminant;
- ☐ Insufficient quantity or concentration:
- ☐ No actual or potential exposure threats;
- ☐ No high levels of contaminants in surficial soils:
- ☐ Not a facility or vessel;
- ☐ Subject to response limitations;
- ☐ Willing/capable responsible party response;
- ☐ Drums, barrels, and/or containers are not present at the site;
- ☐ Site not susceptible to adverse weather:
- ☐ No threat of fire or explosion;
- ☐ Referred to another program.

If necessary, explain:

IV. Removal Considerations and Recommended Response Actions

If yes, check recommended or potential removal actions from § 300.415(d) of the NCP to warrant further removal site evaluation below:

☒ Release or threat of release is present.

- ☒ Site security
- ☒ Drainage control
- ☒ Stabilization or removal of surface impoundments
- ☒ Capping of contaminated soil
- ☒ Use of chemicals to retard or control spread of contaminants
- ☒ Excavation of contaminated soils
- ☐ Removal of drums, barrels, tanks or other bulk storage containers
- ☒ Containment, treatment, disposal or incineration of hazardous substances, pollutants or contaminants
- ☐ Provide alternate water supplies
- ☐ Other (specify and explain):

Briefly explain the rationale for checked alternatives: Lead, cadmium, chromium, and arsenic-impacted soil are present in residential areas. Sediments are impacted above TECs.

V. Remedial Considerations

The Integrated Assessment includes evaluation of remedial considerations and an initial evaluation of Hazard Ranking System (HRS) scoring potential. A post-removal remedial site assessment will be conducted at the conclusion of any removal actions.

VI. Final Comments/Recommendations

A release of lead, cadmium, chromium, and arsenic to soil above residential Tier 2 RSK levels was documented during the IA. Zinc was also identified below RSKs but above background levels. A removal action is recommended to address lead, cadmium, chromium, and arsenic-impacted soil and waste.

V. Definitions

I. **CERCLA** is the Comprehensive Environmental Response Compensation and Liabilities Act, 42 USC §9601 *et seq.* (as amended).

A **FACILITY** is defined as any building, structure, installation, equipment, pipe or pipeline (including any pipe into a sewer or publicly-owned treatment works), well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, or aircraft, or any site or area, where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located; but does not include any consumer product in consumer use or any vessel.

A **HAZARDOUS SUBSTANCE** means any substance, element, compound, mixture, solution, hazardous waste, toxic pollutant, hazardous air pollutant, or imminently hazardous chemical substance or mixture designated pursuant to the Clean Water Act (CWA), CERCLA, Safe Drinking Water Act (SDWA), Clean Air Act (CAA) or Toxic Substances Control Act (TSCA). The term does not include petroleum products, natural gas, natural gas liquids, liquefied natural gas, synthetic gas or mixtures of natural and synthetic gas.

The LIMITATIONS ON RESPONSE provisions of the NCP [40 CFR 300.400(b)] states that removals shall not be undertaken in response to a release: of a naturally occurring substance in its unaltered or natural form; from products that are a part of the structure of, and result in exposure within, residential buildings or business or community structures; or into public or private drinking water supplies due to deterioration of the system through ordinary use.

NCP is the National Oil and Hazardous Substances Pollution Contingency Plan 40 CFR §300-302.

OPA is the Oil Pollution Act, 33 **U.S.C.** §2702 *et seq.,* 40 CFR §300.300- 300.335.

POLLUTANT or CONTAMINANT includes, but is not limited to, any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions or physical deformations, in such organisms or their offspring. The term does not include petroleum products, natural gas, natural gas liquids, liquefied natural gas, synthetic gas or mixtures of natural and synthetic gas. [40 CFR 300.5]

RCRA is the Resource Conservation and Recovery Act, 42 USC§ 6901 *et. seq.;* 40 CFR §260-273.

A **RELEASE** is defined as any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment of barrels, containers, and other closed receptacles containing any hazardous substances or pollutant or contaminant), but excludes: workplace exposures; engine exhaust emissions; nuclear releases otherwise regulated; and the normal application of fertilizer. For purposes of the NCP, release also means threat of release. [40 CFR 300.5]

A **VESSEL** is defined as every description of watercraft or other artificial contrivance used, or capable of being used, as a means of transportation on water other than a public vessel. [40 CFR 300.5]