Preassessment Screen Determination for the Palmerton Zinc Pile Superfund Site

Issued by:

Pennsylvania Department of Conservation and Natural Resources;
Pennsylvania Department of Environmental Protection;
Pennsylvania Fish and Boat Commission;
Pennsylvania Game Commission;
United States Department of Commerce and;
United States Department of the Interior
in their Capacity as Trustees of Natural Resources

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1.0 INTRODUCTION

Pursuant to the authority of section 107(f) of the Federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended, 42 U.S.C. section 9607(f), and other applicable Federal and state laws, designated Federal and state authorities may act on behalf of the public as natural resource trustees to pursue claims for natural resource damages for injury to, destruction of, or loss of natural resources resulting from the release of hazardous substances to the environment. Claims may be pursued against parties that have been identified as responsible for releasing hazardous substances to the environment. Under CERCLA, sums recovered by trustees as damages shall be used only to restore, replace, or acquire the equivalent of such natural resources.

The first step in developing a natural resource damages claim is the preparation of a preassessment screen. The purpose of a preassessment screen is to provide a review of readily available information on hazardous substance releases and the potential impacts of those releases on natural resources to permit a determination as to whether or not a natural resource damage assessment is warranted. The review should ensure that there is a reasonable probability of making a successful claim against parties responsible for releasing hazardous substances to the environment.

This preassessment screen addresses potential claims for natural resource damages for injury to, destruction of, or loss of natural resources resulting from the release of hazardous substances at, to, or from the Palmerton Zinc Pile Superfund site. It was prepared in accordance with the preassessment screen provisions of the Federal regulations for Natural Resource Damage Assessments under CERCLA, 43 CFR Part 11, Subpart B, sections 11.23 through 11.25 (USDOI 1994). The natural resource trustees for the Palmerton Zinc Pile site who have participated in the preparation of this preassessment screen include the Secretary of the Pennsylvania Department of Conservation and Natural Resources (PDCNR), the Secretary of the Pennsylvania Department of Environmental Protection (PDEP), the Executive Director of the Pennsylvania Game Commission (PGC), the Executive Director of the Pennsylvania Fish and Boat Commission (PFBC), the Secretary of the United States Department of Commerce, acting through the National Oceanic and Atmospheric Administration (NOAA), and the Secretary of the United States Department of the Interior (DOI), acting through the Regional Director, Fish and Wildlife Service, Region 5 (FWS) (collectively the "Trustees").

A review of readily available information documents releases of many hazardous substances (e.g., arsenic, cadmium, copper, lead, zinc) to several thousand acres on and adjacent to Blue Mountain (including approximately 2,000 acres that were totally denuded of vegetation), Aquashicola Creek, and the Lehigh River from identified sources. The documented effects of these releases on natural resources for which Federal and state agencies may assert trusteeship under section 107(f) of CERCLA, ensures that there is a reasonable probability of making a successful claim against an identified potentially responsible party for natural resource damages.

Specifically, the Trustees have determined that:

(1) A release of a hazardous substance has occurred;
(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;
(3) The quantity and concentration of the released hazardous substance is sufficient to potentially cause injury to natural resources;
(4) Data sufficient to pursue an assessment are readily available or likely to be obtained at a reasonable cost; and,
(5) Response actions, if any, carried out or planned do not or will not sufficiently remedy the injury to natural resources without further action.

1.1 Description of the Affected Environment

The Palmerton Zinc Pile Superfund site is located in the Ridge and Valley Province of Carbon, Lehigh, and Northampton Counties Pennsylvania. The Palmerton valley is bordered by Blue Mountain to the south, Stony Ridge to the north, and is cut through by the Lehigh River to the west of the Borough of Palmerton (Figures 1, 2). Aquashicola Creek drains the majority of the site, flowing in a southwest direction through the town of Palmerton and joining the Lehigh River at the Lehigh Gap. Over ninety years of smelting operations emitted large quantities of metals that were wind carried and deposited over surrounding areas, resulting in defoliation of thousands of acres throughout this ridge and valley area of eastern Pennsylvania (USEPA 1987). The National Park Service owns and maintains approximately 800 acres of land that has been acquired to protect the Appalachian National Scenic Trail, which winds along the Blue Mountain ridge and through the associated gaps of the area. The Pennsylvania Game Commission also owns several thousand acres of potentially affected State Game Lands on Blue Mountain.

The Palmerton Zinc Pile site was divided into Four Operable Units (OU's) by USEPA: OU1 - Blue Mountain; OU2 - A 2.5 mile long, 32 million ton residual waste cinder bank; OU3 - the residences and yards of the residents of Palmerton Borough, Village of Aquashicola and Lower Towamensing Township; and, OU4 - Surface water, groundwater, and ecological risk for the entire site. A description and discussion of the regulatory actions at each of the four OU's of the site can be found in Section 2.5.

2.0 INFORMATION ON THE SITE AND ON THE RELEASE OF HAZARDOUS SUBSTANCES

As described below, the Trustees have obtained and reviewed readily available information concerning releases of heavy metals to the air, soil, and water resources of the Palmerton Zinc Pile Superfund site.

2.1 Time, Quantity, Duration and Frequency of Releases

A variety of studies over the last three decades have documented elevated levels of heavy metals, which are hazardous substances, in the Palmerton environment. As a result, the United States Environmental Protection Agency (EPA) placed the site on the National Priorities List in September 1983. In examining the site, EPA has determined that the primary contributors of these heavy metals to the Palmerton landscape were two former ore smelting plants (USEPA 1987; USEPA 1993), one of which is currently operated as a hazardous waste recycling facility, primarily using electric arc furnace (EAF) dust (USEPA 2002a).

The EPA has reported that excessive air emissions from the two smelting plants caused the defoliation on the surrounding mountains (USEPA 1987). Over the years, various sources at the smelters have emitted varying amounts of heavy metals. It has been estimated that total emissions of cadmium, lead, and zinc were 3,740, 7,560, and 286,000 tons, respectively (EPA 1987). Using these estimates as a baseline, EPA estimated that the average emission rates of cadmium, lead, and zinc for the period of 1900 to 1979 was 47, 95, and 3,575 tons/year, respectively. The time period from 1970 to 1979 was estimated to have the highest emission rates at 105 tons/year of cadmium, 322 tons/year of lead, and 4,800 tons/year of zinc.

Additional ongoing releases contributing contamination to the environment include the cinder bank, Blue Mountain, and drainage ditches emanating from the defunct west plant (USEPA 2001), and may also include the existing metals recycling facility (USEPA 1993). There remain significant discharges to surface water and groundwater. In March 1986, runoff samples from seeps, springs, and surface drainages were analyzed and showed levels of cadmium, lead and zinc up to 20 times the USEPA ambient water quality criteria (USEPA 1987). A study conducted by Horsehead Resource Development Corporation (HRDC 1987) concluded that rainwater infiltration and surface water infiltration were leaching metals from the cinder bank resulting in a contribution of 80-95 percent of the metals loading to Aquashicola Creek. Runoff from Blue Mountain, combined with ongoing groundwater discharge under the cinder bank, continues to be the source of a significant quantity of metals released to the Aquashicola Creek (USEPA 2001). In addition, the heavy metals that have come to be located in the sediments in Aquashicola Creek and the Lehigh River continue to be a source to downstream environment. In 1998 sediments were dredged from the lower 4,200 ft of Aquashicola Creek adjacent to the East plant and deposited on the cinder bank. Post dredging sediment analysis was not conducted because of a lack of sediment but water quality analysis indicated that surface water concentrations of cadmium and zinc continued to be elevated in lower Aquashicola Creek (USEPA 2002b). In addition, elevated metal levels have been measured in sediments in ditches draining into the Lehigh River from the west plant, and in sediments in the Lehigh River at the mouth of Aquashicola Creek and downstream as far as Cementon (USEPA 2001).

2.2 Hazardous Substance Released

The USEPA described elevated levels of cadmium, lead and zinc in soils, surface waters, and biota as metals of concern in the 1987 OU1 ROD. Stream sampling in 1984 identified cadmium, copper, lead, and zinc as elevated in fish (USFWS 1986). The USEPA described elevated levels of cadmium, copper, lead, and zinc in soils, sediments, surface waters, groundwater and biota as

metals of concern in the 1988 OU2 ROD. The USEPA listed arsenic, cadmium, lead and zinc as chemicals of potential concern (COPC's) in the 2001 OU3 ROD. All of the above inorganics are listed as hazardous substances in Table 302.4, List of Hazardous Substances and Reportable Quantities under CERCLA (40 CFR Part 302.4(a)), and as toxic pollutants pursuant to 40 CFR Part 401.15, as amended.

2.3 History, Current/Past Use and Relevant Operations at the Sites Identified as Sources of Releases

As noted above, several individual sources of contamination were related to the smelting operations. Pre-1980 air emissions from the smelters were the most prevalent source of documented heavy metal release; however, post-1980 activities, including the electric arc furnace dust recycling processes have been confirmed as sources of metals to the Palmerton landscape (Ketterer et al. 2001; USEPA 1993). The cinder bank and other erosional releases were clearly documented as past releases both before and after 1980 (USEPA 1987; HRDC 1987). The historical site and vegetation analysis completed in 1985 (Stokley 1985) clearly documented various additional sources including; slag deposits, earthen-wall impoundments, above ground tanks, pits and revertments, and possible drums.

