Northwest Study Area
Project Completion Report

Prepared for

BHP Copper Inc.

June 14 , 2013

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Project Completion Report

Prepa red for
BH P Copper Inc., Superior, Arizona
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Brown and Caldwell Project No. 140206.610

Brown ANo .
Caldwell ·
201 East Washington Street, Suite 500
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Table of Contents

Executive Summary

During 2011 and 2012, BHP Copper conducted voluntary soil remediation activities on 77 action properties within the Northwest Study Area (NSA) Voluntary Remediation Program (VRP) site located in Superior, Arizona. Soil remediation was conducted to address tailings-impacted soils and to reduce the concentrations of metals of concern, including arsenic, copper, lead, and manganese. The effectiveness of the remediation was positively confirmed by comparing the results of confirmation soil sampling to soil remediation levels that the Arizona Department of Environmental Quality (ADEQ) approved for the NSA site.

BHP Copper also completed soil sampling on 6 properties not previously accessible for evaluation to assess the potential presence of tailings-impacted soils. The results of that sampling determined that these properties meet ADEQ's approved soil remediation levels without requiring remediation. Previously, BHP Copper submitted information to ADEQ regarding 40 other non-action properties that demonstrated compliance with the approved soil remediation levels. ADEQ has since issued written no further action (NFA) determinations for each of those 40 properties.

BHP Copper conducted the remediation and sampling work under ADEQ oversight and in accordance with work plans and procedures reviewed and approved by ADEQ. While performing the field work, BHP Copper maintained a priority focus on the safety of residents and project workers. This NSA Project Completion Report (Completion Report) describes the remediation and sampling procedures and reports the results of recent and historical sampling activities. Property-specific information (including activities conducted, sampling data, and photographs) is provided in an individual Remediation Summary Report for each action property and a Data Summary Report for each non-action property. The Summary Reports are being submitted to ADEQ concurrently with this Completion Report.

Previous soil sampling investigation and data evaluation identified arsenic, copper, lead, and manganese as chemicals of potential concern (COPCs) for the NSA. These metals were the only analytes found to exceed their predetermined residential soil remediation levels (SRLs) during a multi-phased and tiered sampling program that included 19 metals and cyanide (Table 2-1). Based on the Phase IV Human Health Risk Assessment (Brown and Caldwell, 2009), ADEQ approved a site-specific soil remediation level for arsenic consisting of a cumulative excess lifetime cancer risk (CELCR) of $2x10^{-5}$ and a hazard index that is not greater than 1.0. For copper, lead, and manganese, ADEQ approved soil remediation levels equivalent to each metal's predetermined residential SRLs.

Delineation of whether an NSA property was "action" and required remediation, versus "non-action" where no remediation was needed, was determined by comparing the results of comprehensive composite sampling conducted on each individual NSA property to the approved soil remediation levels. Typical subsample locations for composite samples collected from each property are illustrated in Figures 2-2 and 2-3. Results of this comparison for the 6 non-action properties addressed by this report are provided in Table 3-1, while the results for all other sampled NSA properties are shown in Table 2-3. Action and non-action properties, and properties BHP Copper was unable to access, are identified on Figure 1-3 and listed in Tables 1-1, 1-2, and 1-3.

Soil remediation activities conducted by BHP Copper at the 77 action properties included excavation of impacted soil, confirmation sampling throughout the excavated and non-excavated portions of each property to confirm the approved soil remediation levels were achieved, and backfill of the excavated areas with clean replacement soil and crushed landscape rock (unless the property owner declined placement of landscape rock). The results of confirmation soil samples collected prior to backfilling the

properties are presented in Table 5-1. Analytical results for samples collected from the replacement soil used to backfill the excavations is presented in Table 5-2; crushed landscape rock analytical results are provided in Table 5-3. To represent conditions to which residents at the remediated action properties are exposed, data for replacement soil were used to estimate post-backfill conditions. The methodology for this analysis is illustrated in Figure 6-1 and the results are detailed in Table 6-1, including a comparison of confirmation samples and post-backfill conditions against the approved soil remediation levels.

Using the data referenced above, property-specific risk calculations were performed for arsenic and comparisons of COPC concentrations and risk values were made to the approved soil remediation levels. Those evaluations demonstrated that current conditions on the 77 action properties and 6 non-action properties addressed by this Completion Report meet the approved soil remediation levels. The risk calculations were conducted using the procedures and assumptions previously developed in conjunction with ADEQ for the Phase IV Human Health Risk Assessment (Brown and Caldwell, 2009). These assumptions included all potentially complete exposure pathways and are based on representative exposure concentrations, conservative exposure assumptions, and conservative toxicity factors, thus minimizing uncertainty and establishing a high level of confidence in the results.

