# Ryeland Road Arsenic Site

*Heidelberg Township, Pennsylvania*
*EPA Facility ID: PAD981033459*
*Basin: Schuylkill*
*HUC: 02040203*

## Executive Summary

The Ryeland Road Arsenic site is in Heidelberg Township, Berks County, Pennsylvania. From 1920 to 1940, Standard Chemical Works Corporation and then Allegheny Chemical Corporation manufactured pesticides, fungicides, paints, varnishes, and sulfuric acid on the site. During pesticide manufacturing, arsenic was converted to arsenic acid, resulting in byproducts such as lead arsenate. The primary contaminants of concern to NOAA are arsenic, lead, and copper. Tulpehocken Creek and Blue Marsh Lake, which provide freshwater adult habitat for NOAA trust resources, are the habitats of concern to NOAA. NOAA trust resources present in the vicinity of Tulpehocken Creek and Blue Marsh Lake are the anadromous alewife and striped bass and the catadromous American eel. Groundwater transport and surface water runoff are the primary pathways for the migration of contaminants from the site to NOAA trust resources.

## Site Background

The Ryeland Road Arsenic Site is in Heidelberg Township, Berks County, Pennsylvania (Figure 1). The site is in Heidelberg Township, southeast of the Womelsdorf Borough. The main portion of the site, which is approximately 3 ha (7.4 acres) in area, is bordered to the north by railroad tracks, to the south by Ryeland Road, and to the east and west by residential homes (Figure 2). An unnamed spring-fed creek, which ultimately connects to Tulpehocken Creek is north of the site.

The Ryeland Road Arsenic Site consists of four parcels on the north side of Ryeland Road and one parcel south of Ryeland Road (Figure 2). From 1920 to 1940, Standard Chemical Works Corporation and then Allegheny Chemical Corporation manufactured pesticides, fungicides, paints, varnishes, and sulfuric acid in a facility sited north of Ryeland Road. During pesticide manufacturing, arsenic was converted to arsenic acid. This process generated lead arsenate, calcium arsenate, and copper acetoarsenate as byproducts. After the manufacturing facility was closed and demolished, the northern property was divided into four residential parcels. The parcel to the south of Ryeland Road was reportedly used for waste disposal when the facility was in operation, and has remained undeveloped (USEPA 2005a).

Multiple site inspections and site assessments have been conducted at the Ryeland Road Arsenic Site. In 1984 and 1985, the Pennsylvania Department of Environmental Protection (PADEP) conducted a preliminary assessment and a site inspection. From 1985 to 2002, the U.S. Environmental Protection Agency (USEPA) conducted multiple removal actions; an expanded site inspection was completed in 2002 (Tetra Tech 2002). An ongoing remedial investigation/feasibility study was initiated in 2004.

