PHASE II INVESTIGATAIONS AND
HUMAN HEALTH RISK ASSESSMENT FOR ARSENIC
Santa Cruz Branch Line
Santa Cruz and Monterey Counties, California

Submitted by:

AMEC Geomatrix, Inc., Oakland, California

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AMEC Geomatrix

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EXECUTIVE SUMMARY

This report presents results of Phase II investigation activities performed by AMEC Geomatrix, Inc. (AMEC; formerly Geomatrix Consultants, Inc.) from March 2005 through April 2009, along portions of the Santa Cruz Branch Rail Line (the Branch Line) in Santa Cruz County and Monterey Counties, California. The work was performed on behalf of the Santa Cruz County Regional Transportation Commission (SCCRTC) to evaluate environmental conditions along the rail line in support of the acquisition of the Branch Line right-of-way, between Watsonville Junction and Davenport. The Phase II investigations consisted of advancing soil borings to collect soil samples at targeted locations along the Branch Line identified in AMEC's 1996 Phase I environmental site assessment (Phase I; Geomatrix, 1997) and during site reconnaissance in 2005 and 2009, and at systematic sampling locations for general site coverage outside of the targeted sampling locations.

The analytical results for soil samples collected were compared to screening level criteria to evaluate whether environmental impacts were present along the Branch Line corridor. As part of the evaluation a site-specific background concentration of arsenic in soil was calculated for the Branch Line in support of a human health risk assessment (HHRA) for arsenic.

Summary of Work Performed

In 1996, AMEC performed a Phase I environmental assessment for the Site on behalf of the SCCRTC. The Phase I assessment included a review of historical documents, site reconnaissance, and an environmental regulatory file review. The findings of the assessment identified features that potentially could affect environmental conditions on the Branch Line and were used to develop a Phase II investigation and sampling plan.

AMEC implemented Phase II investigations from March through April 2005 and from February through April 2009. The investigations included the completion of a site reconnaissance to observe updated conditions along the right-of-way, a geophysical survey to locate a potential underground storage tank (UST), and the collection of soil samples at targeted on-site features identified during the Phase I assessment and 2005 and 2009 site reconnaissance. AMEC also performed systematic soil sampling of six, 1-mile sections of the Branch Line to evaluate general site conditions and the presence of arsenic in soil; arsenic impacts could have occurred from the possible historical use of herbicides along the right-of-way.

Data Evaluation

Analytical data generated during the Phase II soil investigations were compared to health-based risk screening criteria, and were used to assess whether potential environmental impacts were present along the Branch Line and additional investigation or mitigation could be warranted. AMEC also evaluated data with regard to waste classification criteria in the event that soil potentially could be excavated and require off-site disposal.

As discussed in this report, arsenic is naturally-occurring and typically is present at concentrations greater than risk-based screening criteria. As such, these screening criteria are not directly applicable, and it is appropriate to evaluate the presence of arsenic by estimating the incremental risk from possible exposures to arsenic at concentrations greater than naturally-occurring background. Therefore, as part of the Phase II investigations, samples were collected to develop a sufficiently large data set of arsenic concentrations in soil along the Branch Line to calculate a site-specific background concentration. The background concentration was then used for a site-specific analysis of the potential human health risk from arsenic above background considering potential future activities and uses of the Branch Line.

Summary of Calculated Site-Specific Background Concentration of Arsenic

The analysis of the site-specific background concentration of arsenic was conducted in accordance with California Protection Agency (Cal-EPA) Department of Toxic Control Substances (DTSC) guidance documents (DTSC, 1997 and 2009). The methods used to calculate the site-specific background concentration of arsenic are presented in Appendix E of this report.

A site-specific background concentration of arsenic along the Branch Line was calculated to be 14.4 milligrams per kilogram (mg/kg). The analysis was based on arsenic concentrations in soil samples collected throughout the right-of-way from depths between 1.5 feet and 10 feet below ground surface (bgs); statistical tests indicated that soil in the upper 1.5 feet could be impacted by arsenic and data in this depth interval potentially could bias the background evaluation.

Summary of Human Health Risk Assessment for Arsenic

Based on the results of soil sampling activities, a human health risk assessment was conducted following U.S. Environmental Protection Agency and California Environmental Protection Agency guidelines to assess if future exposures to arsenic in soil will pose a theoretical health risk. Because arsenic is a naturally-occurring substance that can be present in air, groundwater, soil, rocks, and in metal ores, site-specific background levels of arsenic in soil were first estimated and the incremental health risk and hazard over background were calculated.

To assess the potential health risk and hazard, the following factors were considered: how the site is used, how people could come into contact with arsenic in soil, how arsenic enters the body, how much arsenic would enter the body (the dose), and how long it stays in the body.

Because AMEC understands that portions of the right-of-way may be redeveloped into a recreational trail that would be used by residents and visitors for activities, such as walking and running for exercise or biking, a future construction worker and a future recreational user were evaluated. A person cannot be affected by a chemical unless the person comes into contact with the chemical. Possible routes of exposure to arsenic in soil by future construction workers and recreational users are:

- incidental ingestion—eating or drinking something with arsenic in or on it after touching soil with arsenic
- inhalation—breathing dust or particulates in air that has arsenic in it
- skin dermal contact—touching soil that has arsenic on or in it

For the risk assessment, it was conservatively assumed that soil containing arsenic is exposed (that is, no cover that could consist of materials, such as clean soil, gravel, or pavement would be placed over soil) and that arsenic in soil is 100 percent bioavailable (i.e., the fraction of the chemical that is available for absorption into the body) due to the lack of site-specific bioavailability information.

The estimated risk to arsenic in soil was calculated based on theoretical cancer and noncancer health effects over background. Cancer risk is expressed as the maximum number of new cases of cancer projected to occur in a population of one million people due to exposure to arsenic over a 70-year lifetime. For example, a cancer risk of one in one million (1×10^{-6}) means that in a population of one million people, not more than one additional person would be expected to develop cancer as the result of the exposure to the substance causing that risk.

Noncancer hazard is determined by comparing the actual level of exposure (dose) from arsenic to the level of exposure that is not expected to cause any adverse effects, even in the most susceptible people. Levels of exposure at which no adverse health effects are expected are called "reference dose and reference concentration," and are generally based on the results of animal studies. A hazard less than or equal to 1 (ratio of exposure dose to reference dose/concentration) indicates that the predicted exposure to that chemical should not result in an adverse noncancer health effect.

The incremental excess lifetime cancer risk and noncancer hazard is the difference between exposure to arsenic in soil and arsenic as background. The incremental excess lifetime cancer risks range between four in ten million (4×10^{-7}) and five-in-one million (5×10^{-6}) for the future construction worker and three-in-one million (3×10^{-6}) and forty-in one million (4×10^{-5}) for the future recreational user. These incremental excess lifetime cancer risk ranges are within the range considered acceptable by the U.S. EPA and Cal/EPA. The incremental noncancer hazard indexes are less than 1 for both the future construction worker and recreational user. The results of the assessment indicate that the incremental increase in risk over background range from 2 to 5.6 times, suggesting that potential exposures to arsenic in soil as a result of past activities are not significantly different than naturally-occurring levels.

Summary of Primary Environmental Impacts

The results of the Phase II investigations along the Branch Line right-of-way identified two primary environmental impacts:

1. Granite Construction Company:

Soil is impacted with elevated concentrations of petroleum hydrocarbons in the drainage ditch along the railroad right-of-way adjacent to the Granite Construction Company facility in Watsonville, California. Based on the analytical results, petroleum hydrocarbon impacts that exceed relative screening levels extend to depths of at least 12 feet bgs, but are generally less than 20 feet bgs. The lateral extent of petroleum hydrocarbon impacts extends over a distance of at least 90 feet along the drainage ditch. Based on the findings, it is likely that the petroleum hydrocarbon impacts are generally confined to the area of the drainage ditch and appear to be related to a discharge pipe emanating from the Granite Construction facility.