Based on the information presented in this Completion Report and the property-specific Summary Reports submitted herewith, compliance with the approved soil remediation levels is demonstrated for all 83 properties addressed by this Completion Report, and no further action is necessary.

Section 1

Introduction and Project Background

1.1 Purpose

This Northwest Study Area (NSA) Project Completion Report (Completion Report) summarizes soil investigation and remediation activities completed by BHP Copper Inc. (BHP Copper) at the NSA site under the Arizona Department of Environmental Quality (ADEQ) Voluntary Remediation Program (VRP). This report is submitted in fulfillment of the post-project reporting requirement specified in Section 5.2 of the *Tailings Removal Project Work Plan (Revision 3)* (Brown and Caldwell, 2012a) and provides information and data in support of BHP Copper's request that the ADEQ issue No Further Action (NFA) determinations for remediated properties.

Subject to approval of the property owners and tenants, remediation activities including soil excavation, post-excavation confirmation sampling, and property restoration were undertaken at BHP Copper's expense at NSA properties where ADEQ-approved soil remediation levels were not met prior to conducting further action. As explained in this Completion Report, post-excavation sampling demonstrates that these remediation activities achieved ADEQ-approved soil remediation levels at all remediated properties. Therefore, in accordance with Arizona Revised Statutes (A.R.S.) § 49-181.A, BHP Copper is submitting separate requests for an NFA determination for each property within the NSA where soil remediation was undertaken, based on information provided in this Completion Report.

The Completion Report also addresses six properties that were sampled and found to meet the ADEQ-approved remediation levels without the need for further action. BHP Copper is submitting requests for NFA determinations for these properties, which were not included in BHP Copper's previous (August 2011) NFA request (Brown and Caldwell, 2011a). The six additional properties were not included in the previous NFA Request because BHP Copper did not receive property owner approval to conduct sampling until after the August 2011 request had been submitted to the ADEQ. NFA determinations for 40 NSA properties included in the August 2011 request were recently approved by the ADEQ.

1.2 Project Background

The following sections provide a brief description of the NSA, its history, and participation in the VRP.

1.2.1 Northwest Study Area Description

As shown on Figure 1-1, the NSA is located in the northwestern portion of the Town of Superior, Pinal County, Arizona. The Town of Superior is situated at the edge of an alluvial basin. Elevations within the NSA range from 2,880 feet above mean sea level (amsl) along the northern boundary to approximately 2,675 feet amsl at the southern boundary.

The boundaries of the NSA were established in 2003, in consultation with ADEQ, to encompass a largely residential area in which ADEQ had detected elevated concentrations of metals in soil. This portion of the Town of Superior was impacted by a 1993 tailings release and is located adjacent to and downgradient of Tailings No. 3 and 4. Tailings No. 3 and 4 are situated within the West Plant Site, which was previously owned and operated by BHP Copper's predecessor Magma Copper Company (Magma)

and is now owned by Resolution Copper Mining, LLC (RCML). The NSA boundaries were established to encompass the localized drainage area immediately adjacent to Tailings No. 3 and 4 which had been impacted by the 1993 tailings release and may have been impacted by earlier tailings releases. The NSA consists of 129 properties, with a combined area of approximately 45 acres. Figure 1-2 shows observed property line boundaries drawn on a 2011 aerial photograph. While the NSA is primarily residential in nature, it also includes some municipal, commercial, and vacant properties.

1.2.2 Historical Land Use

Land use within the NSA, as with most of the Town of Superior, was closely related to mining activities in the Superior area until the 1990s. Mining operations in the area began in 1875 at the Silver King Mine, located north of the West Plant Site, and continued there until 1888. In 1882 with the discovery of other silver deposits, the Arizona and Lake Superior Mining Company began operations at the Silver Queen Mine. In 1910, Magma purchased the Silver Queen property and established the Magma Mine which began operations in 1911 at what is now referred to as the West Plant Site.

As noted in Section 1.2.1, a tailings release occurred in 1993 during a period of severe storms and widespread flooding in the state. Promptly following that release, Magma capped the source of the release, Tailings No. 3 and 4. The cap was constructed in a manner to minimize the buildup of water in the tailings, to facilitate drainage around the tailings, and to minimize future erosion of the tailings. Operations at the West Plant Site were discontinued in 1996.

In 2004, RCML assumed majority ownership of the East and West Plant Sites. RCML initiated activities to upgrade storm water facilities and permanently close a number of facilities located on the West Plant Site.

1.2.3 Voluntary Remediation Program

BHP Copper conducted all NSA investigation and remediation activities voluntarily under the purview of ADEQ's VRP. BHP Copper volunteered to participate in the VRP in January 2003, soon after learning that elevated metals concentrations had been detected in soil in the Town of Superior residential neighborhood adjacent to the West Plant Site. ADEQ accepted BHP Copper into the VRP in March 2003 and the NSA was assigned Site Code 504994-00.