HRDC (1987) concluded that: 1) runoff from Blue Mountain contained elevated concentrations of cadmium and zinc attributable to many years of particulate fallout from stack emissions; 2) rainwater infiltration and surface water infiltration are leaching metals from the cinder bank and are contributing to contamination in Aquashicola Creek; 3) the cinder bank appears to have the greatest impact on metal loading to Aquashicola Creek, with between 70 and 90 percent of the total metals load originating here; and, 4) New Jersey Zinc Corporation outfalls contribute between 5 to 10 percent of the metals contribution to Aquashicola Creek.

Direct release or disposal of heavy metals and contaminant bearing slag material to the atmosphere, soil and surface water, as well as releases via runoff and migration to groundwater, have occurred and continue to occur at this site. EPA's recently completed ecological risk assessment concluded that contaminants in sediment, surface water, seeps, and sediment interstitial water near the east plant continue to cause a high level of mortality to aquatic organisms. Aquatic community assessments corroborate that aquatic community structure is severely impacted near the site. Despite the fact that much of the soil from Blue Mountain has eroded over the years, surface sampling of remaining soils as part of EPA's recent terrestrial assessment show some of the highest levels of cadmium and zinc ever recorded at this site (USEPA 2001).

2.4 Potentially Responsible Parties

In 1898, the New Jersey Zinc Company built the West Plant adjacent to the Lehigh River. In 1911, the East Plant was built on Aquashicola Creek approximately 2 miles from the original plant. In 1974, the New Jersey Zinc Company merged with Gulf & Western, Inc. (G&W). As the surviving corporation, G&W continued primary zinc smelting until 1981. In 1981, G&W sold the plant, part of Blue Mountain, and the cinder bank property to Horsehead Industries, Inc. (HII). In 1981 HII changed its name to the New Jersey Zinc Company (NJZC). In 1984 the

NJZC changed its name back to HII and acquired the fictitious name of the New Jersey Zinc Company. G&W is the predecessor of Viacom International Inc. (Viacom) and TCI Pacific Communications, Inc. (TCI). Therefore, the Trustees believe they can demonstrate that HII, Viacom, and/or TCI are potentially responsible parties under CERCLA. The Trustees acknowledge that there may be other sources of hazardous substance releases to Aquashicola Creek. These other potential sources of hazardous substance releases may be addressed in future investigations conducted by the Trustees, and other potentially responsible parties may be identified.

2.5 Regulatory History and Actions

The following information was summarized from the most current EPA document, the second five year review report (EPA 2002a) and the EPA Region 3 website (http://www.epa.gov/reg3hwmd/super/PA/palmerton)

Blue Mountain, Operable Unit 1 (OU1) - Over 2,000 acres of forest were defoliated on Blue Mountain and nearly all top-soil from this acreage eroded into Aquashicola Creek and the Lehigh River. In 1987, EPA selected an interim remedy for Blue Mountain that included spreading a sewage sludge/lime/fly ash mixture and seeding with grasses and tree seedlings on a portion of this denuded area. More than 60 miles of roads were bulldozed on the side of the mountain to facilitate the land-based remedial effort on approximately 800 acres. The interim remedial work was initiated in 1991 and completed in 1995. EPA has determined that grass coverage performance standards have been met; however, the woody stem performance standard of 435 stems per acre has not been met. Additional monitoring studies have concluded that metals remain mobile through biological uptake into plants and thus are available to higher trophic level biological receptors (Lee, 1995; USEPA 2001; USEPA 2002a).

In 1999 EPA issued a Unilateral Administrative Order to HII and HRDC (collectively, Horsehead) and to Viacom International Inc. and TCI Pacific Communications, Inc. (collectively, Viacom) to completing the remaining remedial work required under the ROD for OU1. Viacom has complied with the UAO and is cooperating with EPA in conducting revegetation pilot testing on remaining portions of OU1. Viacom, through its contractor Adrian Brown, attempted to establish vegetation in various test plots in 2001. By late fall, 2001, these efforts were determined by EPA to have failed. In 2002, Viacom hired another remedial contractor, Frank and West, Inc. In spring 2003, Frank and West began a revegetation test plot pilot study and the evaluation of that effort is currently ongoing.

Cinder Bank, Operable Unit 2 (OU2) - During operations at the smelters, cinder waste was transported and dumped along a 2.5 mile stretch adjacent to Aquashicola Creek at the toe of slope of Blue Mountain. In 1988, EPA selected an in-situ remedy of capping the cinder bank, vegetating the cap, and conducting additional studies to determine the feasibility of controlling or extinguishing underground fires within the cinder bank. This remedy was selected because it was estimated that it would take 30 to 45 years to remove the 33 million tons of slag waste. In 1995, EPA agreed to allow an experimental application of vegetative cover over 94 acres of the 200 acre site to prevent airborne and precipitation-borne release of contaminants. Later that same year Horsehead entered into a Consent Decree with the United States and the

Commonwealth of Pennsylvania to address violations under RCRA, CAA, and CWA, including specific violations arising from discharges of elevated levels of metals from the Cinder Bank to Aquashicola Creek. Pursuant to the 1995 Consent Decree, Horsehead developed and has been implementing a Pollution Reduction Technologies (PRT) Work Plan that includes surface water diversions, collection and treatment of leachate prior to discharge to Aquashicola Creek, and revegetation of the Cinder Bank. The 1988 ROD was changed by EPA's issuance of an August 27, 2002 Explanation of Significant Differences (ESD) that adopts the PRT plan as the primary Cinder Bank remedy. The ESD removed the requirement to control or extinguish the fires and imposes additional operations and maintenance (O&M) requirements.

The Valley Wide Contamination, Operable Unit 3 (OU3) - The OU3 encompasses primarily the residences that have elevated lead, cadmium, and zinc in their homes and yards in the Borough of Palmerton, the Village of Aquashicola, and a portion of Lower Towamensing Township. In 1994, following the PRP's refusal to do so, EPA initiated an interim removal action that targeted cleanup of lead and cadmium in high risk homes containing children and pregnant women. By 1997, nearly 200 houses were cleaned with EPA funds. EPA issued a human health risk assessment in 1998, and the ROD was issued on October 9, 2001. EPA is currently overseeing Viacom's implementation of this ROD. Beginning in fall 2002, Cummings Riter Consultants Inc., a consultant for Viacom, began to sample properties to determine the extent of contamination. As of fall 2003, 180 out of 1500 properties sampled qualified for cleanup. It is anticipated that a small number of properties will be cleaned up in fall 2003 and the remaining properties identified to date will be completed in spring 2004.

In October 2003, the United States entered into a Consent Decree with Horsehead and Viacom with respect to certain aspects of the Palmerton Site. Pursuant to the Consent Decree, Horsehead and Viacom have agreed to perform all remaining remedial obligations under the RODs for OU1 and OU3, to perform any required operation and maintenance for the remedy at OU2, and to reimburse EPA and DOI for certain past and future response costs incurred and to be incurred. Pursuant to a separate agreement between Horsehead and Viacom, it is anticipated that Viacom will perform all significant remedial obligations under the Decree. Horsehead has filed for bankruptcy protection, but received approval from the bankruptcy court to enter into the settlement. In the Consent Decree, the United States specifically reserves all rights to pursue claims for damages to natural resources.

Groundwater, Surface Water, and Ecological Risk, Operable Unit 4 (OU4) - In 1996, following the PRP's refusal to study the extent of contamination in groundwater and the site streams, EPA initiated such work and initiated data collection for a site wide ecological risk assessment (ERA). The ERA evaluated risk in Aquashicola Creek, the Lehigh River, several riparian areas, wetlands, Blue Mountain, and Stony Ridge, a denuded ridge to the north. The ERA assessed 18 different endpoints including both terrestrial and aquatic communities, concluding adverse risk to 15 of those endpoints. The final draft of the ERA was completed in 2001 (USEPA, 2001). From an aquatic standpoint, the ERA concluded that there are substantive ecological risks in both the Aquashicola Creek and the Lehigh River associated with the release of zinc and copper from the Palmerton Zinc site. On the terrestrial side, the ERA concluded that soils from the site can be toxic to both earthworms (soil invertebrates) and plants and that there is substantive risk to the viability and function of the soil community from site related contaminants. Adverse risks

to all other terrestrial communities fundamentally stems from contaminants found in water, sediments, and/or soils. Due to the massive die-off of vegetation and subsequent loss of soils and soil productivity, the current risks to the viability and function of the terrestrial plant community are associated with both direct and indirect effects of contaminants released at this site. The EPA is currently drafting a risk assessment/feasibility study (RI/FS) for OU4. The activities to be performed at OU4 are not included within the matters addressed by the 2003 Consent Decree.