2. Arsenic along the Branch Line:

Arsenic is generally distributed in shallow soil (less than or equal to 1.5 feet bgs) along the Branch Line right-of-way above the calculated site-specific background concentration of 14.4 mg/kg and is likely a result of railroad operations such as the potential application of arsenical herbicides along the Branch Line.

Although the results of the risk assessment for arsenic in soil indicate that the incremental cancer risk to construction workers and recreational users is within the U.S. EPA's target cancer risk range, arsenic (as well as some other constituents, as noted in this report) was detected at some locations at concentrations that could require special handling during construction activities (e.g., disposal classification). Based on these results, we recommend that a management plan to address arsenic-containing soil during future construction be prepared. This plan would include soil excavation, stockpiling, and disposal procedures, and construction monitoring guidelines.

PHASE II INVESTIGATIONS AND HUMAN HEALTH RISK ASSESSMENT FOR ARSENIC

Santa Cruz Branch Line
Santa Cruz and Monterey Counties, California

1.0 INTRODUCTION

This report presents results of Phase II investigation activities performed by AMEC Geomatrix, Inc. (AMEC; formerly Geomatrix Consultants, Inc.), from March 2005 through April 2009, on behalf of Santa Cruz County Regional Transportation Commission (SCCRTC) along portions of the Santa Cruz Branch Rail Line (the Branch Line) in Santa Cruz County and Monterey Counties, California (the Site; Figure 1). AMEC performed Phase II site investigations on behalf of SCCRTC to evaluate environmental conditions along the rail line in support of the acquisition of the Branch Line right-of-way, between Watsonville Junction and Davenport. The Phase II investigations consisted of advancing soil borings to collect soil samples at targeted locations along the Branch Line identified in AMEC's 1996 Phase I environmental site assessment (Phase I; Geomatrix, 1997) and 2005 and 2009 site reconnaissance, and at systematic sampling locations for general Site coverage outside of the targeted sampling locations. In addition, the 2009 investigation included the collection of additional systematic soil samples for arsenic analysis to evaluate the distribution of arsenic in shallow soil along the Branch Line and to calculate a site-specific background concentration of arsenic in support of a preliminary human health risk assessment (HHRA).

This report contains site background information, a description of the specific objectives and methodologies for sampling performed from March 2005 through April 2009, screening criteria used to evaluate analytical results, an evaluation of arsenic background concentrations, the results of the investigation relative to the screening criteria and calculated arsenic background concentration, the results of the HHRA, and recommendations for further work, if warranted.

2.0 BACKGROUND

This section presents a brief description of the Site, the regional geologic and hydrogeologic setting, and a summary of previous work conducted in association with the Site.

2.1 SITE LOCATION AND DESCRIPTION

The Branch Line includes approximately 31.4 miles of Union Pacific Railroad (UPRR, formerly Southern Pacific Transportation Company [SPTCo]) right-of-way that extends from Davenport (milepost 31.40) to Santa Cruz Junction (milepost 21.11) and from Santa Cruz Junction (milepost 21.11) to Pajaro (Salinas Road, milepost 0.45; Figure 1). Historical SPTCo valuation maps of the Branch Line were obtained by AMEC during the Phase I site assessment. According to these maps, the width of the right-of-way ranges between 21 and 209 feet. However, the width of a majority of the right-of-way ranges between 50 and 100 feet wide.

The Phase I was conducted when SPTCo owned the Branch Line right-of-way. In the Phase I report, AMEC identified locations for targeted sampling using SPTCo milepost numbers. In 1996, UPRR acquired SPTCo and renumbered the mileposts along the Branch Line. All sampling locations and Branch Line features are identified in this report by the new UPRR milepost numbers, where milepost 0.0 is the beginning of the Branch Line at the Watsonville Junction in Pajaro, and milepost 31.4 is the end of the Branch Line at the cement factory in Davenport.

To facilitate discussion of our findings, the Site informally is subdivided into four sections (Figure 1). These sections were developed considering primary historical and existing railroad features such as station sites, city boundaries, and development along the right-of-way. Section designations for the Phase I and Phase II soil investigations are:

Section I	Davenport (milepost 31.4) to the approximate western boundary of the City of Santa Cruz[1] (milepost 22.48)
Section II	Milepost 22.48 to the eastern boundary of the City of Santa Cruz[2] (milepost 18.68).
Section III	Milepost 18.68 through Capitola and Aptos to Leonard's Gulch (milepost 9.06).
Section IV	Milepost 9.06 to Salinas Road (milepost 0.45), which is approximately 0.45 miles from Watsonville Junction.

2.2 SITE HISTORY

Information contained in this section was obtained primarily from the book, California Central Coast Railways, by Rick Hamman (Hamman, 1980). According to Hamman, the portion of the Site formally known as the Santa Cruz Branch Line (approximately mileposts 0.0 to 21.15) began operation in May 1876 as a narrow gauge passenger and freight rail line. At this time, the approximately 20-mile line was owned and operated by the Santa Cruz Railroad. This section of the Branch Line was purchased by SPTCo in June 1881 and was converted fully to a broad gauge railroad by 1883.

1. The City of Santa Cruz boundary, as shown on the Rand McNally map titled “Santa Cruz Watsonville, California, City Map, 1993.”
2. The boundary is approximately at the eastern shore of the Santa Cruz Yacht Harbor.

The portion of the Site formally known as the Davenport Branch Line (approximately mileposts 21.15 to 31.4) was constructed from Santa Cruz Junction to Davenport Landing by a SPTCo subsidiary company, the Coast Line Railway Company. Freight and passenger operations reportedly began on this line in the spring of 1908. During the late 1800s and early 1900s, freight operations for the railroad included conveying lumber, quarried material, and agricultural products out of the Santa Cruz area. With construction of the Davenport Branch Line, incoming freight included coal and gypsum for delivery to the cement factory located in Davenport. Circa 1910, the maintenance repair operations at the Santa Cruz Junction largely were transferred to Watsonville Junction (then known as Pajaro). Passenger service was discontinued in 1938. Currently, three freight trains per week traverse the Branch Line from Watsonville Junction to Davenport, and back.

2.3 REGIONAL GEOLOGIC SETTING AND GENERAL HYDROGEOLOGY

The Site lies in the Coast Range geomorphic province of California. The majority of the Site, from north of Davenport to La Selva Beach, is situated on lowlands seaward of the Santa Cruz Mountains. This portion of the Site generally follows the coastline of the Pacific Ocean and Monterey Bay. Near La Selva Beach, the corridor turns landward toward Watsonville and generally follows the flood plains of the Watsonville Slough and Pajaro River.

These lowlands along the coastline of the Pacific Ocean and Monterey Bay have been interpreted to be uplifted or emergent marine terraces of Quaternary age (Brabb, 1989). The higher terraces are progressively older and more dissected. These terraces are cut into the Santa Cruz Mountains, which consist of Tertiary-age sedimentary rocks that have been folded and faulted by movements along the San Andreas Fault system.

The rocks underlying the site are predominantly of late Cenozoic marine origin with some continental deposits. The portion of the Site from north of Davenport to La Selva Beach rests on the lowest emergent terrace, which consists of poorly-graded marine sands and gravels that range from 20 to 40 feet thick. Locally, this terrace has been cut by streams; these cuts expose some underlying Tertiary mudstones and siltstones in some locations and in other locations contain more recent alluvial fill deposits consisting of sand, silt, gravel, and clay that are generally less than 100 feet thick. The underlying Tertiary rocks range up to 8900 feet thick and are underlain by granitic basement rock. An inactive fault, the Ben Lomond fault, crosses the site west of Santa Cruz; the location of the fault is generally coincident with the San Lorenzo River.

The portion of the Site from La Selva Beach to Watsonville rests on continental deposits consisting of alluvial (flood plain) sand, silt, clay, and gravel and eolian sands. These deposits locally range from 50 to 200 feet thick.