BHP Copper learned of the elevated metals concentrations following the release of an Expanded Site Inspection (ESI) report by the United States Environmental Protection Agency (USEPA) on November 12, 2002. The report was based on a 2001 inspection that ADEQ had conducted of the West Plant Site (USEPA, 2002). Although ADEQ did not identify a specific source of the elevated metals concentrations, it did note the proximity of a residential area to Tailings No. 3 and 4 (located in the eastern portion of the West Plant Site) and the tailings release that occurred in 1993.

In its application to participate in the VRP, BHP Copper proposed conducting soil sampling and a risk assessment in the NSA. Shortly after being accepted into the VRP, BHP Copper submitted a work plan describing how the proposed soil sampling and risk assessments would be conducted. The work plan was approved by the VRP in December 2003 and issued in final form on January 4, 2004 (Brown and Caldwell, January 2004a).

Section 2 presents a summary of the initial soil sampling and risk assessment effort performed in accordance with the 2004 work plan, along with additional property-specific soil sampling and risk assessment activities conducted in 2007 - 2009 that resulted in remediation of soil at many NSA properties. All of the investigation and remediation activities conducted by BHP Copper in the NSA were performed under the VRP with concurrence from the ADEQ.

1.3 Breakdown of NSA Properties: Action, Non-Action, and No-Access

The NSA includes a total of 129 individual properties. The 129 NSA properties were divided in three categories as preparations for soil remediation proceeded throughout 2011. The three property categories were designated non-action, action, and no-access. Non-action properties were those that met the ADEQ-approved soil remediation levels without the need for further action based on results of a 2009 property-specific human health risk assessment (Brown and Caldwell, 2009). The action properties were those where ADEQ-approved soil remediation levels were not being met prior to conducting further action (i.e., soil excavation) based on results of the same 2009 risk assessment. The no-access properties were those where one of the following conditions applied:

- no property owner/contact able to legally authorize access for sampling could be identified; or
- the property owner declined to authorize access for sampling and/or subsequent soil remediation; or
- the property contained no exposed soil areas for sample collection.

The number of properties within each of these categories varied throughout late 2011 and 2012 as a result of changing conditions specific to individual properties within the NSA. At the completion of remediation activities described in this Completion Report, there were 46 non-action properties, 77 action properties, and 6 no-access properties. The properties within each category, including their property number, street address (if applicable), and associated Pinal County parcel numbers, are presented in Tables 1-1 through 1-3. As indicated above, 40 of the 46 non-action properties were previously included in an August 2011 submittal to the ADEQ requesting an individual NFA determination for each property. These NFA determinations were recently issued by the ADEQ. Investigation activities conducted at the six remaining non-action properties, and remediation activities conducted at the 77 action properties are the subject of this Completion Report.

1.4 Document Organization

This Completion Report consists of 9 principal sections and four appendices as described below.

- Section 1, Introduction and Project Background, gives an overview of the Completion Report and summarizes NSA background information;
- Section 2, Summary of Previous Investigations, briefly summarizes investigation and risk assessment activities conducted between 2004 and 2009, including determination of final site-specific remediation levels for NSA remediation activities and the designation of action and non-action properties;
- Section 3, Non-Action Properties Not Previously Sampled, discusses initial characterization sampling of six properties where BHP Copper was unable to obtain access authorization until late 2011 and early 2012, along with property-specific risk assessment findings based on the composite sample results;
- Section 4, Remediation Procedures, describes pre-remediation activities, soil excavation and confirmation sampling, property restoration activities, and waste disposal activities conducted in accordance with the *Tailings Removal Project Work Plan (Revision 3)* (Brown and Caldwell, 2012a) along with property-specific enhancements to the planned remediation activities;
- Section 5, Confirmation Sample Results, provides a summary of property-specific post-excavation confirmation sample results, results of sample analyses for replacement soil used to backfill excavated areas and crushed landscaping rock used to cover the replacement soil;
- Section 6, Demonstration of Compliance with Approved Soil Remediation Levels, describes the risk calculations performed to demonstrate that property-specific post-remediation conditions both prior to and following backfilling of excavated areas achieved the approved soil remediation levels;

- Section 7, Community Involvement, describes community involvement activities performed in support of NSA remediation activities;
- Section 8, Conclusions, presents an overview of the soil remediation conclusions;
- Section 9, References, lists all references cited in this report;
- Appendix A, Decontamination Water Waste Profile Report and Non-Hazardous Waste Manifest;
- Appendix B, Laboratory Reports for Replacement Soil and Landscape Rock Sample Analyses;
- Appendix C, Action Property Area-Weighted Average Calculation Data; and
- Appendix D, Probabilistic Risk Analysis — Crystal Ball Output Summaries.