Stony Ridge

Although sampling of Stony Ridge was included in the ERA, Stony ridge it is not included in any of the operable units. Severe erosion of contaminated soils from Stony Ridge into residential areas caused the initiation of the Stony Ridge Emergency Response Action in 1996 intended to minimize erosion of contaminated soils. EPA's efforts to stabilize a limited area of eroding and contaminated soils on Stony Ridge are completed, although minor maintenance is conducted on a periodic basis to ensure continued stability of the contaminated hillside.

2.6 Damages Excluded from Liability under CERCLA or CWA

The regulations at 43 CFR Part 11.24 provide that the Trustees must determine whether the damages being considered are barred by specific defenses or exclusions from liability under CERCLA or the Clean Water Act (CWA). The Trustees have made such determinations and believe that such defenses or exclusions from liability are not dispositive, and are without merit. These required determinations are as follows:

> The Trustees must determine whether the damages: (i) Resulting from the discharge or release were specifically identified as an irreversible and irretrievable commitment of natural resources in an environmental impact statement or other comparable environmental analysis, that the decision to grant the permit or license authorizes such commitment of natural resources, and that the facility or project was otherwise operating within the terms of its permit or license, so long as, in the case of damages to an Indian tribe occurring pursuant to a Federal permit or license, the issuance of that permit or license was not inconsistent with the fiduciary duty of the United States with respect to such Indian tribe; or (ii) And the release of a hazardous substance from which the damages have resulted have not occurred wholly before the enactment of CERCLA; or (iii) Resulted from the application of a pesticide product registered under the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. section 135-135k; or (iv) Resulted from any other federally permitted release, as defined in section 101 (10) of CERCLA; or (v) Resulting from the release or threatened release of recycled oil from a service station dealer described in section 107(a)(3) or (4) of CERCLA if such recycled oil is not mixed with any other hazardous substance and is stored, treated, transported or otherwise managed in compliance with regulations or standards promulgated pursuant to section 3014 of the Solid Waste Disposal Act and other applicable authorities.
>
> The Trustees must also determine whether the discharge meets one or more of the exclusions provided in section 311(a)(2) or (b)(3) of the CWA.

The Trustees have determined that the potential injuries referred to herein do not meet one or more of the above criteria, nor are they subject to the exceptions to liability provided in sections 107(f), (i), and (j) and 114(c) of CERCLA, and section 311 (a)(2) or (b)(3) of the CWA. Therefore, the continuation of an assessment is not precluded.

3.0 PRELIMINARY IDENTIFICATION OF RESOURCES POTENTIALLY AT RISK

3.1 Preliminary Identification of Pathways

For a period of approximately 80 years beginning in 1898, air emission discharges containing significant quantities of heavy metals emanated from the smelting plants on to soils of Blue Mountain and into the waters and sediments of Aquashicola Creek and the Lehigh River (USEPA 1987). Residual cinder material was stored onsite and serves as a continuing source of heavy metals to groundwater and the surrounding surface environs (HRDC 1987; USEPA 2001).

From these areas, the metals have eroded and accumulated into the entire Palmerton ecosystem through natural and human-directed perturbations. For example, a recent EPA study indicates that the cinder bank and Blue Mountain continue to be a major source of heavy metals to Aquashicola Creek (USEPA 2001). Other potential ongoing sources of heavy metals to the Lehigh River are surface runoff drainages from the defunct west plant, and runoff from the OU1 portion of Blue Mountain located immediately up gradient of the Lehigh River, south and west of Lehigh Gap (USEPA 2001). Ongoing remedial efforts are expected to reduce runoff from revegetated areas of Blue Mountain, but Blue Mountain runoff remains a potential ongoing source of heavy metals.

3.1.1 Air pathways

The most significant pathway of heavy metals from the smelter plants to the surrounding environs was via air emissions. Buchauer (1971) estimated emission rates of sulfur oxides and heavy metals from 1900 to 1970, and collection and chemical analysis of dustfall, soil and hi-vol samples tended to verify her estimates. Heavy metal emission rates were also estimated and summarized by USEPA (1987). Ketterer et al. (2001) determined that lead found in soils and dust near Palmerton is primarily derived from a mixture of zinc smelting and electric arc furnace dusts. About 80 % of the lead in air sampled at Palmerton in 1991 was attributed to electric arc furnace processing (Ketterer et al. 2001). Nearly all of the ecological investigations completed to date have noted that concentration gradients of heavy metals clearly follow the prevailing wind direction in the Palmerton Valley, and elevated concentrations of site-related heavy metals can be found up to 100 kilometers away (Beyer et al. 1984).

3.1.2 Surface water pathways

The surface water pathway(s) also contributed to significant metals loadings to Aquashicola Creek and the Lehigh River. It has been estimated that between 12 and 24 inches of contaminated soil have eroded from Blue Mountain (Sopper 1989; Oyler, undated). Surface runoff was analyzed in 1979 and 1986 and found to contain elevated concentrations of metals (USEPA 1987; HRDC 1987). USEPA sampled surface water in Aquashicola Creek from several

upstream stations and five stations downstream of the cinder bank. Filtered and total recoverable concentrations of calcium, cadmium, magnesium, manganese, nickel, potassium, sodium, and zinc were consistently elevated downstream of the cinder bank (USEPA 2001). Although contaminated sediments were removed from lower Aquashicola Creek, cadmium and zinc continue to be elevated downstream of the cinder bank.

3.1.3 Groundwater pathways

HRDC (1987) sampled 35 groundwater wells and detected highly elevated concentrations of both total and dissolved cadmium, copper, lead, manganese, and zinc in shallow groundwater under the east plant and the cinder bank. USEPA (2001) found that arsenic, cadmium, copper, iron, lead, manganese, magnesium, and zinc were highly elevated in groundwater seeps flowing into Aquashicola Creek at the base of the cinder bank. Concentrations in seep water were considerably higher than either sediment interstitial water or Aquashicola Creek surface water, clearly indicating that groundwater was a contributing pathway for surface water contamination. In addition, deep groundwater is used as a drinking water supply within the site boundaries via public water supply wells and private residential wells but has not been shown to be contaminated to date.

3.1.4 Food chain pathways (bioaccumulation)

Beyer et al. (1985) documented metals accumulation in various songbirds, mammals, leaves, insects, berries, and fungi, concluding that those species dependent upon soil organisms for survival were at the highest risk. Storm et al. (1994) documented levels of metals in tissue and organs of various amphibians (red-backed salamanders and green frog tadpoles) and mammals (white-footed mice, cottontail rabbits, and white-tailed deer), concluding that high concentrations of several metals persisted in animals within 5 km of the smelters. USEPA (2001) determined that bioaccumulation of several metals in insects, plants, and small mammals living on Blue Mountain was sufficiently high enough to conclude that all trophic guilds of birds were at risk.

USEPA (2001) concluded that total recoverable and filtered surface water metals results were similar at each location and sampling event, which indicated that metals present in surface water are primarily in a soluble form and bioavailable. These results collaborate other investigations, in that even with documented acute mortality of some laboratory species observed in sediment bioassays, surviving, free-ranging fish in Aquashicola Creek exhibit highly elevated metal tissue concentrations (USFWS 1986, USEPA 2001).

3.1.5 Particulate movement pathways

Buchauer (1971) confirmed that heavy metals were present in dust and fallout particles, and presumptively implicated the east and west plant smelters as the source. USEPA (1993) microscopically and chemically analyzed dust samples and particles from source samples (cinder bank, east plant, west plant, and main smelter stack) and receptor locations (houses, soils, and ambient air filters) to determine if source locations were responsible for the elevated metals concentrations found at the receptor locations. Sources included the various historic zinc

smelting sources and the contemporary EAF dust recycling processes. Analysis confirmed that certain particles containing detectable cadmium, lead, and zinc were identified at both source and receptor locations, with the zinc smelting emissions being the major contributor of metals to the surrounding environment. Further analysis showed that receptor air filter sample particles resembled the source particles both chemically and morphologically, and the high zinc and lead concentration material was likely from the various sources tested (USEPA 1993). Finally, because the extremely high particulate concentrations of cadmium, lead, and zinc were only explained by the EAF source, and several additional tracer elements were identified, the EAF dust was also confirmed as a source of contaminated particulate discharge to the Palmerton landscape (USEPA 1993; Ketterer et al. 2001).

Particulates suspended in the water column contribute to the total metals loading to Aquashicola Creek and the Lehigh River (USEPA 1987). Suspended matter in the water column may also contribute to toxic responses in aquatic resources and elevated metals concentrations in various species of fish (USFWS 1986; USEPA 2001).