The regional groundwater flow regime has not been extensively documented. However, the general pattern of regional groundwater flow can be interpreted from the geography and geology. The Santa Cruz Mountains to the east likely act as a flow boundary and as the principal area of groundwater recharge, while the lowlands or terraces, are likely a zone of groundwater discharge. Water infiltrating the upland areas percolates downward and recharges groundwater in the bedrock fracture system. Groundwater eventually moves toward the ocean, flowing into the terrace and basin fill sediments. From these sediments, groundwater is discharged directly to the ocean with some discharge through evapotranspiration.

2.4 SUMMARY OF POTENTIAL HISTORICAL ENVIRONMENTAL IMPACTS

In 1996, AMEC performed a Phase I environmental assessment for the Site on behalf of the SCCRTC. The Phase I assessment included a review of historical documents, site reconnaissance, and an environmental regulatory file review. The findings of the assessment identified historical and existing features that could affect environmental conditions on the Branch Line. These findings were documented in AMEC's *Phase I Preliminary Site Assessment Davenport and Santa Cruz Branch Lines* (Geomatrix, 1997) and are summarized below.

Section I (Milepost 31.4 to Milepost 22.48)

On-site features in Section I that potentially could affect environmental conditions included: (1) potential chemical discharge through a drainage tunnel that runs beneath the Branch Line and originates at the Davenport cement factory (approximate milepost 31.36); (2) a historical loading shed and freight depot where chemicals may have been handled at milepost 31.40; and (3) a historical engine house and potential underground storage tank (UST) at milepost 26.69.

Section II (Milepost 22.48 to Milepost 18.68)

The historical review identified several features of potential environmental concern within Section II of the Branch Line. These features included a tool house, roadmaster's car house, scrap bin, and freight house at the Santa Cruz Station (approximate milepost 20.2); an in-ground oil reservoir near the Casino Station (approximately milepost 19.77); and a freight house at the Seabright Station (milepost 18.99). An upright, steel pipe, which was thought to be a well, was observed during reconnaissance along the Branch Line at milepost 21.90. Atypical soil staining was observed between the railroad tracks and surrounding ballast at milepost 20.29, possibly suggesting that a petroleum-based spill occurred in this area. Miscellaneous dumping of debris on the Branch Line near Mission Industrial Lands (at approximate milepost 21.70) that could affect environmental conditions at the Branch Line also was identified.

Section III (Milepost 18.68 to Milepost 9.06)

The historical review identified a freight house on the Branch Line at milepost 16.40. A car repair facility, paint shop, and boat repair facility historically encroached upon the Branch Line in this section at approximate milepost 18.43.

Section IV (Milepost 9.06 to Milepost 0.45)

The historical review identified features of potential environmental concern within Section IV of the Branch Line. These features included two in-ground oil tanks that potentially exist on or near the Branch Line at milepost 1.20. Features of potential environmental concern also were observed on the Branch Line during the 1996 site reconnaissance, including staining (mileposts 1.80 and 2.79), a discharge of unknown composition onto the Branch Line from Granite Construction Company (milepost 2.32), and evidence of runoff from Drisco Pipe onto the Branch Line (approximate milepost 2.34).

Derailments

From discussions with the SCCRTC, we understand several train derailments occurred along the Branch Line since the Phase I was conducted in 1996. AMEC gathered information on these incidents from readily available sources and evaluated whether hazardous materials could have been released onto the Branch Line and potentially impact environmental conditions. Based on information reviewed, there were no indications that chemicals or hazardous materials were released during the derailments.

3.0 INVESTIGATIVE APPROACH

Based on the findings of the 1996 Phase I, AMEC recommended a Phase II investigation consisting of soil sampling at targeted locations identified above, and geophysical surveys at locations where historical USTs and in-ground oil tanks/reservoirs may still have been in place within the Branch Line right-of-way. Additionally, the Phase II investigation addressed specific items that were expressed during the public review process for the project including the addition of systematic soil sampling and soil sampling at targeted railroad tie locations.[3]

A supplemental Phase II sampling program was conducted in 2009 based on the initial 2005 Phase II sampling results, a recent site reconnaissance, and discussions with the SCCRTC. The investigation approach for the 2005 and 2009 Phase II sampling programs are discussed in this section.

3. Items from Section 11 of the February 17, 2005 Transportation Policy Workshop (TPW) meeting minutes.

3.1 2005 PHASE II SAMPLING PROGRAM

AMEC implemented the 2005 Phase II investigation from March through April 2005. The investigation included the following activities:

- Site reconnaissance to obtain a contemporary snapshot of conditions along the right-of-way;
- Geophysical survey in the areas of the potential UST and engine house at milepost 26.69;
- Soil sampling at targeted, on-site features; and
- Soil sampling near chemically-treated railroad ties.

Additionally, at the request of SCCRTC, AMEC performed systematic soil sampling of five, 1-mile sections of the Branch Line. The purpose of the systematic sampling was to evaluate the possibility that railroad operations resulted in pervasive environmental impacts along the entirety of the railroad corridor in addition to potential impacts at targeted locations identified during the Phase I assessment. To assess this possibility, the systematic sampling approach consisted of dividing the Branch Line into four categories based on primary land use surrounding the right-of-way. Conceptually, establishing the sections relative to land use could result in the identification of impacts that could be directly attributable to railroad operations. The 1-mile sections of rail line included one section surrounded by mostly industrial properties, one section surrounded by primarily residential properties, two non-contiguous sections surrounded primarily by agricultural lands, and one section surrounded by open, undeveloped land. The industrial section was located in Watsonville, California, which is within the most heavily industrialized section of the Branch Line. One of the agricultural sections was located west of Santa Cruz (referred to as Agricultural North) and one west of Watsonville (referred to as Agricultural South) where crops and farming practices may differ. AMEC field personnel identified the five representative 1-mile sections during the Phase II site reconnaissance. The 1-mile systematic sampling sections were located as follows:

Agricultural North	Approximately from Milepost 26.11 to Milepost 27.00 (Section I, Figure 3)
Residential	Approximately from Milepost 16.89 to Milepost 17.86 (Section III, Figure 5a)
Undeveloped	Approximately from Milepost 6.55 to Milepost 7.73 (Section IV, Figure 9)
Agricultural South	Approximately from Milepost 2.82 to Milepost 3.89 (Section IV, Figure10)
Industrial	Approximately from Milepost 1.68 to Milepost 2.61 (Section IV, Figure11)

Boring locations for the 2005 targeted and systematic sampling programs are shown on Figures 2 through 11. Sample locations, including approximate milepost locations, sample depths, and sample analyses, are summarized in Table 1.

3.2 2009 PHASE II SAMPLING PROGRAM

A supplemental Phase II sampling program was conducted in 2009 based on the initial 2005 Phase II sampling results, a recent site reconnaissance, and discussions with the SCCRTC.

AMEC performed the following activities as part of the 2009 supplemental Phase II investigation:

- Additional site reconnaissance to observe current conditions along the right-of-way and identify additional potential targeted sample locations;
- Additional soil sampling in the vicinity of previous targeted sampling locations SB-10, SB-23, and SB-45 to define the extent of impacts identified during the 2005 Phase II sampling program (as described in Section 3.2.1);
- Additional systematic soil sampling for arsenic in shallow soil in the residential, undeveloped, and agricultural-south sections;
- At the request of the SCCRTC, additional systematic soil sampling along a 1-mile section of the Branch Line between Seascape and Capitola for general site coverage; and
- Soil sampling at one additional targeted sampling location identified during the recent site reconnaissance performed prior to the initiation of the 2009 supplemental Phase II sampling program.

The investigative approach for the targeted and systematic sampling program is summarized below. Boring locations for the targeted and systematic sampling programs are shown on Figures 2 through 12. Sample locations, including approximate milepost locations, sample depths, and sample analyses, are summarized in Table 2.

3.2.1 Targeted Sampling Approach

In Section II, at boring location SB-10 (approximate milepost 21.70), polynuclear aromatic hydrocarbons (PAHs) were detected in shallow soil samples above screening criteria. This location was initially sampled during the 2005 investigation to address miscellaneous debris that had been deposited on the Branch Line right-of-way. For the 2009 investigation, six soil borings were advanced around SB-10 to depths ranging from 4 to 6 feet below ground surface (bgs) to evaluate the lateral extents of the PAHs in soil and to collect additional data regarding the presence of arsenic on the right-of-way as discussed in Section 3.2.3 (SB-77 through SB-82; Figures 4 and 4a).