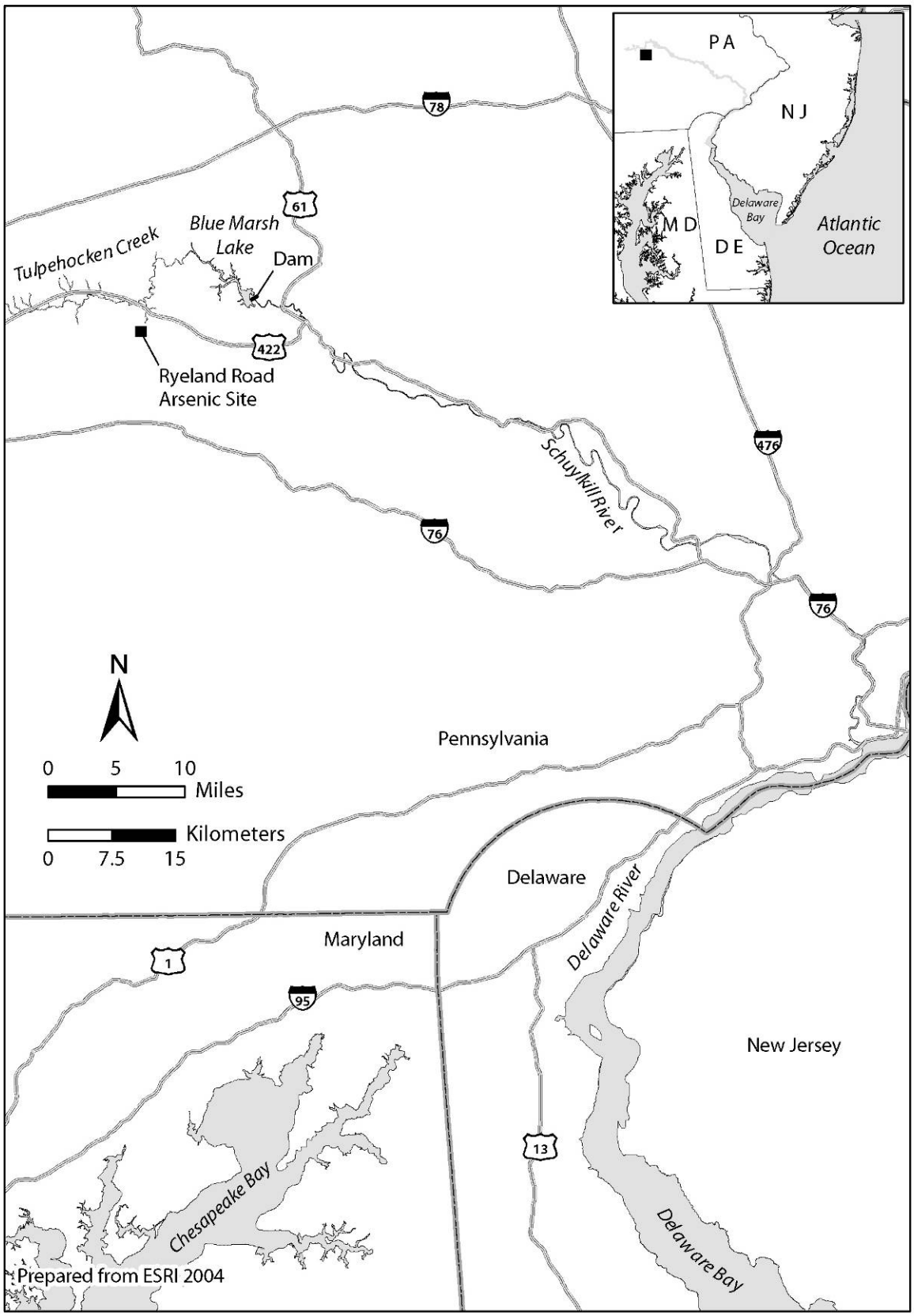


Figure 1. Location of the Ryeland Road Arsenic Site in Heidelberg Township, Pennsylvania.

