AMENDED PREASSESSMENT SCREEN AND DETERMINATION

National Zinc NRDA Site
Osage and Washington Counties, Oklahoma

Prepared by the
Natural Resource Trustees for
The National Zinc NRDA Site

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Table of Contents

1.0 Introduction 3

1.1 Historical NZC/ZCA Facility Background 3
1.2 Purpose of the Preasssessment Screen 3

2.0 Information on the NZC/ZCA Facility and the Release of Hazardous Substances 6

2.1 Timing, Quantity, Duration, and Frequency of Releases 6
2.2 Description of the Hazardous Substances Released 6
2.3 History, Current/Past Use, and Relevant Operations of the NZC/ZCA Facility 7
2.4 Additional Hazardous Substances Potentially Released from the NZC/ZCA Facility 7
2.5 Potentially Responsible Parties (PRPs) 7

3.0 Regulatory History 8

3.1 Past Remedial and Response Actions Taken 8

4.0 Preliminary Identification of Resources Potentially at Risk 10

4.1 Preliminary Identification of Pathways 10
4.2 Exposed Areas 12
4.3 Potentially Affected Resources and Resource Services 14

5.0 Preliminary Determination Regarding Preassessment Screen Criteria... 16

6.0 Conclusions 17

References 22

Appendix A- Figures 25

List of Tables

Table 2-1 Chemicals of Potential Concern at the NZC/ZCA Facility 6

Table 4-1 Concentrations of CoPCs in Whole Water Samples compared with Surface Water Screening Benchmark Values 13

List of Figures

Figure 1-1 Location Map for National Zinc Remediation Site 26

Figure 4-2 a Concentrations of CoPCs in Soils at NZC/ZCA Facility (1 of 2) 27

Figure 4-3 b Concentrations of CoPCs in Soils at NZC/ZCA Facility (2 of 2) 28

1.0 Introduction

This document concerns potential claims for damages to natural resources related to releases of hazardous substances from the National Zinc Company Facility/Zinc Corporation of America Facility (NZC/ZCA Facility) to the environment in Washington and Osage Counties, Oklahoma (see Appendix A – Figures: Location Map for National Zinc site)[1].

1.1 Historical NZC/ZCA Facility Background

The location of the National Zinc Company (NZC) Facility coincides with the current location of the Zinc Corporation of America (ZCA) facility. The NZC/ZCA Facility was proposed for listing on the Superfund National Priorities List (NPL) in May 1993, The NZC/ZCA facility was not listed on the NPL list; however, remediation proceeded under a cooperative cleanup with Oklahoma Department of Environmental Quality oversight. The National Zinc Site is located on the western edge of the City of Bartlesville, Oklahoma. Historical metal processing operations by three horizontal retort zinc smelters commenced at this location in approximately 1907. Two of the smelters ceased operations in the 1920s. The remaining smelter was converted to an electrolytic zinc refinery in 1976 and is not currently operating. During the time the horizontal retorts were in operation, metals contained in the airborne emissions from the smelter(s) were deposited over much of the area of Bartlesville which lies west of the Caney River including residential, commercial, industrial, and ecological areas (EPA 1997).

Historical sources of metals at the NZC/ZCA Facility included: ore delivered to the NZC/ZCA Facility by railcar, dust from the transport and storage of ore and solid waste materials at the NZC/ZCA Facility, metals emissions from roasting and smelting processes, airborne particulates from smelting and sintering processes, and various solid waste materials (e.g. retort and sinter residues, slag, crushed retort, and condenser sands) (EPA 1997).

1.2 Purpose of the Preasssessment Screen

Federal Natural Resource Damage Assessment (NRDA) regulations, at 43 C.F.R. § 11.23(a), require natural resource trustees to complete a Preassessment Screen (PAS) prior to conducting formal injury assessment activities. The purpose of the PAS is to provide a rapid review of readily available information on hazardous substance releases from the NZC/ZCA Facility and the potential impacts to natural resources for which the trustees may assert trusteeship at the National Zinc NRDA Site (42 U.S.C. § 9607(f)). The PAS review is intended to ensure that the Trustees have a reasonable probability of making a successful NRDA claim before monies and effort are expended to carry out a formal assessment. Additionally, the PAS documents the trustees' determination that further assessment efforts are warranted (43 C.F.R. § 11.23).

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[1] The boundaries of Natural Resource Damage Assessment (NRDA) site is not defined by the boundary of the NZC facility boundary; but rather is defined by the nature and extent of contamination and injuries associated with the hazardous substance releases from the NZC/ZCA Facility.

This document fulfills that requirement for the National Zinc NRDA site and follows the structure of Federal Regulations at 43 C.F.R. Part 11. These regulations provide a method for the assessment of natural resource damages resulting from a release of hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended (42 U.S.C. §§ 9601 *et seq.*) and the Federal Water Pollution Control Act (FWPCA), as amended (33 U.S.C. §§ 1251 *et seq.*). Any determination or assessment of natural resource damages in accordance with these regulations shall have the force and effect of a rebuttable presumption on behalf of the Trustees in any administrative or judicial proceeding. (42 U.S.C. § 9607(2)(C)). However, adherence to the methods set forth in these regulations is not mandatory and does not preclude the Trustees' use of alternate methods of assessing damages or arriving at a negotiated settlement with potentially responsible parties.

The CERCLA, FWPCA, and 40 C.F.R. § 300.600(2) authorize the Secretary of the Interior to act as trustee for natural resources, and their supporting ecosystems, managed or controlled by the U.S. Department of the Interior (DOI). The CERCLA, FWPCA, and 40 C.F.R. § 300.610 authorizes Indian tribes to serve as trustees for natural resources, including their supporting ecosystems, belonging to, managed by, controlled by, appertaining to such Indian tribe, held in trust for the benefit of such Indian tribe, or belonging to a member of such Indian tribe, if such resources are subject to a trust restriction on alienation.