In Section III, soil samples from previous boring location SB-23 (approximate milepost 16.39) contained arsenic at elevated concentrations. SB-23 was originally sampled during the 2005 Phase II investigation to evaluate the potential impact of a former freight house located at approximate milepost 16.40. For the 2009 investigation, three soil borings were advanced around SB-23 to depths ranging from 4 to 6 feet bgs to delineate the lateral extents of elevated arsenic concentrations and to evaluate whether the elevated arsenic concentration at this location is attributable to the former freight house operations or related to the general presence of arsenic along the Branch Line (SB-74 through SB-76; Figures 6 and 6a)..

In Section IV, at previous boring location SB-45 (approximate milepost 2.32) located within a drainage ditch adjacent to the Granite Construction facility, petroleum hydrocarbons were detected in soil samples collected during the 2005 investigation above screening criteria and stained soil was observed to a depth of approximately 7 feet bgs. The petroleum-impacted soil appears to have resulted from the discharge of a drainage pipe emanating from the adjacent Granite Construction facility. For the 2009 investigation, six soil borings were advanced in the vicinity of SB-45 to depths ranging from 12 to 20 feet bgs along the drainage ditch to delineate the lateral and vertical extents of petroleum hydrocarbon impacted soil in this area (SB-97 through SB-102; Figures 11 and 11a).

3.2.1.1 Additional Targeted Sampling Based on Site Reconnaissance

On January 19 and 20, 2009, AMEC personnel visited the site and performed a general site reconnaissance to observe and document current conditions prior to the 2009 supplemental soil sampling activities (discussed in Section 4.1.2). During the site reconnaissance, AMEC observed evidence of potential runoff onto the Branch Line right-of-way from the Gino Rinaldi, Inc., property located at approximate milepost 0.7 (Section IV). Two targeted soil borings were advanced near the Gino Rinaldi, Inc. property to evaluate the possible presence of TPHd, TPH quantified as motor oil (TPHmo), PAHs, and select metals.

3.2.2 Systematic Sampling Approach

Additional systematic soil sampling for arsenic was performed to assist in determining the distribution and concentration of arsenic is soil samples along the alignment of the Branch to evaluate whether the presence of arsenic is naturally-occurring or the result of railroad operations, and acquire a sufficient number of representative samples to perform a preliminary HHRA.

Additional systematic sampling was conducted in a manner to increase the sample density within each of the residential, undeveloped, and agricultural-south sections. The data collected during the initial 2005 Phase II sampling program to represent areas of the Branch Line primarily surrounded by industrial land use and agricultural land use north of Santa Cruz was judged to be sufficient to produce a preliminary health risk assessment under these respective settings. Therefore, no additional sampling within the industrial and agricultural north sections was performed.

Twelve soil borings were advanced in each of the residential and undeveloped sections. Four soil borings were advanced for the agricultural-south section. At each of these locations, three soil samples were collected between depths of 0.5 and 4.5 feet bgs.

Additional systematic soil sampling also was conducted along a 1-mile section of the Branch Line between Seascape and Capitola for general site coverage. During the January 2009 site reconnaissance, AMEC personnel identified an accessible 1-mile section of the Branch Line to collect the additional samples. Four soil borings were advanced along the section of the Branch Line between mileposts 10.81 and 12.01 (Sections III and IV, Figure 7). At each of these locations, three soil samples were collected between depths of 0.5 and 4.5 feet bgs for analysis of TPHd, TPHmo, PAHs, and select metals.

4.0 FIELD AND ANALYTICAL METHODS

The Phase II investigations included site reconnaissance, a geophysical survey, and drilling and soil sampling. A detailed description of field methods used for each of these activities is presented in Appendix A. A summary of field activities and analytical methods are described in this section.

Prior to conducting field activities, SCCRTC obtained a right-of-entry agreement from UPPR. AMEC marked boring locations and notified Underground Services Alert (USA). In addition, AMEC contracted with Cruz Brothers Locators, Inc., of Scotts Valley, California, to perform an underground utility clearance at each boring location. AMEC notified UPRR's Fiber Optic Hotline of the planned soil borings (clearing of utilities through UPPR is a requirement for all right-of-way work). No permits were required for the work performed due to the shallow nature of the borings.

4.1 SITE RECONNAISSANCE

Due to the length of time between the completion of the 1996 Phase I and the initiation of the Phase II soil investigations, AMEC visited the site on March 17 and 18, 2005 and January 19 and 20, 2009 to observe and document current conditions prior to soil sampling activities. The site reconnaissance consisted of a combination of windshield drive-by surveys and direct on-site observations, as appropriate; depending on the area the Branch Line traverses.

4.1.1 2005 Site Reconnaissance

No new features of potential environmental concern were identified; however, the following changes were made to the 2005 Phase II investigation:

- A targeted soil boring (SB-42) was placed at milepost 2.55, adjacent to a former Exxon fueling station that was identified in the 1996 Phase I (Section IV, Figure 11).

- The soil sampling and geophysical survey location at the Casino Station (Section II, milepost 19.77) was removed from the Phase II investigation based on information that indicated that the section of the Branch Line right-of-way between mileposts 19.50 and 19.86 is not owned by UPRR. This segment of the Branch Line was sold to the Santa Cruz Seaside Company; however, UPRR retains the right to operate on this segment.

- The geophysical survey location at milepost 1.20 (Section IV) was removed from the Phase II investigation because it was determined, based on further review of historical valuation maps and our understanding of the right-of-way boundaries, that the potential in-ground oil tanks at this location were located outside of the Branch Line right-of-way.

- Four targeted sampling locations were added to the sampling program adjacent to railroad ties to assess the potential for treated railroad ties to impact shallow soil on the Branch Line (borings SB-51 through SB-54; Figures 4, 8, and 9).

- The sampling of groundwater from a possible well previously identified at approximate milepost 21.72 (Section II) during the 1996 Phase I was removed from the Phase II sampling program because it could not be located, as discussed below.

During the site reconnaissance, an effort was made to locate a possible well observed at approximately milepost 21.72 (Section II) during the 1996 Phase I. Based on photographs taken during the Phase I site visit, an upright steel pipe was present sticking up approximately 2 feet above ground surface. No evidence of the possible well or pipe was observed during the March 2005 site reconnaissance. At the request of SCCRTC, AMEC contacted the California Department of Water Resources (DWR) to request information pertaining to this possible well and SCCRTC submitted a formal request to review DWR files for wells within the geographic area of the possible well. The DWR provided AMEC with Water Well Drillers Reports and Well Completion Reports for all wells within the township, range, and section of the geographic area where the possible well was observed in 1996. AMEC reviewed the reports and did not find evidence of any wells located in the area along the Branch Line at milepost 21.72. Therefore, the sampling of groundwater from the possible well, as proposed in the 1996 Phase I report, was eliminated from the Phase II investigation.

4.1.2 2009 Site Reconnaissance

One new feature of potential environmental concern was identified during the site reconnaissance. On January 20, 2009 AMEC observed evidence of potential runoff onto the Branch Line right-of-way from the Gino Rinaldi, Inc., property located at approximate milepost 0.7 in Watsonville, California (Section IV; Figure 12). Gino Rinaldi, Inc. operates Rinaldi Tile and Marble, which fabricates custom residential and commercial stone products. Located on the Gino Rinaldi, Inc. property adjacent to the Branch Line right-of-way is a concrete slab with PVC drainage pipe leading from a maintenance/storage shed toward the right-of-way. In the area where the PVC pipe drains onto the Branch Line right-of-way and in another area along the property line to the Branch Line there was evidence that storm water or wash water used to clean the concrete slab had drained from the Gino Rinaldi, Inc. property onto the Branch Line right-of-way (see photographs presented on Figures 13 and 14).