Concurrent with submittal of this Completion Report to ADEQ, BHP Copper is submitting individual Remediation Summary Reports for the 77 action properties, and Data Summary Reports for six non-action properties that were not part of the August 2011 *Section 181 Report and Request for NFA Determination* (Brown and Caldwell, 2011a).

Each of the 77 Remediation Summary Reports (Brown and Caldwell, 2013a) is a complete, stand-alone document that satisfies the informational requirements for a property-specific NFA determination pursuant to A.R.S. section 49-181.A. The property-specific data and other information contained within each Remediation Summary Report includes the following:

- The location, identification and description of the property to which the Remediation Summary Report applies.
- A summary of soil sampling activities conducted at the property during 2004 (if applicable) and a table presenting the sample analytical results.
- A summary of pre-remediation soil sampling conducted in 2007/2008 or 2012 and a table presenting the sample analytical and risk assessment results, indicating that ADEQ-approved soil remediation levels were not met and further action is required.
- A description of soil remediation and restoration activities performed at each property.
- A summary of confirmation sample analytical and risk assessment results for post-remediation conditions prior to backfilling the excavated areas with clean replacement soil, and analytical and risk assessment results for post-remediation conditions following placement of backfill, indicating that ADEQ-approved soil remediation levels are met and no further action is required.
- Four figures: (1) a general location map depicting the property location within the NSA; (2) an aerial photograph of the property; (3) a site map showing the observed property boundary, structures and other physical features, soil sample locations, and 2007/08 composite sample results; and (4) a site map showing the observed property boundary, structures and other physical features, excavated areas, and 2011 or 2012 post-excavation confirmation composite sample results.
- A complete copy of this May 2013 *NSA Project Completion Report* (provided on CD).
- Copies of property-specific laboratory reports for soil sample analyses (provided on CD).
- A copy of the Agreement to Access the property for sampling (where applicable), the Soil Excavation Agreement for the property that authorized remediation activities, and the Property Restoration Form indicating restoration of the property following remediation had been completed to the owner's satisfaction.
- Photographs illustrating pre-remediation, soil excavation, backfilling of excavated areas, and restored property conditions following remediation.

Each of the six Data Summary Reports (Brown and Caldwell, 2013b) is also a complete, stand-alone document that satisfies the informational requirements for a property-specific NFA determination pursuant to A.R.S. section 49-181.A. The property-specific data and other information contained within each Data Summary Report includes the following:

- The location, identification and description of the property to which the Data Summary Report applies.
- A summary of soil sampling activities conducted at the property during 2004 (if applicable) and a table presenting the sample analytical results.
- A summary of soil sampling conducted in 2011 or 2012 and a table presenting the sample analytical results and risk assessment results, indicating that site-specific soil remediation levels are met and no further action is required.
- Three figures: (1) a general location map depicting the property location within the NSA; (2) an aerial photograph of the property; and (3) a site map showing the observed property boundary, structures and other physical features, soil sample locations, and 2011/12 composite sample results.
- A complete copy of this May 2013 NSA Project Completion Report (provided on CD).
- Copies of property-specific laboratory reports for soil sample analyses (provided on CD).
- A copy of the Agreement to Access the property for sampling.

Section 2

Summary of Previous Investigations

2.1 Introduction

Previous NSA investigation activities have consisted of collection and analysis of soil samples, risk assessment, delineation of action (i.e., soil remediation necessary) and non-action (soil remediation not necessary) properties, and community relations associated with these various efforts. BHP Copper's soil sampling and risk assessment activities conducted between 2004 and 2009 addressed most of the 129 properties within the NSA. Sampling activities were conducted at all NSA properties where BHP Copper was able to obtain access authorization from the property owners and tenants.

2.2 2004 Phase I and II Soil Sampling and Risk Assessment; Identification of COPCs

In 2004, Phase I and Phase II soil sampling was performed on a parcel-specific basis and 373 discrete soil samples were collected at 126 of 143 NSA parcels representing 114 of the 129 NSA properties. These sampling activities were conducted in accordance with the ADEQ-approved *Project Work Plan* (Brown and Caldwell, 2004a). Collection and analysis of soil samples during the Phase I and II activities was performed to (1) characterize the distribution of metals potentially related to a 1993 tailings release from the West Plant Site, and (2) provide the data required to conduct an area-wide HHRA to evaluate potential health risks associated with the detected metals. Analytical results for the 2004 Phase I and II samples are presented in Table 2-1 and the distribution of the 269 sample locations throughout the NSA properties is illustrated in Figure 2-1.