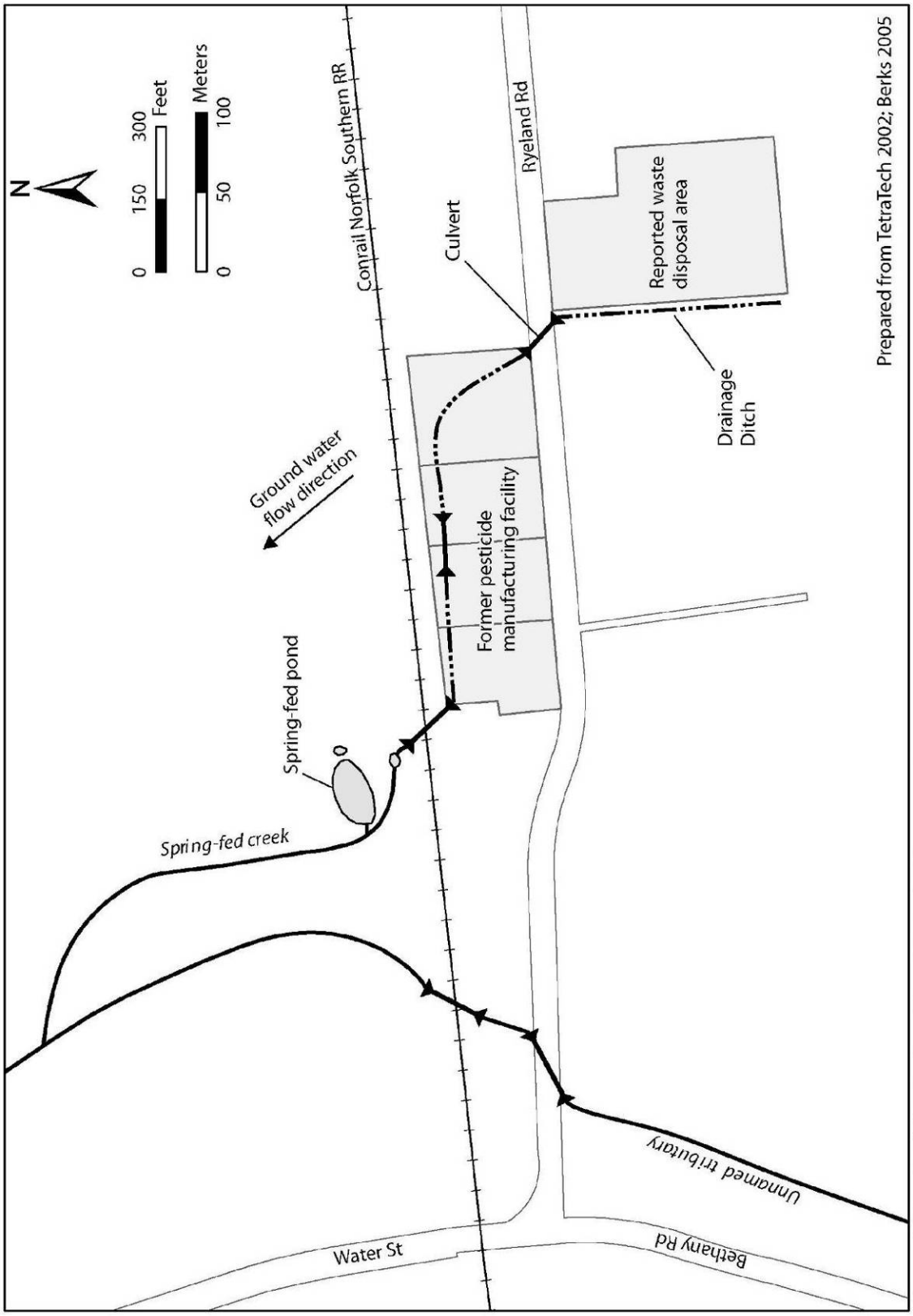


Figure 2. Detail of the Ryeland Road Arsenic Site property.

In 1984 and 1985, the PADEP found lead in a waste pile and identified elevated concentrations of lead and arsenic in surface water, sediment, and waste pile samples (Tetra Tech 2002). From 1985 to 1989, the USEPA removed approximately 4,100 $m^3$ (5,363 cy) of waste material and arsenic- and lead-contaminated soil from areas north and south of Ryeland Road. During the second phase of this removal action, arsenic- and lead-contaminated soil on three residential parcels was removed to a depth of 0.6 m (2 ft) and replaced with clean fill (USEPA 2004). In 2001, approximately 4,100 metric tons (4,519 tons) of arsenic- and lead-contaminated soil were removed from the undeveloped parcel south of Ryeland Road. In 2002, arsenic-contaminated soil in residential yards where the former facility had been located and in a backyard adjacent to the former facility, was excavated to a depth of 0.6 m (2 ft) and replaced with clean fill. The Ryeland Road Arsenic Site was proposed to the National Priorities List (NPL) on March 8, 2004 and was placed on the NPL on July 22, 2004 (USEPA 2004, 2005a).

Groundwater transport and surface water runoff are the primary pathways for the migration of contaminants from the site to NOAA trust resources. Surface water runoff flows into a drainage ditch that runs through the site and joins an unnamed spring-fed creek, which connects to an unnamed tributary of Tulpehocken Creek. Groundwater is encountered beneath the site at 8.5 m (28 ft) below ground surface. The groundwater flows to the northwest toward Tulpehocken Creek (Tetra Tech 2002). Soils on the Ryeland Road Arsenic Site range from silt loam to gravelly loam (USEPA 2004).

### NOAA Trust Resources

The habitats of primary concern to NOAA are the surface waters of Tulpehocken Creek and Blue Marsh Lake. The drainage ditch that flows through the Ryeland Road Arsenic site empties into an unnamed spring-fed creek (Figure 2). The unnamed spring-fed creek joins an unnamed tributary of Tulpehocken Creek (Figure 2), which in turn becomes Blue Marsh Lake (Figure 1). At the base of Blue Marsh Lake dam, Tulpehocken Creek resumes its flow. Tulpehocken Creek flows for approximately 10 km (6 mi) before emptying into the Schuylkill River. The Schuylkill River joins the Delaware River, which discharges into Delaware Bay.