At the Granite Construction facility in Watsonville, California, (approximate milepost 2.32) AMEC personnel observed current conditions near previous boring locations SB-45 where visible surface soil staining at the outfall of a drainage pipe was previously documented during the 1996 Phase I and 2005 Phase II site reconnaissance. Surface soil staining was not present during the January 2009 site reconnaissance; however, standing water (possibly from recent rainfall events) was present in the drainage ditch adjacent to the Granite Construction facility at the outfall of the drainage pipe. Standing water was not present within the upstream portion of the drainage ditch (i.e. east of the drainage pipe emanating from the Granite Construction facility).

No other new features of potential environmental concern were identified during the 2009 site reconnaissance.

4.2 GEOPHYSICAL SURVEY

AMEC contracted with Norcal Geophysics (Norcal) of Petaluma, California, to perform a geophysical survey at the presumed location of the potential UST at milepost 26.69. Norcal surveyed an approximately 10,000-square-foot area, using a combination of vertical magnetic gradient (VMG), hand-held metal-detection (MD), and electromagnetic line locating (EMLL) methods. The survey was designed to scan the near surface (0 to 11 feet bgs) for the presence of metallic features such as pipes, utilities, sumps and dry wells, and USTs. A copy of the geophysical survey report describing field methods and findings is included in

Appendix B and a summary of the work performed and the results are described in Appendix A.

4.3 DRILLING AND SOIL SAMPLING

One hundred and three (103) soil borings were advanced from April 25 through 29, 2005, February 9 through 12, 2009, and on April 13, 2009 (SB-01 through SB-103). Ninety-seven soil borings (SB-01 through SB-50, SB-55 through SB-94, and SB-97 through SB-103) were advanced using a hydraulically driven, direct-push drill rig to depths ranging from 3 to 20 feet bgs using either a dual wall sampling system or a macro-core sampling system to collect soil samples. The remaining six soil borings (SB-51 through SB-54, SB-95 and SB-96) were advanced to a total depth of 1.5 feet bgs using a hand auger and slide hammer equipped with brass sampling sleeves to collect soil samples. Drilling equipment used for sampling was cleaned prior to use at each location. A detailed description of sample collection methodologies is presented in Appendix A. Boring logs are included in Appendix C.

4.4 ANALYTICAL METHODS

Samples were submitted to Test America Laboratories, Inc. of Pleasanton, California (formerly Severn Trent Laboratories, Inc.), a California-certified analytical laboratory under AMEC chain-of-custody procedures. Copies of the chain-of-custody records and laboratory analytical reports are included in Appendix D. The majority of soil samples were analyzed using a phased approach; i.e., shallow samples were analyzed first while deeper samples were placed on hold at the laboratory. If the analytical results for a sample identified the presence of a chemical constituent at a concentration greater than screening criteria, deeper samples were analyzed to evaluate the vertical extent of impacted soil. A detailed description of the analytical approach and methods are presented in Appendix A and summarized below.

Soil samples were analyzed according to the sample collection and analysis summary presented in Tables 1 and 2 for the following constituents:

- Total petroleum hydrocarbons (TPH) quantified as diesel (TPHd) and motor oil (TPHmo) using EPA Method 8015M;
- TPH quantified as gasoline (TPHg) using EPA Method 8015M and 8260B;
- Volatile organic compounds (VOCs) using EPA Method 8260B
- PAHs using EPA Method 8270 with selective ion monitoring (SIM);
- Metals using EPA Method 6000/7000 series; and
- Organochlorine pesticides using EPA Method 8081A.

5.0 DATA EVALUATION

5.1 2005 DATA EVALUATION

Analytical data generated during the 2005 Phase II soil investigations were compared to health-based risk screening criteria, and were used to assess whether additional investigation was warranted. For the purpose of evaluating data it was assumed that the potential future use of the railroad corridor would be for transit or recreation. As such, analytical results from soil borings were compared to the human health direct exposure ESLs for industrial/commercial shallow soil, or industrial PRGs for soil if no ESL was published. It should be noted that the 2005 Phase II soil investigation results were compared to ESLs published in 2005 and that ESL values have been recently updated in May 2008 (RWQCB, 2008). AMEC subsequently evaluated the results of the 2005 Phase II data relative to the updated May 2008 ESLs; the results of the review did not alter the sampling plan implemented for the 2009 Phase II investigation.

Concentrations of metals in samples that were above screening criteria also were evaluated to ascertain whether the detected metal concentrations likely represent background concentrations or are the result of impacts from railroad operations. Metals in soil are naturally-occurring, and their presence is not necessarily the result of anthropogenic impacts. Chromium and cobalt were detected in some soil samples collected during the 2005 investigation at concentrations greater than their respective 2005 industrial ESLs.[4] However, these metals appeared to be detected at similar concentrations in samples collected from the Branch Line in areas surrounded by varying land-use types (residential, industrial, agricultural, and undeveloped) and at varying depths (ranging from 0.5 to 10 feet bgs). These data suggested that the cobalt and chromium concentrations detected were within the natural background concentrations for soil in this area[5].

During the 2005 Phase II investigation, arsenic was detected at concentrations above its industrial ESLs. It should be noted that arsenic is naturally-occurring and typically is present at concentrations greater than risk-based screening criteria, which are derived based on an excess cancer risk level of $1{\times}10^{-6}$. As such, the ESLs are not directly applicable, and it is appropriate to evaluate the presence of arsenic based on its background concentration, and estimate the incremental risk for exposure to arsenic from concentrations greater than background. Due to the range of arsenic concentrations along the Branch Line reflected in the 2005 Phase II systematic sampling program, it was uncertain what arsenic concentrations

4. The 2008 ESLs were updated in May 2008 (RWQCB, 2008) such that no concentrations of chromium and cobalt exceeded their respective ESLs.
5. Metals were considered to be at background concentrations if sufficient data were available to demonstrate that the lateral and vertical distribution of metals concentrations across the site was similar.

represented naturally occurring conditions or arsenic concentrations attributable to an impact. Therefore, as part of the 2009 Phase II investigation, additional samples were collected to develop a sufficiently large data set of arsenic concentrations in soil along the Branch Line to calculate a site-specific background concentration as described in Section 5.2 and 5.3.

AMEC also evaluated data with regard to waste classification criteria in the event that soil potentially could be excavated and require off-site disposal. Total threshold limit concentrations (TTLC) and soluble threshold limit concentrations (STLCs) are used to classify material as hazardous or non-hazardous for disposal purposes in the State of California. TTLCs and STLCs for metals and pesticides are codified in the California Code of Regulations (CCR), Title 22, Section 66216.24. These criteria are not strictly applicable to in-place soil; however, they are used as a tool to assess whether additional evaluation may be warranted. For screening purposes, a value of 10 times the constituent's respective STLC was used to provide an initial evaluation of whether a soil could be classified as a California hazardous waste (analytical testing is required to ascertain the actual soil classification for disposal). In addition to the California waste criteria, the federal Toxicity Characteristic (TC) was used to evaluate the possibility that on-site soil could contain metals at concentrations that would classify the soil as a federal Resource Conservation and Recovery Act [RCRA]) waste. For screening purposes, a value of 20 times the metal's respective TC was used to provide an initial evaluation of whether a soil could be classified as a federal RCRA hazardous waste, should the soil be disposed off-site.

5.2 2009 DATA EVALUATION

Consistent with the 2005 data evaluation, analytical data generated during the 2009 supplemental Phase II soil investigation were compared to health-based risk screening criteria (as updated [RWQCB, 2008]),[6] background concentrations (for metals), and waste classification for disposal purposes.

As previously discussed, due to the range of arsenic concentrations on the Branch Line reflected in the 2005 Phase II systematic sampling program, it was uncertain what arsenic concentrations represented naturally occurring conditions or arsenic concentrations attributable to an impact. Therefore, for the 2009 supplemental Phase II investigation, additional samples were collected to develop a larger data set of arsenic in soil along the Branch Line to calculate a site-specific background concentration. The larger data set of arsenic concentrations also was used for a site-specific analysis of the potential human health risk from arsenic above background concentrations considering potential future activities and

6. The direct exposure for construction/trench worker ESLs also are included on Tables 3 through 9 for informational purposes. These screening criteria are generally less conservative and are provided for SCCRTC planning purposes but were not used for data evaluation.

uses of the Branch Line. The calculation of the site-specific background concentration for arsenic and the HHRA for arsenic are summarized in sections 5.3 and 6.4, respectively.