Claims may be pursued by the trustees for injury to, destruction of, or loss of natural resources against parties that have been identified as potentially responsible for the release of hazardous substances. The damages received will be used to restore, rehabilitate, replace, and/or acquire the equivalent natural resources to those harmed by the hazardous substance releases.

The natural resource trustees who participated in the preparation of this PAS include the DOI, the Cherokee Nation, the Delaware Tribe of Indians and the Osage Nation (collectively the "Trustees"). Other governmental entities also may be natural resource Trustees but are not participating in this PAS.

Osage Nation - Trusteeship

The Osage Nation's historic area and jurisdictional area encompasses 1,470,000 acres, which coincides with Osage County, Oklahoma. The NZC/ZCA Facility is located just east of the Osage Nation territory. The Osage Nation territory and jurisdiction are established and described in Article II and Article XV, Section 1 of the Constitution of the Osage Nation (ratified March 11, 2006, and signed on May 6, 2006) and in the Osage Nation Environmental and Natural Resources Conservation Act (adopted by Resolution No. 30-906, November 15, 2000)

Cherokee Nation - Trusteeship Based on Treaty Boundaries

By the Treaty with the Cherokee, May 6, 1828, 7 Stat. 311, the United States secured, to be conveyed by patent, some seven million acres in Oklahoma (west of the Arkansas territory,

east and south of the location of the Seneca tribe to Grand Lake, west of the Choctaw land base, and west of the Osage land base), as well as an "outlet" securing "free and unmolested use of the Country lying West. . ." of the described land base. Id. at Art. 2. See also Treaty with the Western Cherokee, Feb. 14, 1833, 7 Stat. 414, Art. I (supplementary to the Treaty of 1828). The Treaty with the Cherokee of New Echota, Dec. 29, 1835, 7 Stat. 478, Art. 2, confirmed this acreage and also promised an option of an additional 800,000 acre tract of land between the Missouri border and east and south of the Osage Reservation if the original seven million acres proved insufficient to accommodate the whole Nation. Id. The Nation subsequently took that option on additional land. Treaty with the Cherokee, Aug. 6, 1846, 9 Stat. 871, Art. 1. The Cherokee land base was deeded in a December 31, 1838 patent from the United States.

2.0 Information on the NZC/ZCA Facility and the Release of Hazardous Substances

This section summarizes readily available information reviewed by the Trustees related to the release of hazardous substances from the NZC/ZCA Facility. It should be noted that the Trustees may identify or collect additional information to adequately define the nature and extent of contamination and injuries associated with the hazardous substance released from the NZC/ZCA Facility to the environment.

2.1 Timing, Quantity, Duration, and Frequency of Releases

Smelter operations at the NZC/ZCA Facility began in 1907. While there is no air emission data for the NZC/ZCA Facility, it has been estimated that the NZC/ZCA Facility smelter discharged approximately 1,500 tons (three million pounds [lbs]) of particulate matter per year into the ambient air prior to 1976 (EPA 1993A). A review of the EPA Toxic Chemical Release Inventory database indicated the NZC/ZCA Facility/Zinc Corporation of America released an average of 3,429 lbs of lead, 1,474 lbs of cadmium, and 23,600 lbs of zinc into the air each year from 1987 to 1991 (EPA 1987).

2.2 Description of the Hazardous Substances Released

The NZC/ZCA Facility has been the subject of prior studies and investigations which have revealed elevated heavy metal concentrations in several potential media including, but not limited to: air, soils, surface waters and associated sediments, and groundwater.

The Trustees have reviewed relevant information which indicates that contaminants of potential concern (CoPCs) have been released from the NZC/ZCA Facility. These CoPCs include, but are not limited to, arsenic, cadmium, copper, lead, mercury, selenium, silver, sulfuric acid and zinc (see Table 2.1 - Chemicals of Potential Concern at NZC/ZCA Facility). These CoPCs are hazardous substances as listed in Federal regulations found at 40 C.F.R. § 116.4 and as toxic pollutants pursuant to 40 C.F.R. Part 401.15, as amended.

Table 2-1 Chemicals of Potential Concern at the NZC/ZCA Facility

	CHEMICALS OF POTENTIAL CONCERN							
Media	Arsenic	Cadmium	Copper	Lead	Mercury	Selenium	Silver	Zinc
Terrestrial								
Soil	X	X	X	X	X	X	X	X
Vegetation	X	X	X	X	X	X	X	X
Invertebrates	X	X	X	X	X	X	X	X
Small mammals	X	X	X	X	X	X	X	X
Aquatic								
Sediment	X	X	X	X	X	X	X	X
Surface water		X		X		X		X
Algae	X	X	X	X	X	X	X	X

Invertebrate tissue	X	X	X	X	X	X	X	X
Fish tissue	X	X	X	X	X	X	X	X

PTI 1994.

2.3 History, Current/Past Use, and Relevant Operations of the NZC/ZCA Facility

The NZC Facility began operations in 1907, primarily to recover metals such as zinc, cadmium, and lead for industrial materials. NZC used smelting and chemical processing to recover these metals. In addition to the NZC smelter, a vanadium smelter (closed in the mid-1980s) and two other zinc smelters (closed in the 1920s) have operated on the location that presently encompasses the current NZC Facility. ZCA purchased the NZC Facility in 1987 where they continued the recovery and processing operations (ATSDR 1991).

No stack monitoring (air emission) data are available for the operational activities that occurred at the NZC/ZCA Facility in the past. The only air emission control used by the NZC smelter prior to 1969 was a limited sulfuric acid recovery operation built in 1927. The chemical makeup of the particulate matter found in the stack emissions included the metals detected in the remedial investigations, primarily cadmium, lead, and zinc (U.S. HHS 1995). A more efficient acid recovery operation, which reduced the sulfur dioxide emissions, replaced the old sulfuric acid recovery plant in 1969. An electrostatic refining process that replaced the NZC horizontal retort furnaces in 1976 reduced particulate stack emissions (ATSDR 1991).