Blue Marsh Lake provides adult habitat to non-migrating NOAA trust resources (Table 1) (Chikotas 2005; PADEP 2005a). The Blue Marsh Lake dam prevents the upstream passage of migratory fish species. American eel were found in the lake in 1992 (PADEP 2005a), although that may have been a remnant population from before the dam was built (Chikotas 2005). The lake was stocked with alewife in 1982 and with striped bass on six occasions from 1994 to 2001 (PADEP 2005a). Alewife spawn in areas of slow current or still pools; when landlocked, they can reproduce in cool lakes (Steiner 2005). Blue Marsh Lake is a warm-water fishery (PADEP 2005a), so alewife might be spawning in Tulpehocken Creek and its tributaries. Striped bass require significant lengths of flowing water for successful spawning and generally exhibit little to no natural reproduction when confined to inland lakes (Steiner 2005).

There are no plans to breach the dam or install fish passage structures (Chikotas 2005). Therefore, migratory fish in the Schuylkill River are not trust resources of concern for the Ryeland Road Arsenic Site. No commercial fishery occurs on Tulpehocken Creek or Blue Marsh Lake. Recreational fishing of alewife and striped bass occurs in Blue Marsh Lake.

Table 1. NOAA trust resources present in Tulpehocken Creek and Blue Marsh Lake near the Ryeland Road Arsenic Site (Chikotas 2005; PADEP 2005a).

| **Species** | | **Habitat Use** | | | **Fisheries** | |
|---|---|---|---|---|---|---|
| Common Name | Scientific Name | Spawning Area | Nursery Area | Adult Habitat | Comm. | Rec. |
| **ANADROMOUS FISH** | | | | | | |
| Alewife | *Alosa pseudoharengus* | ♦ | ♦ | ♦ | | ♦ |
| Striped bass | *Morone saxatilis* | | | ♦ | | ♦ |
| **CATADROMOUS FISH** | | | | | | |
| American eel | *Anguilla rostrata* | | | ♦ | | |

A statewide fish-consumption advisory is in effect. The advisory recommends limited consumption of all sport fish (i.e., fish caught recreationally) to protect against exposure to unidentified contaminants (PADEP 2005b).

### Site-Related Contamination

Soil, groundwater, surface water, and sediment samples were collected from the Ryeland Road Arsenic Site during the 2002 expanded site inspection (Tetra Tech 2002). The soil samples were collected from the four parcels north of Ryeland Road and a parcel just to the east of the former pesticide manufacturing facility. The groundwater samples were collected from drinking water wells at seven residences north and east of the Ryeland Road Arsenic Site. The sediment and surface water samples were collected from the spring-fed creek, the unnamed tributary downstream of the creek, and a spring-fed pond north of the railroad tracks (Figure 2).

The primary contaminants of concern to NOAA are arsenic, lead, and copper. Polycyclic aromatic hydrocarbons (PAHs) and pesticides such as DDE, lindane, and chlordane were also detected in sediment samples, and PAHs, polychlorinated biphenyls (PCBs), benzene, and pesticides were also detected in soil samples; however, the source material used in preparing this report did not provide the detected concentrations of these contaminants. For that reason, only metals concentrations are discussed below. Note that analytical results for metals are also incomplete in the source material.

Table 2 summarizes the maximum concentrations of contaminants of concern to NOAA detected during the site investigations and compares them to relevant screening guidelines. Site-specific or regionally specific screening guidelines are always used when available. In the absence of such guidance, the screening guidelines for groundwater and surface water are the ambient water quality criteria (AWQC; USEPA 2002); the screening guidelines for sediment in a freshwater environment are the threshold effects concentrations (TECs; MacDonald et al. 2000); and the screening guidelines for soil are the Oak Ridge National Laboratory final preliminary remediation goals (ORNL-PRGs; Efroymson et al. 1997) and the USEPA's ecological soil screening guidelines (USEPA 2005b). Exceptions to these screening guidelines, if any, are noted in Table 2. Only maximum concentrations that

exceeded relevant screening guidelines or for which there are no screening guidelines are discussed below. When known, the general sampling locations are also provided for maximum concentrations that exceeded screening guidelines or do not have screening guidelines.