Data evaluation criteria for the 2005 and 2009 Phase II investigations are presented in the analytical results summary tables (Tables 3 through 9).

5.3 CALCULATION OF SITE-SPECIFIC BACKGROUND CONCENTRATION OF ARSENIC

Site-specific background concentrations of arsenic in soil were calculated for the Branch Line in support of a site-specific analysis of the potential risk to human health and whether remedial action or risk management measures specific to arsenic in soil may be warranted. The analysis was conducted in accordance with California Protection Agency (Cal-EPA) Department of Toxic Control Substances (DTSC) guidance documents (DTSC, 1997 and 2009). The methods used to calculate the site-specific background concentration of arsenic are presented in Appendix E and summarized below.

The results of 2005 and 2009 Phase II soil sampling activities were considered in the analysis of site-specific background concentration of arsenic. As part of these two sampling events, 228 soil samples were collected and analyzed for arsenic from 98 locations across the Branch Line at depths ranging from 0.5 to 10 feet bgs. This dataset was subsequently reduced to include only samples that are considered representative of ambient conditions for arsenic along the Branch Line.

Analytical data for arsenic in samples collected at depths greater than 1.5 feet bgs were considered representative of background because: (1) soil at depth is generally of the same geologic origin as soil from near surface (between 0 and 1.5 feet bgs); and (2) the deeper depth intervals are likely not affected by the potential application of arsenic-containing herbicides along the Branch Line (e.g., surface application). In addition, arsenic as background in deeper soil is valid because the chemical properties for arsenic suggest that the compound does not migrate through soil except for short distances and at high source soil concentrations, unless there was a transport mechanism to facilitate vertical migration. Finally, analyses performed for the dataset suggest that the results of arsenic at depths of more than 1.5 feet bgs are statistically different from soil samples collected between 0 and 1.5 feet bgs. A total of 84 samples were collected at depths of greater than 1.5 feet bgs from 67 locations.

In addition to removing analytical results from shallow samples (depths less than or equal to 1.5 feet bgs), data was further screened to eliminate potential biases due to overrepresentation of specific areas. For example, analytical results from targeted locations SB-74 through SB-82 were removed from the dataset for the calculation of site-specific background because these samples were clustered around previous targeted locations SB-10 and SB-23. Inclusion of these sample results from a localized area along the Branch Line would have provided overrepresentation towards the distribution of arsenic in these areas. Only analytical results for samples collected at SB-10 and SB-23 were included in this analysis.

After removing these data points, the dataset used to evaluate background concentrations of arsenic (referred to as “background dataset”) consisted of a total of 72 samples collected from depths greater than 1.5 feet bgs from 56 locations. The background dataset is presented in Table E-1 of Appendix E.

Several statistical evaluations of the background dataset were performed to test whether concentrations of arsenic in samples collected at depths greater than 1.5 feet bgs were not related to possible surficial impacts and to test whether there were differences in arsenic background concentrations based on soil type (i.e., differences in arsenic concentrations is soils that are primarily sand versus primarily clay or silt). Additionally, the distribution of the background dataset was evaluated to identify whether multiple distributions or outliers are present

As recommended by the DTSC (DTSC, 2009), the upper bound percentile of the background dataset was selected as a background threshold value to represent ambient conditions along the Branch Line. A site-specific background concentration of arsenic along the Branch Line was calculated to be 14.4 mg/kg based on the upper percentile of the background dataset.

6.0 SUMMARY OF RESULTS

A detailed summary of the analytical results is presented in Appendix A. Soil boring logs are included as Appendix C. Copies of the chain-of-custody records and laboratory analytical reports are included in Appendix D, which has been provided on a compact disk (CD). AMEC performed a quality assurance/quality control assessment of the analytical data; the results of the assessment are summarized in Section 6.5.

A summary of findings for the 2005 and 2009 Phase II investigations and our refined understanding of environmental impacts at targeted and systematic locations, the general presence of arsenic along the Branch Line, and the summary for the HHRA for arsenic, are summarized in the following sections.

6.1 GEOPHYSICAL SURVEY

A UST potentially located at milepost 26.69 (Section I) was investigated by conducting a geophysical survey and by advancing two soil borings (SB-04 and SB-05) in the area. No evidence supporting the presence of a UST was identified from the geophysical survey or from the analytical results of soil samples collected. However, the geophysical survey indicated the possibility of an abandoned 25-foot-long section of utility line and a rectangular reinforced concrete pad in this area.

6.2 TARGETED SAMPLING

- TPHg and VOCs were not detected in any of the targeted soil samples analyzed.

- Where targeted soil samples were analyzed for pesticides, concentrations detected were not above applicable health-based screening criteria.

- TPHd and TPHmo were not detected above their applicable ESLs in any of the targeted soil samples analyzed except for samples collected near SB-45 as described in the following bullet.

- SB-45 Area—TPHd was detected above the industrial ESL at several sampling locations advanced along the drainage ditch adjacent to the Granite Construction facility in Watsonville (Figure 11). TPHmo was detected in two samples collected in this area. Visible hydrocarbon staining was observed in soil to depths up to approximately 16 feet bgs (SB-101 and SB-102). Based on the analytical results, petroleum hydrocarbon impacts that exceed industrial ESLs extend to depths of at least 12 feet bgs, but are generally less than 20 feet bgs (SB-101 and SB-102). The lateral extent of the petroleum hydrocarbon impacts was defined to the east (based on 2005 industrial ESLs) by previous boring location SB-46.[7] The lateral extent of impacts to the west was not defined during this investigation; however petroleum hydrocarbon impacts extend over a lateral distance of at least 90 feet along the drainage ditch. Based on these findings, it is likely that the petroleum hydrocarbon impacts are generally confined to the area of the drainage ditch and appear to be related to the discharge pipe emanating from the Granite Construction facility.

- SB-10 Area—Select PAHs were detected above their respective industrial ESLs at targeted boring location SB-10 at 0.5 feet bgs (Section II). Boring SB-10 targeted an area associated with miscellaneous dumping of debris near the Mission Industrial Lands area of Santa Cruz (Figure 4). PAHs were not detected in the deeper sample collected at 1.5 feet bgs from boring SB-10 and were not detected above their respective industrial ESLs in the step-out borings advanced around this location. These data suggest that impacts from PAHs are laterally limited and surficial and their presence is consistent with miscellaneous urban releases that do not constitute significant environmental impacts. Arsenic was detected above the site-specific background concentration in three samples collected around SB-10; the concentrations are consistent with the general presence of arsenic in shallow soil throughout the railroad corridor and are likely attributable to historic railroad operations.

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7. The concentration of TPHd in the sample collected from SB-46 at 3 feet bgs was 530 mg/kg and is less than the 2005 industrial ESL of 750 mg/kg; however, this concentration is slightly greater than the updated 2008 industrial ESL of 450 mg/kg.

- SB-23 Area—Arsenic was detected in shallow soil samples (less than or equal to 1.5 feet bgs) above the calculated site-specific background concentration at boring location SB-23 and at two step-out borings located around SB-23 (SB-74 and SB-76). The distribution of arsenic near SB-23 is consistent with its general presence in shallow soil throughout the railroad corridor and is likely attributable to the historical railroad operations.

- SB-47 contained arsenic at elevated concentrations relative to the site-specific background concentration. SB-47 was advanced to evaluate the potential impact of surface staining at approximate milepost 1.81. Based on the results of the systematic sampling conducted along the industrial section where SB-47 is located, arsenic is generally distributed at elevated concentrations along industrial areas of the Branch Line as a result of industrial activities and/or railroad operations.