2.4 Additional Hazardous Substances Potentially Released from the NZC/ZCA Facility

Besides the particulate and metal discharges, the NZC/ZCA facility discharged sulfur dioxide into the ambient air in July 1977 (EPA 1978). This malfunction resulted in an increase of sulfur dioxide into the atmosphere than was permitted. From reference material (ATSDR 1999) it is known that sulfur dioxide converts to sulfuric acid, a hazardous substance found in the Federal regulations at 40 C.F.R. § 116.4. Residents near the NZC/ZCA Facility reported to the EPA that vegetation damage and human respiratory damage occurred because of the malfunction. EPA concluded that long-term emissions from the NZC/ZCA may have injured local plants and exposed individuals to elevated levels of sulfuric acid in the ambient air (U.S. HHS 1995).

2.5 Potentially Responsible Parties (PRPs)

The following parties are potentially responsible for the elevated concentrations of heavy metals at the National Zinc NRDA site: Cyprus Amax Minerals Company (wholly incorporated by Phelps Dodge Inc. Phelps Dodge was bought out by Freeport MacMoRan Inc in 2007), Salomon Incorporated, Fluor Corporation, Horsehead Corporation, Morgan Stanley Smith Barney, Union Pacific Railroad, Burlington Northern Santa Fe (BNSF), Southern Kansas and Oklahoma Railroad (SK&O Railroad), Watco, St. Joe Minerals Corporation, and the City of Bartlesville. Other parties responsible for the hazardous substances may be discovered during the Assessment Phase of the NRDA process and added to the list of PRPs.

3.0 Regulatory History

3.1 Past Remedial and Response Actions Taken

On May 10, 1993, the EPA proposed that the NZC/ZCA Facility be placed on the NPL. The EPA designated the NZC/ZCA Facility as those areas that had concentrations of lead, cadmium, or arsenic in the soil, which exceed the established remediation levels, within an approximate three mile radius of the Zinc Corporation of America facility. The NZC/ZCA Facility were addressed by EPA pursuant to the Resource Conservation and Recovery Act of 1976 (RCRA), as amended, under a Consent Order with the current owners and operator of the NZC/ZCA Facility (EPA 1997).

The EPA and the Oklahoma Department of Environmental Quality (ODEQ) signed a Memorandum of Understanding (MOU) to conduct a national pilot project to complete a CERCLA quality investigation and remediation of the NZC/ZCA Facility under state authority. EPA agreed to not make a final determination to list the NZC/ZCA Facility on the NPL as long as the pilot project proceeded in a timely manner and meets the requirements of CERCLA and the National Contingency Plan. (ODEQ 1994A)

A remedial investigation and feasibility study (RI/FS) was conducted by PTI Environmental Services (PTI) on behalf of the PRPs. The RI/FS was conducted pursuant to a Consent Agreement and Final Order for Remedial Investigation, Feasibility Study, and Remedial Design (RI/FS/RD) (Case No. EH 94 106) issued by ODEQ (EPA 1994B).

The Record of Decision (ROD) for Operable Unit 1 (OU1) was signed in December 1994, which focused on residential, commercial, and industrial areas (EPA 1994B). Based on the results of the OU1 RI/FS, remediation actions and preliminary remediation goals were established for soil and sediment media. In August 1995, ODEQ and the PRPs signed a consent agreement followed with the implementation of the remedial action work plan. By August 1999, remedial actions for OU1 were substantially completed except for a limited area of railroad properties identified in the Consent Agreement (EPA 1994B). In February 2011, the ODEQ issued a letter approving the Remedial Action Completion final report for the Operable Unit 1 (ODEQ 2011).

In 1995, a baseline ecological risk assessment (ERA) was conducted as part of the RI/FS/RD for Operable Unit 2 (OU2). OU2 addressed the ecological and agricultural areas at the NZC/ZCA Facility. The ERA indicated potential risks to ecological receptors associated with aquatic exposure to cadmium, lead, selenium, and zinc in certain portions of the remediation area (EMC^2 2002). The ROD for OU2 was signed by the State in October 1996. The focus of the ROD was to prevent impacts to aquatic ecology caused by stream sediments having elevated concentrations of the OU2 CoPCs (EMC^2 2001). The remediation actions called for excavating sediments contaminated with CoPCs from the North and West tributaries that drained the smelter property. Ecological impacts to downstream areas were expected to recover by natural attenuation once the selected sediments were removed from the upper reaches of the draining tributaries and after control measures were implemented at the smelter. ODEQ and EPA concluded that

groundwater evaluations were to be limited to within the NZC/ZCA boundary and no further action on groundwater was required as part of OU2. Remedial actions of the impacted sediments at OU2 were completed in August 1999 (EMC^2 2002).

In order to address the contamination at the former NZC/ZCA Facility, EPA issued a RCRA corrective action in August 1993 which required the owners of the NZC/ZCA Facility to develop and implement cleanup procedures for the contamination. Subsequently, the owners conducted ambient air monitoring near residue piles and investigated whether groundwater contamination found at the NZC/ZCA Facility had migrated off the NZC/ZCA Facility property (Roberts/Schornick 1994, Zinc Corporation of America 1994). The results of the ambient air monitoring indicated that the interim dust suppression method, enacted by the NZC/ZCA Facility owners, was preventing any significant emissions from the residue piles (Roberts/Schornick 1994). The owners of the NZC/ZCA Facility also sampled the groundwater under the NZC/ZCA Facility from 36 groundwater monitoring wells (EPA 1993B). These samples were analyzed for total metals (arsenic, antimony, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, silver, selenium, thallium, tin, vanadium, and zinc). The results of the analyses were reported in the RCRA permit application submitted by the owners of the NZC/ZCA Facility (ATSDR 1995).

4.0 Preliminary Identification of Resources Potentially at Risk

4.1 Preliminary Identification of Pathways

For a period of approximately 70 years beginning in 1907, air emission discharges containing heavy metals emanated from the NZC/ZCA Facility to the surrounding areas. These surrounding areas have been contaminated by the heavy metal particulates and have accumulated into the surrounding ecosystem.