Selection of analyses performed on the 2004 Phase I and II samples was based on a review of analytical data presented in the ESI (USEPA 2002). While ESI samples were analyzed for 23 metals and cyanide, most of the metals were detected at low concentrations and some metals (e.g., potassium and sodium) are not subject to risk assessment. As approved by ADEQ in the *Project Work Plan* (Brown and Caldwell, 2004a), analysis was not conducted for metals not subject to risk assessment and a tiered approach was used for the remaining metals and cyanide. Three tiers were established such that all samples were analyzed for metals most likely to exceed their predetermined residential soil remediation levels (SRLs) and the remaining metals and cyanide were analyzed less frequently, as follows:

- Tier 1 analytes included arsenic, copper, and lead because the concentrations of these metals were either above or more than 80 percent of their residential SRLs in the samples collected during the ESI. All samples were analyzed for the Tier 1 analytes.
- Tier 2 analytes included manganese and antimony because these metals were reported to be in excess of 20 percent of their respective residential SRLs in one or more of the ESI samples. Twenty (20) percent of all samples were subject to Tier 2 analysis.
- Tier 3 analytes included all analytes that were reported to be in excess of 10 percent of their respective residential SRLs in one or more of the ESI samples or analytes for which there was some other special interest. Tier 3 analytes included aluminum, barium, beryllium, cadmium, chromium, cobalt, cyanide, iron, mercury, nickel, selenium, silver, thallium, vanadium, and zinc. Ten percent of all samples were subject to Tier 3 analysis. Cyanide was only detected in one ESI background sample, but was included in Tier 3 because of concerns voiced by a local resident.

Samples were not selected for Tier 2 and Tier 3 analyses until the Tier 1 analyses had been completed and those samples with the most elevated arsenic, copper, and lead concentrations had been identified. Only arsenic, copper, lead, and manganese were detected above their respective predetermined residential SRLs in one or more samples collected during Phase I and II (Table 2-1).

Using the 2004 discrete sample results, a probabilistic risk assessment was conducted on an area-specific basis (i.e., for the entire NSA and the NSA subdivided into six exposure units labeled A through F). Risk assessment results, presented in the August 13, 2004 *Risk Assessment Report* (Brown and Caldwell, 2004b), indicated that aluminum, antimony, barium, beryllium, cadmium, chromium, cobalt, cyanide, mercury, nickel, selenium, silver, thallium, vanadium, and zinc were present in the soil of sampled properties at concentrations below the predetermined soil remediation levels for residential properties (predetermined residential SRLs) as listed in Appendix A of the Arizona Soil Remediation Standards (Arizona Administrative Code [A.A.C.], Title 18, Chapter 7, Article 2). The report also indicated that arsenic was present in soil at most locations above its predetermined residential SRL, and copper, lead, and manganese were present in soil at concentrations above their respective predetermined residential SRLs in one or more locations. Based on these findings, arsenic, copper, lead, and manganese were designated as chemicals of potential concern (COPCs) for subsequent sampling activities. The probabilistic risk assessment indicated that cancer and non-cancer risks associated with arsenic in the soil were within the acceptable risk management ranges authorized by Arizona Administrative Code (A.A.C.) R18-7-206.D.

Review of the Phase I and II sample analytical results also indicated that arsenic and lead were the only metals detected in soil at concentrations greater than the Minimum Groundwater Protection Levels (GPLs) listed in ADEQ's *Screening Method to Determine Soil Concentrations Protective of Groundwater Quality* (Screening Method) (ADEQ, 1996). Therefore, during Phase III, alternative GPLs for arsenic and lead were calculated using procedures outlined in the Screening Method. More specifically, USEPA Test Method 1312, the Synthetic Precipitation Leaching Procedure, was used to generate leachate from 10 representative NSA soil samples. The concentrations of arsenic and lead in the leachate were then used to calculate Alternative GPLs of 1,108 milligrams per kilogram (mg/kg) and 49,793 mg/kg for arsenic and lead, respectively (Table 2-2). These alternative GPLs were well above the highest arsenic and lead concentrations reported for any sample collected in the NSA. Therefore, no further action was required at the NSA with respect to the water quality requirement listed in the Arizona Soil Remediation Standards (A.A.C. R18-7-203(B)(1)).

2.3 2007-2008 Phase IV Soil Sampling

Following extensive analysis of information in the 2004 *Risk Assessment Report*, discussions between BHP Copper and ADEQ resulted in the initiation of an additional sampling program designated Phase IV. The Phase IV program was conducted in 2007 and 2008 in accordance with the *Phase IV Work Plan* (Brown and Caldwell, 2007) to identify, on a property-specific basis, the extent to which COPCs (arsenic, copper, lead, and manganese) exceeded their predetermined residential SRLs, and to provide the large number of samples needed to conduct a property-specific HHRA. All Phase IV soil samples were analyzed for arsenic. Samples were also analyzed for copper, lead, and/or manganese on a property-specific basis. Samples from a given property were analyzed for copper, lead, and/or manganese whenever any of those metals had been detected in the 2004 samples at concentrations greater than 75 percent of their predetermined residential SRLs[1].