3.1.6 Sediment pathways

Heavy metals in the outfalls from the smelting plants, in the groundwater under the cinder bank, and in the runoff and seeps from the smelting plants, cinder bank, and Blue Mountain traveled via the surface water and groundwater and settled into the sediments within and adjacent to Aquashicola Creek and the Lehigh River. Once sediments are contaminated with heavy metals, they can serve as an ongoing source of metals to the environment. Sediment concentrations of cadmium, chromium, copper, lead, and zinc were significantly higher at locations downstream of the cinder bank versus the upstream locations. Sediment zinc concentrations were also correlated with arsenic, barium, beryllium, cadmium, copper, lead and manganese concentrations, which indicate a common source or transport route (USEPA 2001). Sediment interstitial water concentrations of many metals were highly elevated at locations adjacent to the cinder bank, which indicates that a large portion of the metals load in the water column of the lower Aquashicola Creek originates from the sediments adjacent to the highly contaminated cinder bank (USEPA 2001). Sediments have since been removed from lower Aquashicola Creek but surface water cadmium and zinc levels remain high (USEPA 2002b). Sediment metal concentrations were elevated in all four sampling locations in the Lehigh River downstream of Aquashicola Creek (USEPA 2001). The USEPA (2001) also found that sediment concentrations of arsenic, cadmium, copper, lead and zinc were up to several orders of magnitude higher in ditches draining the west plant than at any other sediment location sampled in the entire study. These drainages empty directly to the Lehigh River, clearly implicating their sediments as a direct pathway to the Lehigh River (USEPA 2001).

3.1.7 Soil pathways

Soils represent the most widely investigated environmental media at the Palmerton site. Many investigations have documented highly elevated concentrations of cadmium, lead, and zinc, with orders of magnitude higher concentrations in the top few inches of litter than the underlying mineral soils (Buchauer 1973; Beyer et al. 1984; Beyer et al. 1985; REWAI 1988; USEPA 1993; Storm et al. 1994; USEPA 2001). The soil pathway was clearly established by the mid-1980's

when USEPA listed this site, and soil metals concentrations have driven all remedial actions (both emergency response and interim remedy actions) to date (USEPA 2002a). Several investigators noted direct acute toxicity to soil dwelling organisms (Beyer et al. 1984; USEPA 2001) while others noted conspicuously absent or reduced abundance of terrestrial fauna (e.g., vegetation, bacteria, fungi, soil microbes, salamanders, and birds) in areas closest to the smelters where metal concentrations were elevated (Jordan 1975; Jordan and Lechevalier 1975, Nash 1975; Beyer et al. 1985; Beyer 1988; Strojan 1978; Storm et al. 1993).

3.1.8 Vegetation pathways

Several researchers have documented metals uptake into existing and reestablished vegetation on Blue Mountain. Buchaeur (1973) reported concentrations of 70 ppm cadmium, 100 ppm lead, and 4,500 ppm zinc in foliage of trees within 1 km of the east plant. Jordan (1975) reported that a zinc-tolerant, winter annual (*Arenaria patula*) was found invading the denuded portions of Blue Mountain and dried foliage of the plant collected from the Lehigh Gap area contained zinc at 13,000 ppm. Sopper (1989) reported metals concentrations in various tree and herbaceous species that were planted on test plots on Blue Mountain. Metals uptake varied greatly depending upon the soil amendment ratio and vegetative species tested; however, nearly all herbaceous and tree species on every plot accumulated cadmium, lead, and zinc at concentrations in excess of established tolerance concentrations for normal plant growth (Lee, 1995; Sopper 1989) and food chain transfer (Lee 2001). Maximum concentrations in herbaceous species were 26 ppm cadmium, 118 ppm lead, and 2,082 ppm zinc. Foliage of tree seedlings generally accumulated similar levels as the herbaceous species; however the softwoods such as alder and poplar accumulated very high levels (maximum cadmium, lead, and zinc at 66, 140, 4,000 ppm, respectively) (Sopper 1989).

Monitoring reports conducted for the EPA suggest the potential for ongoing bioaccumulation into vegetation. Lee (1995) reported that the interim remedy will not control the migration of excessive metals into plants and grazing animals. Lee (2001) compared vegetation cover measurements made in 1995, 1996, and 1999 and reported that planted grasses were beginning to die out and annual weed species were becoming abundant, indicating there could be potential for increased surface runoff of particulate metals and a regression back to prior conditions. Lee (2001) also recommended that poplar and black birch trees be removed from the interim remedy area to reduce metals exposure from foliage and to reduce the accumulation of metals on the soil surface resulting from leaf drop. Clearly, the vegetation transport pathway is complete and the possibility exists for recontamination to the soil surface and biological receptors. Viacom has currently contracted Blasland, Bouck and Lee (BB&L) for vegetation sampling to evaluate metals uptake at the site.

3.2 Exposed Areas

The total area over which obvious exposure or effects have occurred includes over 2000 acres of denuded forestland on Blue Mountain and Stony Ridge as depicted in Figures 3 and 4 (Sopper, 1989). Based on numerous physical and ecotoxicological studies metals contamination extends from a minimum of 10 km west of the smelters to 20 km east of the smelters (Beyer et al., 1984; Beyer, 1988; Beyer and Storm, 1995; Buchauer, 1973; Sileo and Beyer, 1985; Storm et al., 1993;

Storm et al., 1994). Elevated metals concentrations have been measured in the water column 5.5 km upstream and in the sediments 11 km upstream in Aquashicola Creek (USEPA, 2001), in the water column at the confluence of Aquashicola Creek and the Lehigh River (Versar 2001), and in the sediments 20 km downstream in the Lehigh River (USEPA, 2001).

3.2.1 Exposed surface water estimates and concentrations

Measured metals concentrations in surface waters of Aquashicola Creek and the Lehigh River have historically exceeded the EPA Ambient Water Quality Criteria (AWQC) (USEPA 1987; HRDC 1987). For example, maximum concentrations in the Aquashicola water column for cadmium, copper, lead, manganese, and zinc were 31, 360, 21, 280, and 1140 ppb, respectively. Maximum concentrations in the Lehigh River water column for cadmium, copper, lead, manganese, and zinc were 13, 70, 5, 200, and 310 ppb, respectively (HRDC 1987). Total recoverable and filtered metals concentrations in the water column were also measured in Aquashicola Creek three separate times by USEPA in 1997. Maximum concentrations of cadmium, calcium, copper, lead, manganese, and zinc were 8.6; 25,000; 9.4; 6.6; 330; and, 2300 ppb, respectively (USEPA 2001). The observed cadmium and zinc concentrations for several of the downstream stations were well above both the acute and chronic EPA AWQC (USEPA 2001). Surface water sampling in summer 2001 showed that Aquashicola Creek was a significant continuing source of zinc to the Lehigh River, with concentrations of both total and dissolved zinc found at 771 and 629 ppb, respectively (Versar 2001).

3.2.2 Exposed sediment estimates and concentrations

Elevated metals levels have been detected in sediments throughout Aquashicola Creek and the Lehigh River (USEPA 1979; HRDC 1987; USEPA 2001). Reported maximum concentrations in 1986 Aquashicola Creek sediments were 95 ppm cadmium, 695 ppm copper, 765 ppm lead, 52,000 ppm manganese, and 23,600 ppm zinc. Maximum sediment concentrations in the Lehigh River were 53 ppm cadmium, 148 ppm copper, 345 ppm lead, 52,700 ppm manganese, and 7,000 ppm zinc (HRDC 1987). USEPA (2001) documented several metals in Aquashicola Creek that were higher downstream of the cinder bank versus upstream locations. Maximum concentrations were 61 ppm arsenic, 1,200 ppm barium, 2.5 ppm beryllium, 140 ppm cadmium, 10,000 ppm calcium, 33 ppm chromium, 420 ppm copper, 800 ppm lead, 8,100 ppm manganese, 5.6 ppm selenium, 3.3 ppm silver, 180 ppm sodium, and 17,000 ppm zinc (USEPA 2001). Some of the highest sediment metals concentrations ever recorded at Palmerton were from the drainages of the west plant, with 170 ppm arsenic, 120 ppm cadmium, 71,000 ppm copper, 910 ppm lead, and 86,000 ppm zinc (USEPA 2001). Limited sediment sampling in the Lehigh River by USEPA in 2001 still showed elevated concentrations of 28 ppm cadmium, 110 ppm copper, 200 ppm lead, 3,900 ppm manganese, and 4,400 ppm zinc.

3.2.3 Exposed groundwater estimates and concentrations

The most comprehensive groundwater investigation at Palmerton was conducted by HRDC (1987). Data were collected from a total of 35 groundwater monitoring wells showed some extremely high concentrations of both total and dissolved metals. Maximum concentrations (total metals) were 2.7 ppm cadmium, 1.9 ppm copper, 2.1 ppm lead, 129 ppm manganese, and

913 ppm zinc. Maximum concentrations (dissolved metals) in former shallow groundwater production wells (curb wells) were 2.34 ppm cadmium and 70.5 ppm zinc. Although none of these samples were collected from seeps or visible discharge points, it was widely acknowledged in the report that metals leaching to groundwater, and its subsequent discharge to Aquashicola Creek was the primary source of contamination to the aquatic system (HRDC, 1987; USEPA, 2001). USEPA (2001) sampled four groundwater seeps near the cinder bank that were discharging directly to Aquashicola Creek. Several metals were still in the ppm range, with concentrations of 0.08 ppm cadmium, 0.26 ppm copper, 0.24 ppm lead, 4.6 ppm manganese, and 15 ppm zinc. Most recently, the concentrations of dissolved cadmium and zinc measured at monitoring well 11 located off the east end of the Cinder Bank were 340 ppb and 419 ppm respectively (USEPA, 2002b).