4.1.1 Air Pathways

The historic unrestricted air emissions across the National Zinc NRDA site are the primary mechanism of dispersal for the hazardous substances. Exhaust from the smelters released volatilized and fine particles of metals in dust directly into the air where they were transported and later deposited over the surrounding land and surface water. However, metals concentrations measured in the air from sampling in the mid to late 1990's have not exceeded present regulatory limits (EPA 1997). These findings coincide with newer amendments made to the Clean Air Act in 1990 which added provisions relating to the reduction of toxic air pollutants, acid rain, and ozone depletion (EPA 2007).

4.1.2 Soil Pathways

Aerial deposition of heavy metal particulates has directly contaminated the soils at the National Zinc NRDA site. After several screening steps during the RI/FS/RD investigation, eight metals were considered to be suitable soil CoPCs. These include arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc (PTI 1994). These hazardous substances were transferred to soils near the smelters by deposition and may have been transported to other soils by wind and water erosion.

Soils make up an integral component of the terrestrial habitat for biological resources such as plants, soil invertebrates, and wildlife. These resources may be exposed to these hazardous substances in soils through a number of subsequent pathways including dermal absorption, uptake by inhalation, or ingestion.

4.1.3 Surface Water Pathways

Surface waters at the National Zinc NRDA site have been directly exposed to metals through aerial deposition, erosion of contaminated soils and through movement and re-suspension of contaminated sediments. The surface water pathway(s) have contributed to heavy metal loadings to the North Tributary, the West Tributary, and parts of Eliza Creek (see Appendix A Figure 1.1 Location Map for National Zinc Site). The CoPCs identified in surface waters through the RI/FS/RD include, cadmium, lead, selenium, and zinc. An aquatic exposure analysis demonstrated that these CoPCs are bio-available in those areas and are being bio-accumulated to concentrations above reference values (PTI 1994).

Surface waters include lakes, rivers, ponds, streams, and wetlands but also include sediments suspended in water or lying on the bank, bed, or shoreline (43 C.F.R. § 11.14). Surface water is an integral component of the aquatic habitat. Biological resources such as aquatic plants, invertebrates and wildlife may be exposed to hazardous substances in surface through a number of subsequent pathways including dermal absorption, uptake by inhalation, or ingestion.

4.1.4 Sediment Pathways

Sediment contamination has occurred at the National Zinc NRDA site by the deposition of hazardous substances from smelters to sediments (settlable solids), precipitation of hazardous substances from surface water (dissolved fraction), and erosion from contaminated soils. These contaminated sediments can serve as an ongoing source of contamination to the National Zinc NRDA site. Sediment CoPCs were identified in the RI/FS/RD based on the magnitude and spatial extent of the contaminant concentrations. These include arsenic, cadmium, copper, lead, mercury, selenium, silver, and zinc. These metals were found relatively widespread throughout the National Zinc NRDA site with concentrations above reference values (PTI 1994).

Sediments are an integral component of the aquatic habitat. Biological resources such as aquatic plants, invertebrates and wildlife may be exposed to hazardous substances in sediments through a number of subsequent pathways including dermal absorption, uptake by inhalation, or ingestion.

4.1.5 Groundwater Pathways

Shallow groundwater could transport metals from the NZC/ZCA Facility to the surface waters south of the NZC/ZCA Facility. Shallow groundwater flow direction in the study area of the ERA appears to be controlled by both the bedrock surface elevation as well as groundwater discharges to the North and West tributaries. Piezometric data indicates that shallow groundwater discharges primarily into the North Tributary and to a lesser extent into the West Tributary (PTI 1994). Additional information on groundwater contamination will be gathered during the Assessment Phase of the NRDA process.

Groundwater at the National Zinc NRDA site is not used for drinking water because aquifers under the National Zinc NRDA site yield only small amounts of poor quality water due to natural geologic conditions and historical oil production activities (EPA 1997).

4.1.6 Food Chain Pathways (bio-accumulation)

Hazardous substances at the National Zinc NRDA site have accumulated in abiotic media and have been transferred through the food chain by dermal contact or ingestion of soil, sediment, surface water, and prey. Analyses of CoPCs in above ground parts of plants and whole-body samples of invertebrates and small mammals demonstrated that CoPCs are

bio-available and are being bio-accumulated to concentrations above reference values (PTI 1994).

Potential terrestrial receptor species include native grasses and annual forbs, invertebrates, small mammal communities (e.g. hispid cotton rat and white-footed mouse), and raptors (e.g. red-tailed hawks, owls). Potential aquatic receptor species include benthic macro-invertebrate assemblages (e.g. gastropods, crayfish, and various insect larva), several fish communities (e.g. mosquitofish, sunfish, spotted and largemouth bass), and piscivorous birds such as great blue herons and belted kingfishers.

4.2 Exposed Areas

4.2.1 Exposed Soil Estimates and Concentrations

Soils, categorized as a geologic resource, provide ecological services such as habitat for soil organisms, the nutrients and water holding capacity necessary to sustain vegetative cover, and substrate for litter decomposition. Soils are essential for the cycling of elements, minerals, and nutrients through the environment. The soils at the National Zinc NRDA site are important in providing a medium for vegetation, invertebrates, microbes, and other biota that migratory birds and other wildlife need for forage and prey. Since the soils were highly contaminated at the National Zinc NRDA site, the potential to expose the other biological resources and surface water to the contamination is highly likely.

Injury to terrestrial soils has occurred when concentrations of a hazardous substance are sufficient to cause:

> *Injury...to surface water, groundwater, air, or biological resources when exposed to the substances (43 C.F.R. 11.62(e)(11)).*

CoPC concentrations of arsenic, chromium, copper, lead, mercury, selenium, silver, and zinc found in the soils from the ERA study area generally exceeded background concentrations (see Appendix A – Figure: 4.1a and 4.1b - Concentrations of CoPCs in Soil).