- Gino Rinaldi, Inc.—Arsenic was present above the calculated site-specific background concentration of 14.4 mg/kg in one sample (SB-95 at 1.5 ft bgs) collected adjacent to the Gino Rinaldi, Inc. facility. Based on these results, the runoff water discharge that appears to emanate from the Gino Rinaldi, Inc. has not chemically impacted the Branch Line right-of-way and the detection of arsenic above site-specific background concentrations is likely due to the general presence of arsenic along the rail line and the historical railroad operations.

6.2.1 Railroad Ties

Four sampling locations were placed near railroad ties along the Branch Line to evaluate the potential for the ties to impact shallow soil. The results of the sampling indicated that PAHs, including benzo(a)pyrene, were present in one of the shallow soil samples at one boring location (SB-52 at 0.5 feet bgs) above their respective industrial ESLs; however, PAHs were not detected above criteria at other sampling locations. These results suggest that the presence of railroad ties has not significantly impacted soil beneath the right-of-way. Arsenic was present above the site-specific background concentration in four soil samples from two locations (SB-52 and SB-53) collected near railroad ties; however, the elevated concentrations of arsenic relative to the background concentration are likely attributable to the general distribution of arsenic along the Branch Line. VOCs were not detected in any of the samples collected at these locations.

6.3 SYSTEMATIC SAMPLING

Systematic sampling was conducted along six 1-mile sections of the Branch Line to assess general environmental conditions outside of the targeted sampling locations. The six 1-mile sections included areas of the Branch Line primarily surrounded by agricultural, residential, undeveloped or industrial lands. The results of the systematic sampling were evaluated in aggregate for each section as the purpose of the sampling was to assess the possibility that railroad operations resulted in pervasive environmental impacts along the entirety of the railroad corridor. Chemical impacts that appeared to be similar within each section, if any existed, potentially could indicate an impact from railroad operations. A detection of a constituent above screening criteria in a single sample within a section was not considered to indicate an impact along the right-of-way unless the detected concentration was substantially elevated to warrant additional evaluation. The results are summarized below.

- TPHg and VOCs were not detected in any of the samples.
- TPHd and TPHmo were detected in various systematic samples collected; however, they were not detected at concentrations above applicable ESLs.
- The presence of organochlorine pesticides was evaluated only in the northern and southern agricultural sections of the right-of-way. The pesticides toxaphene and dieldrin were detected above industrial ESLs in three of four shallow soil samples collected in the agricultural section that was located south of Santa Cruz. Toxaphene was detected above industrial ESLs in shallow soil samples at three of four borings and dieldrin was detected above industrial ESLs in shallow samples from two of four borings. The concentrations of these pesticides are relatively low, that is, within an order of magnitude of their respective ESLs. Other pesticides also were detected, but at concentrations less than the screening criteria. No pesticides were detected above their respective industrial screening criteria in the agricultural section located north of Santa Cruz. Historically, pesticides which may include toxaphene and dieldrin have been applied to strawberries, brussel sprouts, and other crops in the Santa Cruz County area.[8] The analytical results for pesticides in the southern agricultural section suggest that farming practices in this area have resulted in a relatively low-level impact to the Branch Line.
- PAHs—The concentration of benzo(a)pyrene and dibenzo(a,h)anthracene was elevated relative to industrial ESLs in two of eight sample locations (SB-41 and SB-40, respectively) within the industrial section. The concentration of indeno(1,2,3-c,d)pyrene was above the industrial ESLs in one of four sample locations (SB-30) within the agricultural section south of Santa Cruz and the concentration of benzo(a)pyrene in one of four samples (SB-71) from the 1-mile section between Seascape and Capitola was at its industrial ESL. These results indicate that the presence of PAHs in shallow soil along the Branch Line is not pervasive and instead are consistent with miscellaneous urban or railroad operation releases that do not constitute significant environmental impacts

6.3.1 Systematic Sampling for Arsenic

The results of the 2005 and 2009 systematic sampling for arsenic indicate that arsenic is generally present above the calculated site-specific background concentration in shallow soil (less than or equal to 1.5 feet bgs) along the Branch Line. Based on its distribution it appears that these elevated arsenic concentrations are attributable to railroad operations.

8. California Department of Pesticide Regulation, 1998 Annual Pesticide Use Report: Santa Cruz County Indexed by Commodity.

6.4 EVALUATION RELATIVE TO DISPOSAL CRITERIA

As discussed in Section 5.0, analytical data generated during the 2005 and 2009 sampling programs were evaluated relative to criteria that are used to classify material as a California or federal RCRA hazardous waste for disposal purposes. It is important to note that the criteria are not specifically applicable to in-place soil; however, provide an indication as to whether special handling procedures could be necessary should soil be removed from the right-of-way in the future. From the comparison to this criteria,

- the concentration of arsenic in some soil samples was above the 10 times the STLC and 20 times the TC screening criteria;
- the concentration of lead in some soil samples was above the 10 times the STLC and 20 times the TC screening criteria;
- chromium was detected in three samples at a concentration 10 times its STLC screening criterion; and,
- concentrations of p,p'-DDE, p,p'-DDT, and toxaphene in some soil samples collected from the southern agricultural section were above their respective TTLC and 10 times the STLC screening criteria; endrin was detected in one soil sample at a concentration equal to 10 times its STLC screening criterion.

6.5 SUMMARY OF HUMAN HEALTH RISK ASSESSMENT FOR ARSENIC

To evaluate the potential human health risks associated with the presence of arsenic in soil above naturally-occurring background along the Branch Line right-of-way, AMEC conducted a HHRA (Appendix H) based on projected future use following standard practices as specified in California Environmental Protection Agency (Cal/EPA) and U.S. Environmental Protection Agency (USEPA) guidelines for the performance of risk assessments. The overall approach taken in the HHRA is consistent with the Reasonable Maximum Exposure (RME) approach as defined by the U.S. EPA (1989). The RME approach is defined as the "highest exposure that is reasonably expected to occur at a site."

Evaluation of the potential health risk at the Site involved a four-step process; data evaluation, exposure assessment, toxicity assessment, and risk characterization, as summarized in this section.

In data evaluation, analytical results for arsenic in soil were evaluated and summarized for quantitative analysis in the HHRA. Soil samples collected along the Branch Line from depths ranging from 0.5 to 10 feet bgs as part of Phase II site characterization and supplemental investigations activities served as the source of data for the HHRA. As described in Section 5.1, analytical data for arsenic in samples collected at depths greater than 1.5 feet bgs were considered representative of background. Therefore, only data collected from shallow depths of less than or equal to 1.5 feet bgs were quantitatively evaluated in the HHRA.

In exposure assessment, the identification of possible exposed populations and quantitative estimates of the magnitude, frequency, and duration of exposure are evaluated. AMEC understands that portions of the right-of-way may be redeveloped into a recreational trail that would be used by residents and visitors for activities such as walking and running for exercise or biking. As such, potential future receptors include constructions workers involved in construction-related activities and recreational receptors. As a baseline HHRA, exposure to arsenic in soil could potentially occur from dermal contact, incidental ingestion, and inhaled as dust generated from wind erosion or from soil disturbances.

Because the Branch Line is up to 31.4 miles long, potential exposures are best evaluated by dividing the line into exposure units to provide a realistic, yet conservative, exposure evaluation. Based on the distribution of arsenic in soil, eight subsections of the Branch Line were identified to represent exposure units. In addition, the entire Branch Line was evaluated as a separate exposure unit.

To quantify human health risks, it was necessary to estimate the exposure point concentration (EPC) for arsenic in soil. EPCs for arsenic in soil from each exposure unit were estimated based on the 95 percent upper confidence limit (UCL) on the arithmetic mean of the analytical data (top 1.5 feet of soil) or the maximum concentration, whichever was lower.

In toxicity assessment, information was collected to assess the potential for arsenic to cause adverse health effects in exposed individuals, including cancer and noncancer health effects. Cal-EPA approved toxicity criteria were used in the assessment.