3.2.4 Exposed soil estimates and concentrations

Buchauer (1973) was the first to report extremely high metal concentrations in the organic layer of soils on Blue Mountain, with maximum concentrations of cadmium, copper, lead, and zinc at 1,750; 2,000; 2,000; 135,000 ppm, respectively. Beyer et al. (1985) reported mean concentrations of cadmium, copper, lead and zinc for surface soil (O2 horizon) collected on Blue Mountain in 1979 at 710; 440; 2,700; and 24,000 ppm, respectively. In another investigation, Beyer et al. (1984) found maximum surface litter (O2 horizon) concentrations approximately 1.2 kilometers downwind of the smelters on the Blue Mountain ridgeline at 1,300 ppm cadmium; 280 ppm copper; 3,200 ppm lead; and, 35,000 ppm zinc.

The most comprehensive soil sampling was conducted in 1985 and 1986 from 413 locations around Palmerton (REWAI 1988). Cadmium, lead and zinc concentrations were determined for various depths of soil, and the data were used to generate isopleth maps for these three metals. Although the maximum soil metal concentrations measured were 364 ppm cadmium, 1,730 ppm lead, and 40,000 ppm zinc, the isopleth maps are representative of the mineral soils which have been shown to be much less contaminated than the upper organic layer (USEPA 1993). Storm et al. (1994) collected litter and soils in 1987 from 6 locations on Blue Mountain, all within 10 kilometers of the smelters. Maximum concentrations of cadmium, copper, lead and zinc in litter were 1192; 552; 3460; and, 24,000 ppm, respectively (Storm et al. 1994).

The USEPA followed up the REWAI work with a soils investigation in 1992 and concluded that the REWAI isopleth maps grossly underestimate the actual metal levels in the upper soil horizon of undisturbed sites throughout the Palmerton area (USEPA 1993). Samples of undisturbed litter were collected from 23 areas surrounding Palmerton and average concentrations of cadmium, copper, lead and zinc near Palmerton (including several stations along the Appalachian National Scenic Trail) were 293; 289; 1800; and 11,800 ppm, respectively. Maximum concentrations of cadmium, copper, lead, and zinc were 782; 698; 3,570; and 32,200 ppm, respectively. More recent soil organic layer sampling performed by USEPA in 1997 revealed maximum mean concentrations (5 replicates per site) of arsenic, cadmium, copper, lead and zinc at 102; 486; 1,462; 3,728; 17,040 ppm, respectively. The mean concentrations found in the organic layer for cadmium, lead and zinc also exceeded the recommended ecological cleanup levels derived in that document for 9 of 12 stations sampled (USEPA 2001).

Based on the above data summary, three important conclusions are evident: 1) the organic soil layer for square miles surrounding the Palmerton site is extremely contaminated; 2) the REWAI (1988) soil isopleths grossly underestimate the concentrations present in the upper soil horizons (USEPA 1993); and, 3) the metal concentrations in undisturbed Blue Mountain organic soils have remained consistently elevated over the past 20 to 30 years (USEPA 2001).

3.2.5 Exposed biota estimates and concentrations

Biotic resources that may have been exposed to heavy metal contamination include a wide variety of plants, benthic invertebrates, fish, terrestrial salamanders, various soil invertebrates, birds, and mammals. Investigators have surmised that metals exposure is responsible for the decline of seed tree species (Jordan 1975), soil microflora (Jordan and Lechevalier 1975), soil microfauna (Strojan 1978), and lichens (Nash 1975). Beyer et al. (1984) found that the metals-laden O2 soil litter collected from the Palmerton site was toxic to woodlice, and determined the primary causative agent as zinc. Direct toxicity effects to higher level organisms has been reported for lead in shrews (Beyer et al. 1985), zinc in white-tailed deer (Sileo and Beyer 1985), and zinc and cadmium in horses (Gunson et al. 1982). Contaminant burdens of cadmium in Palmerton deer kidneys approached that known to cause tubular damage (Sileo and Beyer., 1985) and levels of lead in livers of two cuckoos were as high as those associated with death in other birds (Beyer et al., 1985). Other documented exposures, such as significantly increased body burdens or significantly decreased blood delta-aminolevulinic acid dehydratase (ALAD) activity, were found in various birds and mammals that occupied the Palmerton site as compared to a 10 km upwind site (Beyer et al., 1985).

EPA (2001) concluded that "adverse risk" from site-related contaminant exposure existed for 15 of 18 ecological endpoints studied. Those endpoints identified at risk were the viability and function of the following communities: periphyton, benthic macroinvertebrate, fish, soil, terrestrial plant, herbivorous mammal, insectivorous bird, omnivorous bird, carnivorous bird, piscivorous bird, amphibian, wetland plants, wetland invertebrate, wetland fish, and wetland habitat and functions. The Ecological Risk Assessment (ERA) included very specific sediment, surface water, and soil toxicity tests, community surveys, and food chain modeling to reach the above conclusions. For nearly all of the above assessment endpoints, protective literature values were exceeded, thus prompting some additional quantifiable methods of assessment. The following types of evaluations were used in the ERA document exposure to natural resources: Sediment and surface water bioassays showed acute mortality and chronic impairment (i.e., reduced growth) to test organisms. Earthworm and terrestrial plant bioassays showed acute mortality and growth impairment in many locations. Native community assessments for benthic invertebrates, fish, and terrestrial amphibians showed statistically reduced populations in high metals areas. Risks to avian and mammalian communities for the EPA ERA were documented via food chain modeling, and the results were consistent with published literature accounts of depressed numbers, degraded habitat, and high levels of exposure as documented in tissues of resident birds.

Wildlife habitat adjacent to the smelters is heavily impaired, and wildlife use in these areas is significantly reduced when compared to surrounding unimpaired habitats (Storm et al. 1993). EPA (2001) concluded that substantive contaminant risk existed for amphibians because there

was a clear association with the complete lack of amphibians close to the smelters, independent of habitat (i.e., even areas of suitable habitat with high metals concentrations did not support amphibians). Earthworms exposed to site soils in 28-day toxicity studies showed significant mortality in sites located within 6 km of Lehigh Gap; 6 of the 7 stations closest to the smelters suffered 100 percent mortality (EPA 2001). Many metals in soils exceed threshold concentrations of suspected toxicity (Efroymson et al. 1997).

USEPA (2001) concluded that concentrations of various metals were generally higher in fish at locations adjacent to and downstream of the cinder bank and east smelter, with maximum concentrations of 1.63 ppm cadmium, 18.3 ppm copper, 0.9 ppm lead, and 378 ppm zinc. Except for copper concentrations, metals levels in fish inhabiting Aquashicola Creek have showed some decline from the maximum concentrations found in Aquashicola fish in 1985 (3.3 ppm cadmium, 1.5 ppm copper, 3.9 ppm lead, and 670 ppm zinc (USFWS 1986). Although an official fish advisory was never issued for Aquashicola Creek and the Lehigh River, the ATSDR, after reviewing the summary findings of the USFWS (1986), recommended that fish from the streams should be consumed no more than once per week (HRDC 1987).

3.3 Potentially Affected Resources and Resource Services

A wide range of natural resources and natural resource services under Federal or State trusteeship are affected or potentially affected by the release of heavy metals from the smelting plant sites, the cinder bank, and continuing releases from Blue Mountain and Stony Ridge. These natural resources provide a variety of ecological and human services. Federal and state ecological guidelines and water quality criteria for metals in surface water, ground water, sediment, and wildlife are presented in Tables 1 and 2. Potentially affected resources, and the services they provide, are described further below.

3.3.1 Surface water and sediment resources and services

Aquashicola Creek and Lehigh River surface waters, and the services these waters provide, have been affected by metals contamination. The surface waters of this system provide habitat for fish and invertebrate species, including feeding, breeding, and nursery services. Elevated metals levels have been reported in sediments throughout Aquashicola Creek and into the Lehigh River (EPA 2001). Sediments, like surface water, serve as a medium for the transport of energy and nutrients, and as habitat for various aquatic biota, including benthic finfish and invertebrate species. Sediments are believed to be the major sink for metals in the Aquashicola Creek and Lehigh River ecosystems. Floodplain soils and associated wetlands have also been affected by metals contamination (USEPA 2001). In addition, these aquatic resources support both consumptive and non-consumptive recreational activities such as recreational fishing, hunting, trapping, swimming, boating, rafting, and wildlife viewing.

3.3.2 Soil resources and services

The soils surrounding the Palmerton site may have been the most affected of all resources. Sopper (1989) estimated that about 30 centimeters of the original surface soil has eroded from portions of Blue Mountain, resulting in a barren and devastated landscape. Remaining soils are

toxic to invertebrates (Beyer et al 1984; USEPA 2001) and residual soil contamination has been implicated in reductions of abundance of every plant and a variety of animal species investigated on Blue Mountain. Types of services that have been devastated due to the direct loss of soil and the residual contamination include, habitat for soil organisms, fertility and water holding capacity necessary to sustain vegetative cover, litter decomposition, and nutrient cycling.