Soil concentrations of several CoPCs were correlated with whole-body tissue concentration of the hispid cotton rat. Cadmium, lead, and zinc concentrations in whole-body samples were significantly correlated with their respective concentrations in soil. Metals in soils may have also affected species richness in plant communities in the area (PTI 1994).

4.2.2 Exposed Surface Water Estimates and Concentrations

Surface water resources at the National Zinc NRDA site provide ecological services such as habitat for aquatic biota and a water supply for the vegetation. Under the NRDA

regulations, injury to surface water from the release of hazardous substances has occurred when concentrations and the duration of exposure to substances are:

> *In excess of applicable water quality criteria established by...the CWA, or by other Federal or State laws or regulations, in surface water that before the...release met the criteria and is a committed use...as a habitat for aquatic life, water supply, or recreation (43 C.F.R. 11.62(b)(iii)).*

The CoPCs for the aquatic environment include, but are not limited to, cadmium, lead, selenium, and zinc (see Table 4.1 - Concentrations of CoPCs in Whole Water Samples).

The ERA showed the highest concentrations of cadmium, selenium, and zinc present in the North Tributary and declined in downstream areas. Lead concentrations, however, were elevated in most parts of the Eliza Creek drainage system, including the West and North tributaries and the main channel of the creek both upstream and downstream from the confluence with the North Tributary. Exceedances of the Oklahoma Water Quality Standards (OWQS) were found at 14 stations in the ERA study area. As a component of EPA's ambient toxicity monitoring program, the ODEQ collected surface and sediment samples from the North Tributary of Eliza Creek. Toxicity tests were performed on the ODEQ samples where significant effects were observed in all of the reproductive toxicity tests (six out of six) performed using *Ceriodaphnia* (PTI 1994).

Table 4-1 Concentrations of CoPCs in Whole Water Samples compared with Surface Water Screening Benchmark Values

Metals	Reference Value[1] (µg/L)	Min. Conc. (µg/L)	Max. Conc. (µg/L)	EPA Acute Surface Water Screening Values[2] (µg/L)	EPA Chronic Surface Water Screening Values[2] (µg/L)	TNRCC Surface Water Screening Values[3] (µg/L)
Cadmium	0.04	0.06	398.0	1.79	0.66	0.6
Lead	0.68	1.0	13.6	33.78	1.32	1.0
Selenium	2.1	1.1	23.3	20.0	5.0	5.0
Zinc	3.7	22.2	15,600.0	65.04	58.91	58.1

[1] PTI 1994
[2] EPA 2001.
[3] Texas Natural Resource Conservation Commission 2001.

4.2.3 Exposed Sediment Estimates and Concentrations

Sediments provide ecological services such as habitat for benthic organisms and substrate for aquatic vegetation. Benthic flora and fauna are integral to maintaining the structure and function of the aquatic ecosystem (e.g. base of the aquatic food web) and play a vital role in ecosystem energy and nutrient cycling. Injury to sediments is defined as a component of injury to surface water resources, and has occurred when:

> *Concentrations and duration of hazardous substances [are] sufficient to have caused injury...to groundwater, air, geologic, or biological resources, when*

exposed to surface water, suspended sediments, or bed, bank, or shoreline sediments (43 C.F.R. 11.62(b)(1)(v)).

The highest concentrations of the eight sediment CoPCs were found in the North Tributary where concentrations declined in downstream areas with increasing distance from the North Tributary. Concentrations in the lower West Tributary were also substantially elevated (PTI 1994). Potential injury to sediments was determined by comparing sediment concentrations at the National Zinc NRDA site and several difference sediment screening benchmarks. These include the MacDonald *et al.* (2000) consensus-based Threshold Effects Concentration (TEC) and the Probable Effects Concentrations (PEC) levels where the TEC is a sediment concentration below which harmful effects to aquatic biota are unlikely to be observed in freshwater ecosystems. The PEC is a sediment concentration above which harmful effects to aquatic biota are likely to be observed. The ecological screening benchmarks for freshwater sediments from U.S. EPA Region 6 were also compared with sediment concentration data from the National Zinc NRDA site (see Table 4.2 – Concentrations of CoPCs in Sediments compared with Freshwater Sediment Screening Benchmark Values). The exceedances of sediment values taken from the National Zinc NRDA site compared to the sediment screening benchmark values provides a reasonable basis for determining that sediments are injured at the National Zinc NRDA site.

Table 4-2 Concentrations of CoPCs in Sediments compared with Freshwater Sediment Screening Benchmark Values

Metals	Mean Reference Value[1] (mg/kg)	Min. Conc. Value[1] (mg/kg)	Max. Conc. Value[1] (mg/kg)	Consensus TEC Levels[2] (mg/kg)	Consensus PEC Levels[2] (mg/kg)	TNRCC Freshwater Sediment Screening Values[3] (mg/kg)
Arsenic	8.2	1.4	78.0	9.79	33.0	5.9
Cadmium	0.8	1.6	929.0	0.99	4.98	0.596
Copper	16.8	1.9	264.0	31.6	149.0	35.7
Lead	25.5	4.4	900.0	35.8	128.0	35.0
Mercury	0.03	0.02	2.4	0.18	1.06	0.174
Selenium	0.4	0.34	80.0	--	--	--
Silver	0.55	0.68	7.8	--	--	1.0
Zinc	105.0	27.7	11,900.0	121.0	459.0	123.0

[1] PTI 1994
[2] MacDonald *et al.* 2000
[3] Texas Natural Resource Conservation Commission 2001.

4.3 Potentially Affected Resources and Resource Services

The natural resources potentially affected by the hazardous substances include surface water, soils, sediments, groundwater, and biotic resources. Some of these resources include threatened and endangered species, migratory birds and their habitats protected by the DOI

and tribal resources and resource services. These trust resources exist, or formerly existed, within the National Zinc NRDA site. Potentially affected trust resources include, but are not limited to:

- Surface waters and sediments including, riverine, riparian, and wetland habitats at the National Zinc NRDA site;
- Riparian, terrestrial, and aquatic plant and animal species at the National Zinc NRDA site;
- Geologic resources (soils) including Tribally owned Indian lands (or lands held in trust) at the National Zinc NRDA site;
- Air resources at the National Zinc NRDA site;
- Migratory and non-migratory birds.