In risk characterization, the likelihood and degree of chemical exposure and the possible adverse health effects associated with such exposure were quantified. Cancer risks and noncancer hazard indices (HIs) were calculated according to regulatory guidance for each receptor. Because of the number of assumptions required during the risk assessment process, some degree of uncertainty is inevitably associated with the risk and hazard estimates. A summary of these uncertainties is presented in the HHRA (Appendix F).

The risk characterization steps involved the following:

1. Estimate potential “background” human health risks associated with arsenic in soil (soil samples collected at depths greater than 1.5 feet bgs);
2. Estimate potential “baseline” human health risks associated with arsenic in soil along the Branch Line in the absence of any remedial action; and
3. Estimate the incremental increase, if any, in risk associated along the Branch Line above risk associated with background conditions.

Cancer risk is expressed as the maximum number of new cases of cancer projected to occur in a population of one million people due to exposure to arsenic over a 70-year lifetime. For example, a cancer risk of one in one million (1×10^{-6}) means that in a population of one million people, not more than one additional person would be expected to develop cancer as the result of the exposure to the substance causing that risk.

Noncancer hazard is determined by comparing the actual level of exposure (dose) from arsenic to the level of exposure that is not expected to cause any adverse effects, even in the most susceptible people. Levels of exposure at which no adverse health effects are expected are called "reference dose and reference concentration," and are generally based on the results of animal studies. A hazard less than or equal to 1 (ratio of exposure dose to reference dose/concentration) indicates that the predicted exposure to that chemical should not result in an adverse noncancer health effect.

The results of the risk assessment are compared to U.S. EPA and Cal/EPA's acceptable risk levels. According to the California Health and Safety Code, response actions are to be based upon and be no less stringent than the requirements established by the National Contingency Plan (NCP). According to the NCP, "acceptable exposure levels for known or suspected carcinogens are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 1×10^{-4} and 1×10^{-6} (i.e., risk range) using information on the relationship between dose and response. The 1×10^{-6} risk level shall be used as a point of departure. From this point of departure, other site-specific risk management decisions are taken into account to justify a higher acceptable risk threshold within the 1×10^{-4} to 1×10^{-6} range. The final determination of the acceptable risk threshold is generally made on a site-specific basis by the lead regulatory agency."

Naturally-occurring levels of arsenic in soil are typically associated with a theoretical excess lifetime cancer risk level of 1×10^{-6} or greater. Based on the site-specific background concentration, the estimated excess lifetime cancer risk and noncancer hazard quotient (HQ) for a future construction worker are one-in-one-million ($1x10^{-6}$) and 0.20, respectively. The estimated excess lifetime cancer risk and HQ for a future recreational user are eight-in-one-million ($8x10^{-6}$) and 0.15, respectively.

Assuming potential exposures throughout the entire Branch Line, the estimated baseline cancer risk and hazard index for the future construction worker are three-in-one million ($3x10^{-6}$) and 0.6, respectively. The estimated baseline cancer risk and hazard index for a future recreational user are twenty-in-one million ($2x10^{-5}$) and 0.4, respectively.

For individual exposure units, the estimated baseline cancer risks for a future construction worker range from eight-in-ten million ($8x10^{-7}$) to six-in-one million ($6x10^{-6}$). The hazard indexes range from 0.2 to 1.1. The estimated baseline cancer risks for a future recreational user range from six-in-one million ($6x10^{-6}$) to fifty-in-one million ($5x10^{-5}$). The hazard indexes range from 0.1 to 0.8.

Based on these estimates, the incremental excess lifetime cancer risk and noncarcinogenic hazard index is the difference between baseline and background. The incremental theoretical excess lifetime cancer risk range between four-in-ten million (4×10^{-7}) and five-in-one million (5×10^{-6}) for the future construction worker and three-in-one million (3×10^{-6}) to forty-in-one million (4×10^{-5}) for the future recreational user. As per the NCP, these ranges are within the range considered acceptable by the U.S. EPA and Cal-EPA. The incremental noncarcinogenic hazard indexes are less than 1 for both the future construction worker and recreational user suggesting that potential exposure to arsenic along the entire Branch Line is not expected to result in an adverse noncarcinogenic health effects.

The results of the assessment indicate that the incremental increase in risk over background range from 2.0 to 5.6 times higher than baseline for individual exposure units, suggesting that potential exposures to arsenic in soil are not significantly different than naturally-occurring levels.

6.6 QUALITY ASSURANCE AND QUALITY CONTROL

Quality assurance/quality control (QA/QC) samples are analyzed to assess the accuracy, precision, and completeness of the data. QA/QC samples consisted of laboratory-analyzed method blanks, laboratory control sample/laboratory control sample duplicate (LCS/LCSD), and matrix spike/matrix spike duplicate (MS/MSD) samples to provide internal quality control. Equipment blank samples were collected and analyzed to provide field quality control. AMEC performed a QA/QC evaluation of the analytical results. Based on our evaluation, the data is considered acceptable for analysis of general environmental conditions along the right of way. A detailed description of the evaluation is presented in Appendices F and G.

7.0 CONCLUSIONS AND RECOMMENDATIONS

In general, the results of the investigation program suggest limited environmental impacts along the Branch Line right-of-way. The primary environmental impacts identified during the investigations and recommendations based on our refined understanding of environmental impacts along the Branch Line are outlined below.

7.1 PRIMARY ENVIRONMENTAL IMPACTS

In summary, the results of the Phase II investigations along the Branch Line right-of-way identified two primary environmental impacts:

1. Granite Construction Company: Soil is laterally and vertically impacted with elevated concentrations of petroleum hydrocarbons in the drainage ditch along the railroad right-of-way adjacent to the Granite Construction facility.

2. Arsenic is generally distributed in shallow soil (less than or equal to 1.5 feet bgs) along the Branch Line right-of-way above the calculated site-specific background concentration of 14.4 mg/kg and is likely a result of railroad operations such as the potential application of arsenical herbicides along the Branch Line. The results of the risk assessment indicate that the incremental cancer risk to construction workers and recreational users are within the U.S. EPA's target risk range, and potential exposures to arsenic in soil are not significantly different than naturally-occurring levels. However, based on a comparison of the arsenic data from shallow soil to hazardous waste screening criteria, it is possible that impacted soil, should it be disposed of, could be classified as a California or federal, RCRA hazardous waste.

Additionally, chromium, lead, and pesticides were detected in some samples at concentrations that exceeded the hazardous waste screening criteria (however, the concentrations were below their respective 2009 ESLs). Soil at these areas could require special handling (e.g. disposal classification) during construction activities.

7.2 RECOMMENDATIONS

Based on the results of the Phase II investigations, we recommend that remediation and/or mitigation measures be implemented to address petroleum-affected soil on the Branch Line property adjacent to the Granite Construction facility and arsenic-impacted soil along the Branch Line. Specifically,

Granite Construction Company – It is unknown whether groundwater, which was observed to occur at a depth of approximately 16.5 feet bgs, is impacted by the petroleum present in soil. It is anticipated that the Santa Cruz County Health Services Agency would require that this potential impact be evaluated. Additionally, we recommend that petroleum-impacted soil be excavated; the depth of the excavation would depend on factors such as whether groundwater is impacted and potential future construction requirements along the Branch Line in this area. Further, we recommend that actions be taken to suspend discharge from the Granite Construction facility into the drainage ditch. A preliminary scope of work and cost estimate to address impacts adjacent to the Granite Construction Company is included in Appendix I.

Arsenic along the Branch Line – Although the results of the risk assessment for arsenic in soil indicate that the incremental cancer risk to construction workers and recreational users is within the U.S. EPA's target cancer risk range, arsenic (as well as some other constituents, as noted above) was detected at some locations at concentrations that could require special handling during construction activities (e.g., disposal classification). Based on these results, we recommend that a management plan to address arsenic-containing soil during future construction be prepared. This plan would include soil excavation, stockpiling, and disposal procedures (considering profiling of arsenic and other constituents), and construction monitoring guidelines. A preliminary scope of work and estimated costs to address arsenic-containing soil along the Branch Line is included in Appendix J.

8.0 REFERENCES

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