3.3.3 Biotic resources and services

Vegetation losses have been enormous. Approximately 2000 acres of eastern hardwood forest have been lost. The growth, survival, and reproduction of existing and future native vegetation is threatened by metals uptake, soil phytotoxicity, soil infertility, reduced rates of nutrient cycling, losses of soil, reduced plant diversity, forest fragmentation, and the potential influx of invasive species as a result of metals releases to this environment. Many investigators have concluded that various free-roaming aquatic and terrestrial species may have been directly affected via toxicity and indirectly via loss of sufficient prey items and life-sustaining habitat. As a result of the metals released at the Palmerton Zinc Pile site, certain aquatic and terrestrial species may have avoided these areas or their relative abundance been directly reduced via toxicity. In addition, many biotic resources support both consumptive and non-consumptive recreational activities such as fishing, hunting, trapping, swimming, boating, rafting, and wildlife viewing. Altered habitats and subsequent reductions in biotic species may have reduced recreational opportunities in the Palmerton area, including recreational services commonly occurring on trustee owned and managed properties (i.e., The Appalachian National Scenic Trail and Pennsylvania State Game Lands). Additional resources and services have been lost with regard to the Trustee's ability to sustain land management plans for timber harvesting and regeneration, and wildlife habitat enhancement practices involving the establishment and management of wildlife food plots.

3.3.4 Groundwater resources and services

Sampling and analysis of groundwater at the Palmerton Zinc Pile site has documented the release of hazardous substances including but not limited to zinc, cadmium, copper, barium, lead, and manganese to this resource (HRDC, 1987; USEPA, 2001). Shallow wells located along the Aquashicola Creek on the East Plant property, formerly public water supply wells known as "curb wells," were discontinued from use during or prior to 1981 because of contamination with site-related metals including zinc and cadmium. Public water supply wells that are in current use include: the Palmer Water Company wells PW-4, PW-6, and PW-7 located just off the western edge of the Cinder Bank Waste Pile; the acid plant well PW-A, located at the East Plant property; and, the foundry well located at the former West Plant property. These wells access a deep bedrock aquifer and have not shown contamination above Pennsylvania's primary maximum contaminant levels to date. There has not been any significant investigation or assessment of groundwater quality at the West Plant area. There is also groundwater use via private residential and commercial/industrial wells at the site in areas outside of the Palmer Water Company service area.

The highest concentrations of metals in the groundwater have been measured in shallow groundwater in the vicinity of the Cinder Bank Waste Pile and the former acid plant lagoon area.

The discharge of contaminated shallow groundwater to the Aquashicola Creek has been estimated to be the major source of cadmium and zinc contamination entering the creek (HRDC, 1987; USEPA, 2001). The potential for the contamination of the deeper aquifer from the shallow contaminated groundwater has not been thoroughly studied or evaluated but is the subject of the current Remedial Investigation/Feasibility Testing.

4.0 PRELIMINARY DETERMINATION REGARDING PREASSESSEMENT SCREEN CRITERIA

In accordance with section 11.23(e) of the Federal Natural Resource Damage Assessment Regulations (43 CFR Part 11.23(e)), the Trustees have determined that all of the following criteria have been met.

4.1 Criterion 1 - A release of a hazardous substance has occurred.

It has been documented that huge quantities of various heavy metals, which are classified as hazardous substances, were released from the Palmerton zinc smelters, the cinder bank, and other areas encompassing this CERCLA site. It has been estimated that the smelters alone released 3,740 tons of cadmium, 7,560 tons of lead, and 286,000 tons of zinc (USEPA 1987). Over twenty years after the smelters were shut down, the soils and vegetation on Blue Mountain and Stony Ridge and the sediments of Aquashicola Creek and the Lehigh River continue to release metals to the water column, atmosphere, groundwater, and biota of the Palmerton landscape (USEPA 2001).

Additional on-going releases contributing contamination to the environment may include the existing metals recycling facility (USEPA 1993), the cinder bank (USEPA 2001), and drainage ditches emanating from the defunct west plant (USEPA 2001).

4.2 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.

The exposed areas and the natural resources adversely affected by releases of metals are within the trusteeship of the Trustees as defined under CERCLA. Specific affected areas of trusteeship include: land, surface water, ground water, sediments, air resources, biotic resources, floodplain soils, and surface soils.

Hundreds of acres of trustee owned and managed properties (i.e., The Appalachian National Scenic Trail and Pennsylvania State Game Lands) have been defoliated due to releases from the Palmerton Zinc Pile Superfund site. Thousands of additional acres have accumulated metals that far exceed background concentrations. Studies have concluded that the following natural resources, either belonging to, managed by, controlled by, or appertaining to the trustees have been adversely affected by the release: the forested ecosystems and associated biota (Buchauer 1971; Buchauer 1973; Jordan 1975; Stokley 1985; Sileo and Beyer 1985; Beyer et al. 1985; Beyer 1988; Storm et al. 1993; Storm et al. 1994; Beyer and Storm 1995; USEPA 2001); soil ecosystems and associated organisms (Nash 1972; Nash 1975; Jordan and Lechevalier 1975; Strojan 1978; Beyer et al. 1984; Beyer et al 1985; Beyer and Linder 1995; Beyer 2001; EPA

2001); and, aquatic ecosystems, wetlands and associated organisms (USFWS 1986; Carline and Jobsis 1993; USEPA 2001).

Although EPA concluded that no specific health advisories or use restrictions were warranted for hikers utilizing the Appalachian National Scenic Trail, the Agency for Toxic Substances and Disease Registry (ATSDR) recommended that the NPS post "hiker advisory" signs discouraging children from daily recreation in the area and discouraging hikers from consuming water from untested on-site springs. NPS lands have been posted with these signs since 1990. Due to slope instability, trail user safety, access and movement patterns may have been compromised. Future OU1 remedial efforts may include sections of the ANST and State Game Lands, so there is potential for future impacts to recreational users in these areas. Future maintenance and management costs may also be increased as a result of the existing contamination and/or remedial actions.

In addition, the trustees believe that altered habitats and reductions in biotic species may have reduced recreational opportunities in the Palmerton area, including both consumptive and non-consumptive activities such as recreational fishing, hunting, trapping, hiking, swimming, boating, rafting, and wildlife viewing.

4.3 Criterion 3 - The quantity and concentration of the released hazardous substance is sufficient to potentially cause injury to natural resources.

It has been estimated that the Palmerton smelters emitted 3,740 tons of cadmium, 7,560 tons of lead, and 286,000 tons of zinc (USEPA 1987). In addition, an estimated 32 million tons of slag waste make up the 2.5 miles long cinder bank, with typical concentrations of cadmium, lead and zinc of 250; 3,600; and, 27,000 ppm, respectively. Metals continue to be released to Aquashicola Creek and the Lehigh River via runoff and groundwater discharge. According to sampling and investigation completed to date, the total quantity and concentrations of these releases is sufficient to cause injury to the soils, sediment, waters, and biota of the Palmerton Zinc Pile site (See above references and discussion in 4.2 above). Direct injuries to specific resources have been documented in the above referenced literature. Indirect effects via elimination and alteration of life-dependant food, water, and habitat are also documented. Reported metals concentrations in Blue Mountain soils historically and currently exceed current effects-based concentrations (Efroymson et al. 1997) and site-specific ecological risk levels established by the EPA (USEPA 2001). Reported metals concentrations in surface waters of Aquashicola Creek and the Lehigh River have historically exceeded both the EPA and DRBC Ambient Water Quality Criteria (Versar 2001).

4.4 Criterion 4 - Data sufficient to pursue an assessment are readily available or are likely to be obtained at a reasonable cost.

Significant amounts of data relevant to natural resources and potential damages resulting from metals exposure on Blue Mountain, Aquashicola Creek, and the Lehigh River are available from the published literature, government agencies (PAFBC, NPS, FWS, PAGC, NOAA, PADEP, PADCNR, and USEPA), the various responsible parties, and other sources. These data include information on contaminant releases, concentrations in the environment, and the effect of

contamination on natural resources. Given the volume of available information, additional data useful for an assessment could be obtained at a reasonable cost.

4.5 Criterion 5 - Response actions carried out or planned do not or will not sufficiently remedy the injury to natural resources without further action.

Interim measures to control identified releases of metals on Blue Mountain and Aquashicola Creek have been undertaken or are underway for three of the four Operable Units, and several EPA removal actions have been conducted to alleviate flooding and erosion issues at the base of Stony Ridge. Response actions taken to date, however, have not sufficiently restored the injured natural resources of Blue Mountain, Stony Ridge, Aquashicola Creek, and the Lehigh River nor are they expected to preclude the continued release of metals.