Natural resource services are defined as "the physical and biological functions performed by the resources including the human uses of those functions. These services are the result of the physical, chemical, or biological quality of the resource (43 CFR § 11.14(nn)). The services that the Trustees believe have been potentially impaired or lost from resource injuries from the releases at the NZC/ZCA Facility include, but are not limited to:

- Beneficial uses of surface waters and associated sediments including fish and wildlife propagation and recreation (fishing);
- Beneficial uses of groundwater including irrigation for plants and other uses;
- Riverine habitat functions such as fish and wildlife propagation, nutrient cycling, and contaminant sequestration;
- Agricultural production, plant habitat, and native plants;
- Terrestrial habitat for migratory birds;
- Plant and animal species that are culturally significant to the Cherokee Nation, Delaware Tribe of Indians and Osage Nation.

Hazardous substances are present at concentrations sufficient to cause toxicity to food organisms, which indirectly reduce the ability of the surrounding ecosystem to provide supporting services required by trust natural resources. Fishing is conducted on Eliza and Sand Creeks (tributaries to the Caney River). In addition, the flood plain of Sand Creek is actively mined for sand. The Caney River, a major navigable waterway, flows through the center of Bartlesville and is used for recreation and fishing. These resources and resource services have been potentially affected by the contaminant releases (ATSDR 1995).

5.0 Preliminary Determination Regarding Preassessment Screen Criteria

Criterion #1: A discharge of oil or release of a hazardous substance has occurred [43 C.F.R. § 11.23(e)(1)].

The Trustees have reviewed readily available information indicating that hazardous substances have been released from the NZC/ZCA Facility into the surrounding environment. These hazardous substances include arsenic, cadmium, copper, lead, mercury, selenium, silver, sulfuric acid and zinc.

Criterion #2: Natural resources for which the Trustees may assert trusteeship under CERCLA have been or are likely to have been adversely affected by the release [43 C.F.R. § 11.23(e)(2)].

Natural resources for which the Trustees may assert trusteeship under CERCLA that have been or are likely to have been adversely affected by the hazardous substance releases include, but are not limited to, migratory birds, federally-listed threatened and endangered species, and their supporting ecosystems and culturally significant resources of the Cherokee Nation, Delaware Tribe of Indians, and Osage Nation.

Criterion #3: The quantity and concentrations of the released hazardous substances are sufficient to cause or potentially cause injury to natural resources [43 C.F.R. § 11.23(e)(3)].

The remedial investigations, performed by the ODEQ and EPA, revealed that soil, sediment, surface water, and other media are contaminated by hazardous substances, in elevated concentrations, over a relatively widespread area surrounding the NZC/ZCZ Facility. The elevated concentrations of contaminants in sediment samples after remediation widely exceed published sediment quality toxicity guidelines and have the potential to injure natural resources and resource services in the area.

Criterion #4: Data sufficient to pursue an assessment is readily available or likely to be obtained at a reasonable cost [43 C.F.R. § 11.23(e)(4)].

Data gathered by previous studies and investigations is readily available and useful for the injury assessment. The data from EPA and ODEQ's field investigations and remedial actions provide pre- and post-remedial data. Other information from EPA records will also be helpful in documenting the release of hazardous substances. Additional studies and data collections will be necessary to effectively determine the extent and nature of the injuries to other natural resources and resource services. This will be accomplished in the Assessment Phase of the NRDA process.

Criterion #5: Response actions, if any, carried out or planned, do not or will not sufficiently remedy the injury to natural resources without further action [43 C.F.R. § 11.23(e)(5)].

The sediment toxicity levels that were achieved through remediation of OU2 exceed published scientific literature guidelines regarding sediment toxicity levels for freshwater ecosystems. Furthermore, the response actions that were taken do not fully address the injuries to vegetation, aquatic and terrestrial wildlife, threatened or endangered species, migratory birds, or culturally significant resources of the Cherokee Nation, Delaware Tribe of Indians and Osage Nation from the historic, cumulative, and long-term exposures. It is the opinion of the Trustees that there is a potential for continued injury to natural resources and their supporting ecosystems at the National Zinc NRDA site

6.0 Conclusions

Following the review of information described in this Preassessment Screen, the Trustees have determination that the criteria specified in the NRDA regulations, 43 C.F.R. Part 11, have been met. The Trustees have determined that the remedial actions carried out at the NZC/ZCA Facility do not or will not sufficiently remedy the injuries to natural resources without further restoration actions. The Trustees have also determined that there is a reasonable probability of making a successful claim for damages with respect to natural resources over which the Trustees can exhibit trusteeship. Therefore, it has been determined by the Trustees that an assessment of natural resource damages is warranted.

Pre-Assessment Screen Determination – Osage and Washington counties, Oklahoma

Approval Signature:

Date: 7/23/12

Principal Chief, Cherokee Nation

Pre-Assessment Screen Determination – Osage and Washington counties, Oklahoma

Approval Signature:

Date: 8/10/11

Principal Chief John D. Red Eagle, Osage Nation

Pre-Assessment Screen Determination – Osage and Washington counties, Oklahoma

Approval Signature:

Date: 8/18/2011 Paula Pechonick
Principal Chief, Delaware Tribe of Indians

Pre-Assessment Screen Determination – Osage and Washington counties, Oklahoma

Approval Signature:

Date: 10/3/2011 Joy E. Nicholopoulos

Regional Director, Region 2
U.S. Fish and Wildlife Service
Authorized Official for the Department of the Interior