For the Phase IV sampling effort, BHP Copper successfully obtained access authorization to sample 119 of the 129 properties. Unlike the discrete sampling performed in 2004, composite sampling was

[1] SRLs mentioned here are those established in 1997, which predate the current SRLs established in 2007.

performed at each property during 2007 and 2008. In general, three composite sample areas (CSAs) were designated on each property, with each CSA representing approximately one-third of the property. One composite soil sample was collected in each CSA. Each composite sample was formed from 10 discrete subsamples collected from the interval between ground surface and 0.5 feet below ground surface (bgs). The locations of the 30 discrete subsamples were selected to provide an approximately uniform coverage throughout each property. Following collection, a composite sample was formed from each set of 10 discrete subsamples collected within a CSA by taking aliquots from each subsample and compositing the aliquots. Figures 2-2 and 2-3, respectively, show typical composite sample locations on properties without structures and with structures. A total of 343 composite soil samples were collected and analyzed during the Phase IV sampling activities. The results of these property-specific composite sample analyses are presented in Table 2-3.

The *Phase IV Work Plan* (Brown and Caldwell, 2007) also included provisions for collecting and analyzing discrete subsurface samples from 10 selected properties within the NSA. The objective of this sampling was to determine the vertical distribution of arsenic in areas where 2004 sampling results indicated the potential for elevated arsenic concentrations in subsurface soil. Discrete surface and subsurface soil samples were collected from soil borings at 27 locations on Property Nos. 8, 12, 14, 54, 89, 100, 101, 103, 125, and 127. Analytical results for 73 soil samples collected in the soil borings are presented in Table 2-4. All 73 samples were analyzed for arsenic. In addition, samples collected from 22 borings were also analyzed for copper, samples from 20 borings were also analyzed for lead, and samples from 3 borings were also analyzed for manganese. Evaluation of the soil boring results indicated that arsenic concentrations significantly increased with depth in only four borings, and three of those boring were on a single property (No. 103). The increased arsenic concentrations at Property No. 103 occurred at 3.5 feet bgs. Elevated lead concentrations were reported at that same depth in each boring. The fourth soil boring where a significant increase in arsenic concentration occurred with depth was located on Property No. 8.

Preliminary probabilistic risk assessments were performed on a property-specific basis using results of the 343 Phase IV composite soil samples and exposure assumptions recommended by ADEQ's toxicologist. These exposure assumptions were more conservative than those used in 2004. The preliminary risk assessments further supported the 2004 risk assessment's determination that the cancer risks are within the range specified by Arizona regulation. However, as a measure of added protectiveness, BHP Copper proposed to remove soil in portions of some properties, subject to the approval of the properties' owners and tenants.

2.4 Tailings Removal Project Work Plan and Phase IV Risk Assessment; Approved Soil Remediation Levels

On June 16, 2008, BHP Copper submitted to ADEQ the *Tailings Removal Project Work Plan (*Brown and Caldwell, 2008) to address portions of properties where remediation was indicated on the basis of the preliminary risk assessments. The work plan proposed to use the predetermined residential SRLs as action levels for copper, lead, and manganese, and proposed a site-specific action level of 90 mg/kg for arsenic, representing a hazard quotient (HQ) of less than one and a cumulative excess lifetime cancer risk (CELCR) of 4×10^{-5}. The work plan included plans for the excavation of soil containing arsenic, copper, lead, and manganese in excess of the action levels, and the replacement of the excavated soil with clean soil. ADEQ approved the work plan and the remediation levels proposed for copper, lead, and manganese but withheld approval of the remediation level proposed for arsenic pending further discussion (ADEQ, 2008).

On March 23, 2009, BHP Copper submitted the *Phase IV Human Health Risk Assessment* (Brown and Caldwell, 2009) to ADEQ with a letter responding to ADEQ comments (BHP Copper, 2009) and explaining

how the arsenic remediation level proposed in the 2008 *Tailings Removal Project Work Plan* complied with A.A.C. R18-7-206 (Brown and Caldwell, 2009). The 2009 property-specific risk assessment results are presented in Table 2-3. After reviewing the *Phase IV Human Health Risk Assessment* and the accompanying letter, ADEQ approved a site-specific soil remediation level for arsenic consisting of a CELCR of 2×10^{-5} and a hazard index[2] that is not greater than one (ADEQ, 2009). BHP Copper then revised the *Tailings Removal Project Work Plan* in accordance with ADEQ's final determination regarding the approved soil remediation levels (Brown and Caldwell, 2010).