Table 2. Maximum concentrations of contaminants of concern to NOAA at the Ryeland Road Arsenic Site (Tetra Tech 2002; USEPA 2004a). Contaminant values in bold exceed or are equal to screening guidelines.

| | Soil (mg/kg) | | Water (µg/L) | | | Sediment (mg/kg) | |
|---|---|---|---|---|---|---|---|
| **Contaminant** | Soil | ORNL-PRG[a] | Groundwater | Surface Water | AWQC[b] | Sediment | TEC[c] |
| **METALS/INORGANICS** | | | | | | | |
| Arsenic | **66,000** | 9.9 | **530** | **500** | 150 | **400** | 9.79 |
| Cadmium | **29** | 0.36[d] | NAv | NAv | 0.25[e] | **1.2** | 0.99 |
| Chromium[f] | **30** | 0.4 | NAv | NAv | 11 | 30 | 43.4 |
| Copper | **460** | 60 | **1,000** | NAv | 9[e] | **79** | 31.6 |
| Lead | **150,000** | 40.5 | **190** | **5.5** | 2.5[e] | **430** | 35.8 |
| Mercury | **1** | 0.00051 | NAv | NAv | 0.77[g] | NAv | 0.18 |
| Nickel | **47** | 30 | NAv | NAv | 52[e] | 12 | 22.7 |
| Selenium | **32** | 0.21 | NAv | NAv | 5.0[h] | 2.2 | NA |
| Silver | 1.5 | 2 | NAv | NAv | 3.2[e,i] | NAv | 4.5[j] |
| Zinc | **1,200** | 8.5 | NAv | NAv | 120[e] | NAv | 121 |

a: Oak Ridge National Laboratory (ORNL) final preliminary remediation goals (PRG) for ecological endpoints (Efroymson et al. 1997).
b: Ambient water quality criteria for the protection of aquatic organisms (USEPA 2002). Freshwater chronic criteria presented.
c: Threshold Effects Concentration (TEC). Concentration below which harmful effects are unlikely to be observed (MacDonald et al. 2000).
d: Ecological soil screening guidelines (USEPA 2005b).
e: Criterion expressed as a function of total hardness; concentrations shown correspond to hardness of 100 mg/L $CaCO_3$.
f: Screening guidelines represent concentrations for $Cr.^{+6}$
g: Derived from inorganic, but applied to total mercury.
h: Criterion expressed as total recoverable metal.
i: Chronic criterion not available; acute criterion presented.
j: Freshwater upper effects threshold (UET) for bioassays. The UET represents the concentration above which adverse biological impacts would be expected.
NA: Screening guidelines not available.
NAv: Contaminant concentration not available in the documents reviewed.

## Surface Water

Two metals were detected in surface water samples collected from the Ryeland Road Arsenic Site at maximum concentrations that exceeded screening guidelines. The maximum concentration of arsenic, which occurred in a sample collected from the spring-fed pond north of the former facility, exceeded the AWQC by a factor of three. The maximum concentration of lead, which occurred in a sample collected from the spring-fed creek north of the former facility, exceeded the AWQC by a factor of two.

Sediment

Four metals were detected in sediment samples collected from the Ryeland Road Arsenic Site at maximum concentrations that exceeded screening guidelines, and one metal was detected for which no screening guideline is currently available for comparison. The maximum concentrations of arsenic, cadmium, copper, and lead were detected in a sample collected from the spring-fed creek north of the former facility. The maximum concentrations of arsenic and lead exceeded the TECs by one order of magnitude. The maximum concentration of copper exceeded the TEC by a factor of 2.5. The maximum concentration of cadmium slightly exceeded the TEC. No screening guideline is available for comparison to the maximum concentration of selenium, which was detected in a sample collected from the spring-fed creek just downstream of its point of origin.

Groundwater

Three metals were detected in groundwater samples collected from the Ryeland Road Arsenic Site at maximum concentrations that exceeded screening guidelines. The maximum concentrations of copper and lead were detected in a sample collected from the storage tank for a residential drinking water well, adjacent to the former facility to the east. The maximum concentration of copper exceeded the AWQC by two orders of magnitude. The maximum concentration of lead exceeded the AWQC by one order of magnitude.

The maximum concentration of arsenic, which exceeded the AWQC by a factor of 3.5, was detected in a sample collected from a spring north of the undeveloped parcel.

Soil

Nine metals were detected in soil samples collected from the Ryeland Road Arsenic Site at maximum concentrations that exceeded screening guidelines. The source material used in preparing this report does not indicate the soil sampling locations. The maximum concentrations of arsenic, lead, and mercury exceeded the ORNL-PRGs by three orders of magnitude. The maximum concentrations of selenium and zinc exceeded the ORNL-PRGs by two orders of magnitude. The maximum concentration of chromium exceeded the ORNL-PRG by one order of magnitude, while the maximum concentration of cadmium exceeded the USEPA's ecological soil screening guideline by one order of magnitude. The maximum concentrations of copper and nickel exceeded the ORNL-PRGs by factors of eight and 1.5, respectively.

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