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Appendix A- Figures

Figure 1-1 Location Map for National Zinc Remediation Site

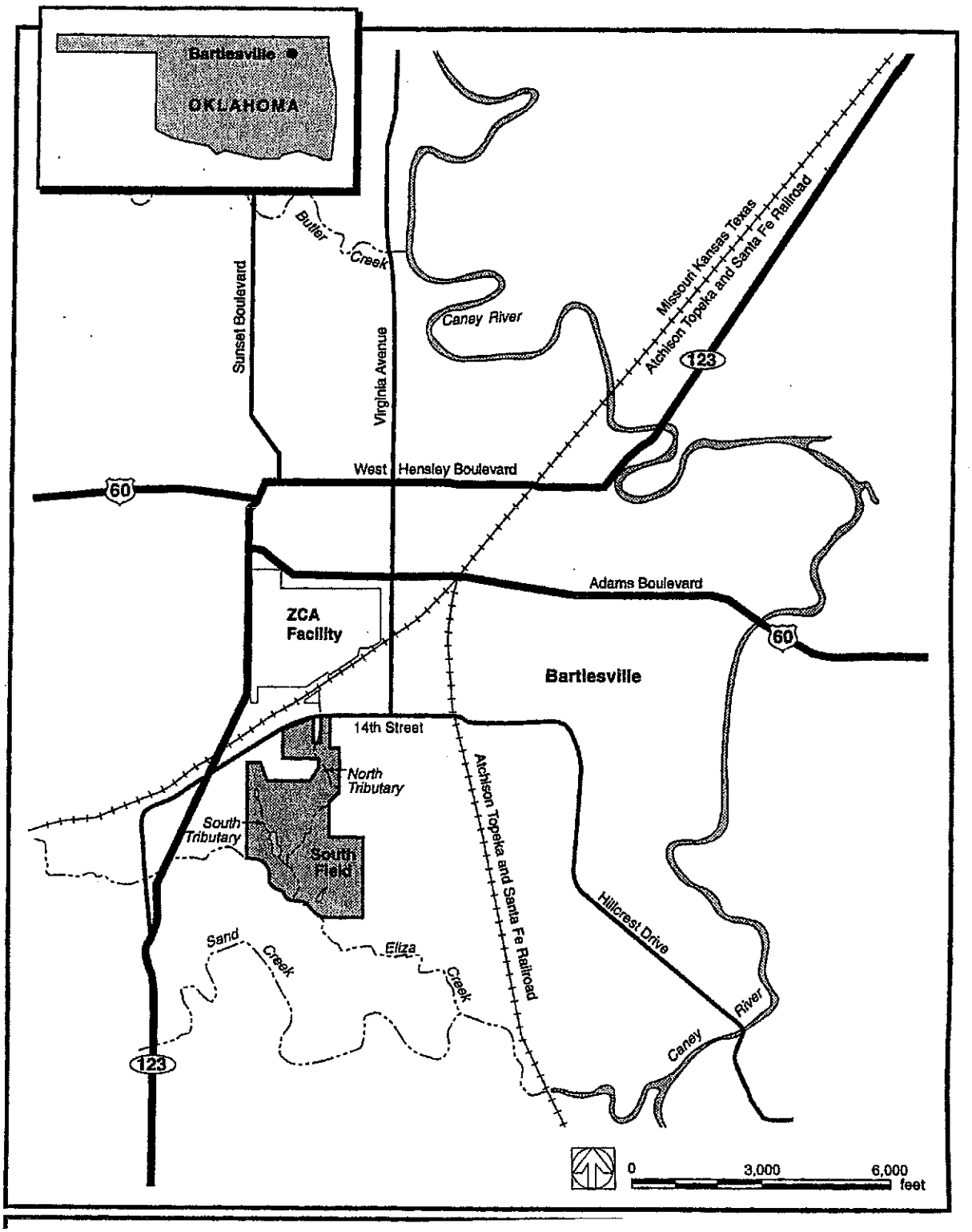

Figure 4-2 a Concentrations of CoPCs in Soils at NZC/ZCA Facility (1 of 2)