Results of the 2009 risk assessment were used to identify properties that met the ADEQ-approved soil remediation levels without the need for remedial action (non-action properties), as well as properties that would require remedial action to meet the ADEQ-approved soil remediation levels (action properties). BHP Copper requested an NFA determination for the non-action properties in a *Section 181 Report and Request for NFA Determination* (Brown and Caldwell, 2011a) submitted to the ADEQ in August 2011. BHP Copper's *Tailings Removal Project Work Plan*, which addressed soil remediation procedures to be implemented at the action properties, underwent revisions during 2011 and 2012 before the final version (*Tailings Removal Project Work Plan* [Revision 3]) was issued (Brown and Caldwell, 2012a). Remediation of the action properties, which began in September 2011, is described in Section 4 of this Completion Report.

[2] As indicated in A.A.C. R18-7-201.20, the hazard index (HI) is the sum of the hazard quotients (HQ) of chemicals acting by a similar mechanism and/or on the same target organ. Because arsenic, copper, and manganese do not affect the same organ or act by a similar mechanism at the levels found in the NSA, their non-cancer hazard levels are reported in terms of HQs. HQ and HI calculations are not applicable to lead.

Section 3

Additional Non-Action Properties

This section addresses six NSA properties that were not included in the Phase IV sampling activities conducted in 2007 and 2008 but were found to be non-action properties based on sampling conducted during 2011 and 2012. The six properties, their parcel numbers, and street addresses are as follows:

- Property No. 6 – Parcel No. 106-12-136, No Address Listed;
- Property No. 7 – Parcel No. 106-12-137, 301 North Mine Avenue;
- Property No. 67 – Parcel No. 106-09-090, 81 North Pinal Avenue;
- Property No. 106 – Parcel No. 105-06-071, 61 A South McKelveyville Road;
- Property No. 121 – Parcel No. 105-06-061, 96 West Old Phoenix Road; and
- Property No. 129 – Parcel No. 105-03-030A, 979 West Main Street.

The locations of these six properties are illustrated on Figure 3-1.

BHP Copper did not have permission to access these properties for the Phase IV soil sampling that established the initial identification of action properties. However, between September 2011 and March 2012, BHP Copper successfully obtained signed agreements to access the six properties and conduct composite soil sampling. The composite sampling was conducted on September 2, 2011 at Property Nos. 6, 7, and 106, September 19, 2011 at Property No. 67; March 26, 2012 at Property No. 129; and March 30, 2012 at Property No. 121.

Sampling of these six properties was conducted in accordance with the procedures described in the *Phase IV Work Plan* (Brown and Caldwell, 2007). As described in Section 2 of this Completion Report, each property was subdivided into three CSAs and one composite sample was collected from each CSA. Each composite sample consisted of 10 discrete subsamples.

Consistent with the *Phase IV Work Plan*, arsenic was selected for analysis at all properties, regardless of prior analytical results. Metals other than arsenic were selected for analysis at a property if results of 2004 sampling exceeded 75 percent of their residential SRLs. However, composite samples collected at Property Nos. 6, 7, and 67 were analyzed for all four NSA COPCs (i.e., arsenic, copper, lead, and manganese) because these properties had not been sampled previously in 2004.

Results of composite sample analyses for the CSAs at these six properties are presented in Table 3-1. To determine whether they should be designated non-action or action properties, the composite sample results for each property were subjected to risk evaluation for arsenic using the same methodology and assumptions described in the *Phase IV Human Health Risk Assessment* (Brown and Caldwell, 2009). The arsenic risk assessment results for these six properties are also presented in Table 3-1 and summaries of the risk model outputs are provided in Appendix D. As shown on Table 3-1, CELCR and HQ values for arsenic were all less than the approved site-specific soil remediation levels (SSRLs). The results for copper, lead, and manganese analyses (at applicable properties) were all less than their predetermined residential SRLs. Based on these results, all six properties are designated non-action.

BHP Copper is requesting NFA determinations for these six properties because they have been found to meet the ADEQ-approved soil remediation levels without the need for further action. Data and information satisfying the information requirements for a property-specific NFA determination pursuant to A.R.S. section 49-181.A are presented in a stand-alone Data Summary Report (Brown and Caldwell,

2013b) for each of the six properties which are being submitted to the ADEQ concurrent with this Completion Report.

Section 4

Remediation Procedures

This section summarizes the soil remediation activities conducted at NSA action properties in accordance with BHP Copper's *Tailings Removal Project Work Plan (Revision 3)* (Brown and Caldwell, 2012a).

4.1 Pre-Remediation Activities

Pre-remediation activities were conducted in advance of soil excavation to ensure that necessary excavation could proceed safely and with minimal disruption to residents of action properties and neighboring properties.

4.1.1 Permits

Prior to commencement of property remediation activities, BHP Copper's Excavation Contractor, Dalmolin Excavating (Dalmolin), obtained a Dust Permit from Pinal County Air Quality Control District (PCAQCD). Dust Permits are required by PCAQCD for any earthmoving activities that disturb more than 0.1 acres. Dust control techniques implemented by Dalmolin included routine wetting of soils with water prior to and during earthmoving activities. In the event of high winds, earthmoving activities were temporarily suspended if wetting with water was not effective.