In 1987, EPA selected an interim remedy for Blue Mountain (OU1) that included land spreading a sewage sludge/lime/fly ash mixture and seeding with grasses and tree seedlings, with the goal of restoring an eastern forested ecosystem. The interim remedial work was completed on approximately 800 acres in 1995, and grass coverage performance standards have been met; however, the woody stem count performance standard established in the work plan was not met. Limited monitoring studies completed on the remediated areas have concluded that metals remain mobile through biological uptake into plants and animals and may pose risk to higher level biological receptors (Lee 1995; Lee 2001; USEPA 2001). To date, recommended maintenance actions necessary to lower contaminant translocation potential (routine chemical sampling of plants, removal of tree species accumulating excessive metals, and maintenance of pH at 6.5 to 7.0 have not been completed.

In 1999, EPA issued a Unilateral Administrative Order (UAO) to the responsible parties to complete remaining remedial work on OU1. Viacom has entered into a Consent Decree with the United States requiring completion of the remedial activities required under the OU1 ROD. Based upon the failure of the first revegetation pilot tests, and the absence of woody species and methods for immobilizing metals in the current pilot study, it is doubtful that the final Blue Mountain remedy will fully restore natural resource injuries.

In 1988, EPA selected an in-situ remedy for the cinder bank (OU2) consisting of capping , a vegetative cover, studies to determine the feasibility of extinguishing the underground fire that has been smoldering for decades, runoff diversion, and leachate collection and treatment. In 1995, as part of a signed a consent decree to address violations under RCRA, CWA and CAA, EPA and the Commonwealth of Pennsylvania agreed to an experimental approach to revegetate the Cinder Bank, conduct runoff diversion, and leachate collection and treatment. However, given the difficulties associated with containing all discharges associated with such a substantial volume of contaminated materials, it is doubtful that metals releases and injuries to aquatic resources will be eliminated without further action.

The final area of interest to the Trustees is OU4, which consists of ground water, surface water, and ecological risk. In 1996, following the PRP's refusal to study the extent of contamination in groundwater and the site streams, EPA initiated such work along with a site wide Ecological Risk Assessment (ERA). The EPA evaluated ecological risk in Aquashicola Creek, the Lehigh

River, several riparian areas, wetlands, Blue Mountain, and Stony Ridge by assessing 18 different endpoints. USEPA (2001) concluded that significant risk existed for 15 of those endpoints, including both terrestrial and aquatic communities. EPA has not yet determined what additional remedial actions should be implemented for OU4 and is in the process of drafting a remedial investigation/feasibility study (RI/FS) for OU4.

Finally, the Trustees have no assurance that all impacted areas associated with Blue Mountain, the ANST, and State Game Lands will be evaluated and remedied. Areas of significant contamination are not included within the areas proposed for remediation. Other huge areas such as Stony Ridge and the west plant contain similarly high levels of metals, have sparse vegetation, and have been confirmed to discharge metals to the aquatic ecosystem. There are no current plans to remediate these areas, and therefore any injuries to natural resources will not be addressed without further action.

Based on the above, the Trustees do not expect that the interim remedial measures carried out or future planned actions will fully address the various sources and pathways of exposure of natural resources to metals, or the injuries resulting from such exposure. Therefore, the Trustees have determined that the response actions carried out or currently planned do not or will not sufficiently remedy the injury to the natural resources of the Palmerton Zinc Pile site without further action.

5.0 CONCLUSION

Following the review of information described in this Preassessment Screen, the Trustees have made a preliminary determination that the criteria specified in 43 CFR Part 11 (Natural Resource Damage Assessments) have been met. The Trustees have further determined that there is a reasonable probability of making a successful claim for damages with respect to natural resources over which the Trustees have trusteeship. Therefore, the Trustees have determined that an assessment of natural resource damages is warranted.

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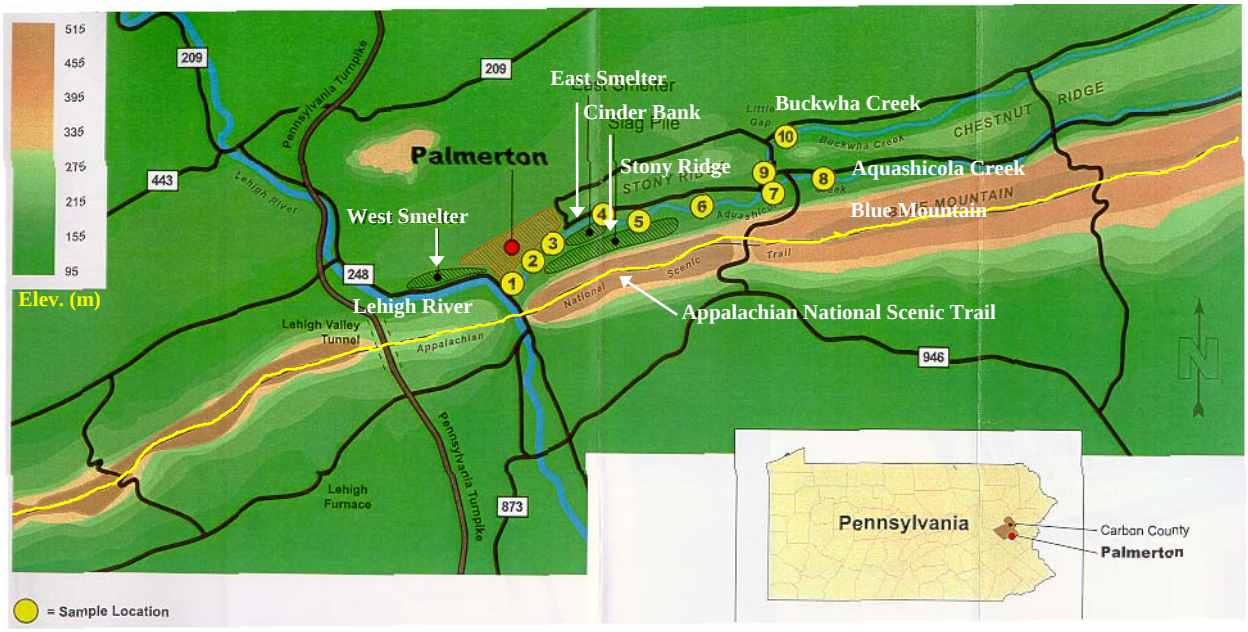

Figure 1. Palmerton Zinc site, Palmerton, PA. Numbered locations are EPA Ecological Risk Assessment aquatic sample locations on the Aquashicola Creek and Buckwha Creek. Adapted from USEPA (2001).