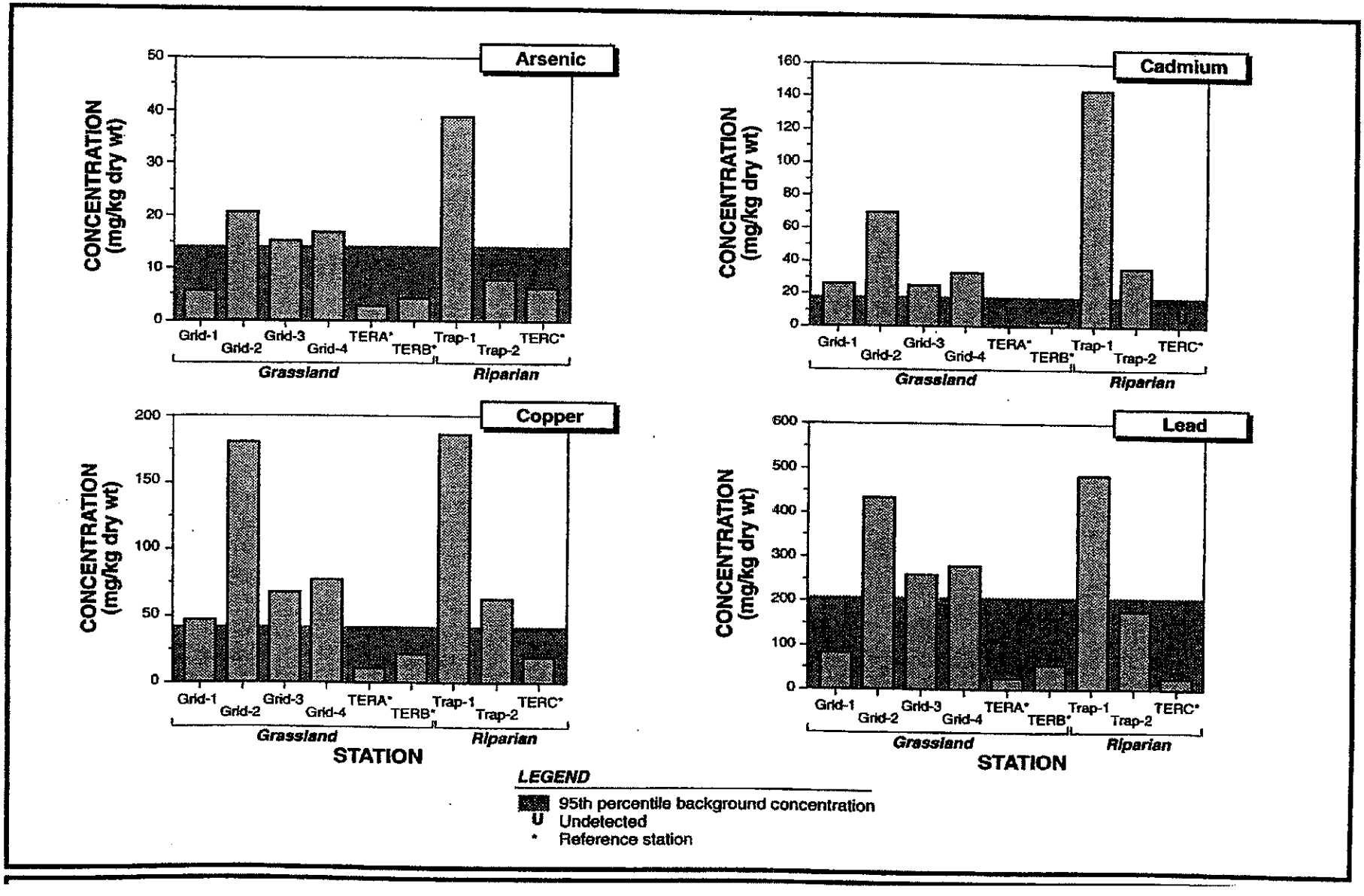
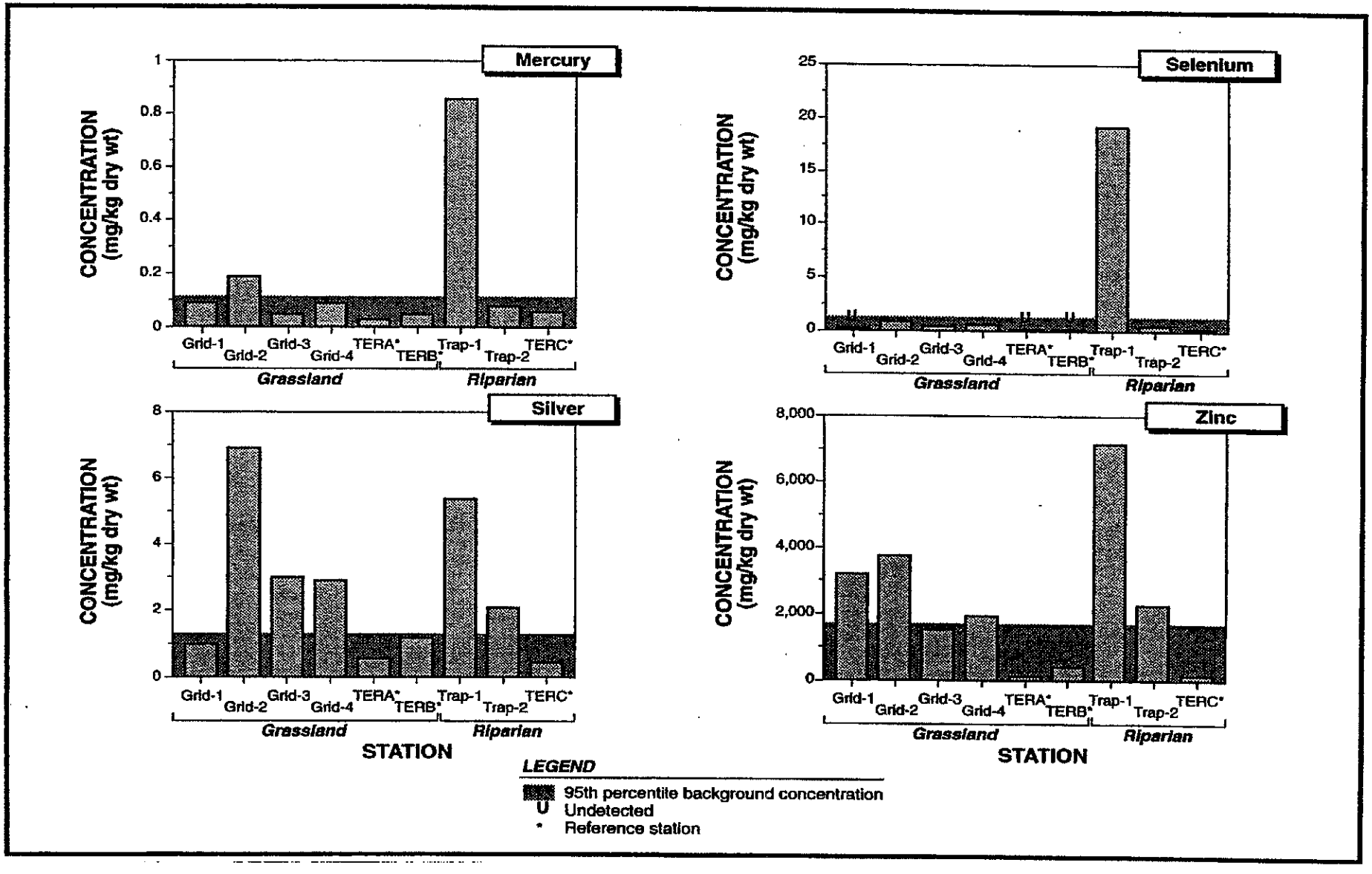
Figure 4-3 b Concentrations of CoPCs in Soils at NZC/ZCA Facility (2 of 2)