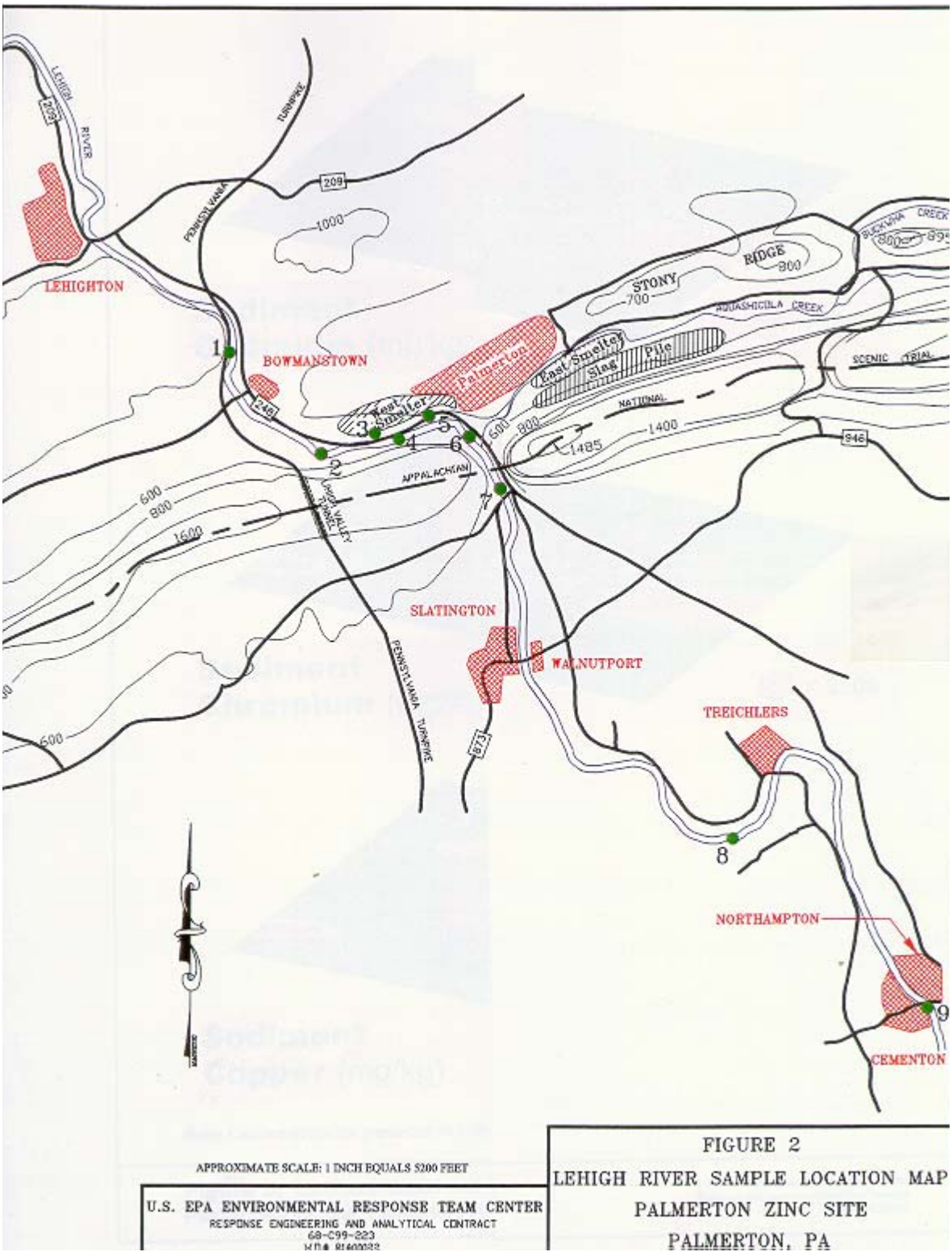

Figure 2. Palmerton Zinc site, Palmerton , PA. Numbered locations are EPA Ecological Risk Assessment aquatic sample locations on the Lehigh River (USEPA, 2001).

Figure 3. Photograph showing the loss of vegetation and topsoil on Blue Mountain.

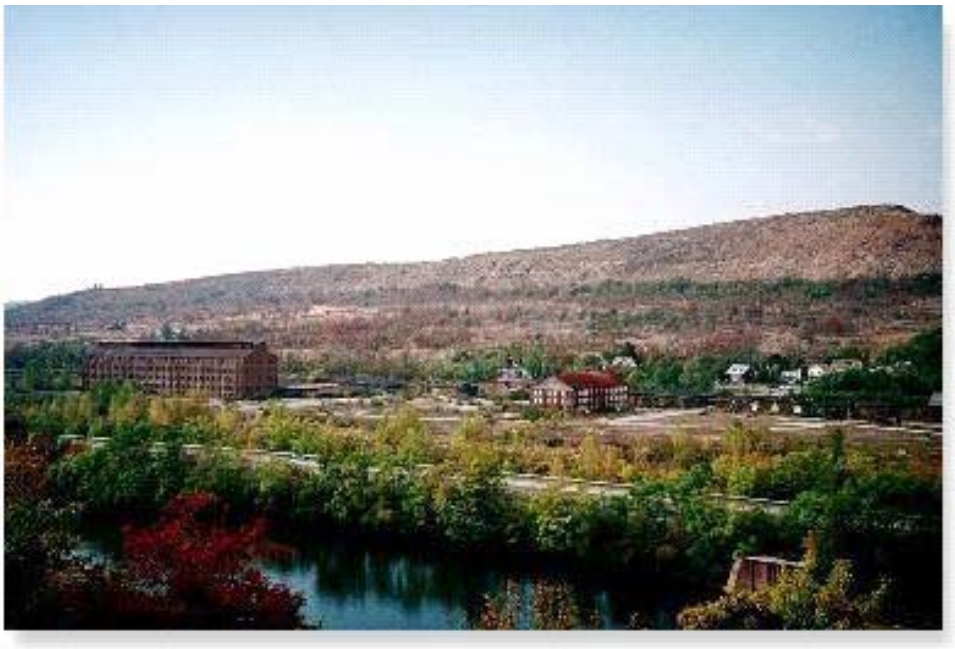

Figure 4. Photograph of the western extension of Stony Ridge behind the west smelter.

Table 1. Summary of U.S. EPA's Ecological guidelines for Cd, Cu, Pb, and Zn at Palmerton Zinc site, Palmerton, PA (U.S.EPA, 2001).

	Cd	Cu	Pb	Zn
Surface Water	**μg/l**	**μg/l**	**μg/l**	**μg/l**
AWQC Acute	3.9	18	82	120
AWQC Chronic	1.1	12	3.2	110
Fish	1.7	3.8	18.9	36.4
Daphnia	0.15	0.23	12.3	46.5
Invertebrate	NA	6.1	25.5	>5243
Aquatic Plant	2	1	500	30
EPA Region III	0.53	6.5	3.2	110
Sediment	**mg/kg**	**mg/kg**	**mg/kg**	**mg/kg**
NOAA ER-L	1.2	34	47	NA
EPA Region III	1.2	34	46.7	150
EPA Region IV	1	18.7	30.2	124
OSWER	1.2	34	47	150
ARCS TEC	0.592	28	34.2	159
Ontario MOE Low	0.6	16	31	120
Receptor Benchmarks				
Benthos				
Sediment (mg/kg)	0.57	13.4	5.17	7.7
Water (μg/l)	0.25	0.77	2.58	1.3
Fish (μg/l)	0.05	0.36	8.1	6.3
Periphyton (μg/l)	0.8	6.0	28.5	2.4
Vascular Plants (mg/kg)	4.0	100	50	50
Birds		**mg/kg/BW/day**		
No observed effect level	0.97	19	0.133	13.9
Lowest observed effect level	9.7	190	1.33	139
Mammals		**mg/kg/BW/day**		
No observed effect level	1	203	13	160
Lowest observed effect level	10	2030	130	320

Table 2. Summary of Pennsylvania water quality criteria for Cd, Cu, Pb, and Zn.

Surface Water	Cd mg/l	Cu mg/l	Pb mg/l	Zn mg/l
Human water and fish ingestion	0.01	1.0	0.05	5.0
Aquatic Life Freshwater				
Hardness 50 Acute	0.002	0.009	0.034	0.065
Hardness 50 Chronic	0.007	0.001	0.001	0.059
Hardness 200 Acute	0.010	0.034	0.200	0.210
Hardness 200 Chronic	0.002	0.021	0.008	0.190
Groundwater	**mg/l**	**mg/l**	**mg/l**	**mg/l**
Safe Drinking Water MCL	0.005	1.0	0.015	5.0

PREASSESSMENT SCREEN
FOR THE
Palmerton Zinc Pile
1 November 2003
PREPARED BY THE
US Fish and Wildlife Service
United States Department of the Interior
REGARDING NATURAL RESOURCE DAMAGE ASSESSMENT & RESTORATION

Commonwealth of Pennsylvania
Acting by and Through

Pennsylvania Game Commission:

By: Vernon Rose Date 2/13/04
Vernon Ross
Executive Director

Approved as to legality and form

William R. Pouse
Authorized Agency Attorney-PGC

PREASSESSMENT SCREEN
FOR THE
Palmerton-Zinc Pile
December 2003
PREPARED BY THE
US Fish and Wildlife Service
United States Department of the Interior
REGARDING NATURAL RESOURCE DAMAGE ASSESSMENT & RESTORATION

Commonwealth of Pennsylvania
Acting by and Through

Pennsylvania Department of Environmental Protection

By: _____ Date 12-08-03
Kathleen McGinty
Secretary

Legally reviewed:

_____ .
Authorized Agency Attorney-DEP

PREASSESSMENT SCREEN
FOR THE
Palmerton Zinc Pile
1 November 2003
PREPARED BY THE
US Fish and Wildlife Service
United States Department of the Interior
REGARDING NATURAL RESOURCE DAMAGE ASSESSMENT & RESTORATION

Commonwealth of Pennsylvania
Acting by and Through

Pennsylvania Fish and Boat Commission:

By: _____ Date 2/2/04

Dennis T. Guise
Deputy Executive Director

Approved as to legality and form

Lisa C. Maple 2/2/04
Authorized Agency Attorney-PFBC

PREASSESSMENT SCREEN
FOR THE
Palmerton Zinc Pile
1 November 2003
PREPARED BY THE
US Fish and Wildlife Service
United States Department of the Interior
REGARDING NATURAL RESOURCE DAMAGE ASSESSMENT & RESTORATION

Commonwealth of Pennsylvania
Acting by and Through

Pennsylvania Department of Conservation and Natural Resources:

By: _____ Date 1/6/04
Michael DiBerardinis

Approved as to legality and form

_____
Authorized Agency attorney-DCNR

PREASSESSMENT SCREEN

FOR THE
Palmerton Zinc Pile
1 November 2003
PREPARED BY THE
US Fish and Wildlife Service
United States Department of the Interior
REGARDING NATURAL RESOURCE DAMAGE ASSESSMENT & RESTORATION

The United States Department of Commerce

By: _____

David Kennedy
Director, Office of Response and Restoration
National Oceanic and Atmospheric Administration

Date 12/03/03

PREASSESSMENT SCREEN
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Palmerton Zinc Pile
1 November 2003
PREPARED BY THE
US Fish and Wildlife Service
United States Department of the Interior
REGARDING NATURAL RESOURCE DAMAGE ASSESSMENT & RESTORATION

The United States Department of the Interior:

By: _____ ACTING

Marvin E. Moriarty
Regional Director, U.S. Fish and Wildlife Service

Date 1-27-04