BHP Copper submitted a Notice of Intent to obtain coverage under ADEQ's Construction General Permit for the entire NSA. A *Storm Water Pollution Prevention Plan* (SWPPP) (Brown and Caldwell, 2011b) was prepared to designate required controls and inspection frequencies. Generally, before commencing any earthmoving activities on an individual property, straw wattles were placed on the downgradient edges of the property boundaries. These controls were maintained and left in place until all remediation activities on the affected property were completed. Excavation procedures were coordinated to minimize the stockpiling of excavated soil during property remediation. In the unusual event that all excavated soil was not removed from the property at the end of the work day, the soil was stockpiled within the property boundaries, covered with fabric as necessary to limit unauthorized access and wind dispersion, and straw wattles were placed around the stockpile perimeter. The SWPPP was modified as needed to update storm water controls, inspection requirements, and to include property used to stockpile clean replacement soil. Inspections of the stockpile area for clean replacement soil are ongoing until a Notice of Termination is filed with the ADEQ.

Excavated soil removed from the NSA was transported to BHP Copper's Pinto Valley facility for disposal at predetermined locations as specified by the facility's Aquifer Protection Permit (APP).

4.1.2 Property Needs Assessment and Soil Excavation Agreement

BHP Copper representatives met with the owner or tenant of each property at which soil excavation was proposed to discuss the steps required to prepare the property for soil excavation, the need for a signed Soil Excavation Agreement authorizing BHP Copper and its subcontractors to perform work on the property, the need for a signed Soil Excavation Plan, and the safety precautions that would be employed while remediation activities were in progress. A Property Needs Assessment Checklist was used to guide the discussions and document the owner's responses. If the owner only wrote and spoke Spanish, copies of the Soil Excavation Agreement and the Soil Excavation Plan were provided in Spanish, and a representative of BHP Copper who was fluent in Spanish discussed the documents with the owner.

Planned soil excavation activities did not begin at a NSA action property until the owner had signed the Soil Excavation Agreement and Soil Excavation Plan. If the property was occupied by a tenant rather than the owner, the tenant was also required to sign the Soil Excavation Agreement and Soil Excavation Plan. Attached to the Soil Excavation Plan was a figure showing the Authorized Work Areas (AWAs), which were the areas to be excavated. BHP Copper representatives asked the owner/tenant to indicate on the AWA figure any areas of the property the owner did not want disturbed, and areas that should not be disturbed because of underground utilities, irrigation piping, septic systems, or other underground structures. The owner/tenant was also asked to indicate where fill had been placed on the property and to provide as much information as possible concerning that material.

The owner/tenant was informed of the procedures that would be used to more precisely define the area within which soil would be excavated. BHP Copper representatives also explained the need to accurately locate underground utilities, septic systems and any other underground structures that might limit excavation. After the owner/tenant had signed the Soil Excavation Agreement, BHP Copper notified Arizona Blue Stake of the planned excavation activities. Arizona Blue Stake then contacted all utility companies that provide service to the area to have them locate and mark their respective subsurface lines. BHP Copper also notified its private utility locating contractor, who visited the property to identify and mark detectable underground lines, pipes, and structures (e.g., septic systems) that were privately installed and did not fall within the purview of Arizona Blue Stake's utility clearance effort.

Property owners/tenants were asked to clear areas proposed for soil excavation of all outdoor furniture, trailers, automobiles, debris, etc. before soil excavation could commence. In some cases, BHP Copper's excavation contractor assisted in removing or temporarily relocating personal property. The owners/tenants were asked to participate in development of the Soil Excavation Plan showing what items would be temporarily relocated and where they would be stored while remediation activities were in progress.

4.1.3 Brush Clearance

BHP Copper performed brush clearance activities on multiple properties throughout the NSA. On some properties, brush clearance provided improved access for subsequent remediation activities. It also facilitated sampling of previously inaccessible areas on some properties. Brush clearance performed by BHP Copper on five non-action properties included in the August 2011 *Section 181 Report and Request for NFA Determination* (Brown and Caldwell, 2011a) led to resampling of these properties and subsequent recalculation of risk for arsenic in accordance with provisions of the Phase IV Human Health Risk Assessment (Brown and Caldwell, 2009). Results of arsenic risk recalculations for these five non-action properties resulted in their re-designation as action properties (Section 4.3).

4.2 Remediation Activities

This section provides a general summary of remediation activities conducted at all action properties, but does not address activities specific to individual properties. Property-specific activities are summarized in an individual *Remediation Summary Report* (Brown and Caldwell, 2013a) that was prepared for each action property upon completion of remediation activities.

4.2.1 Pre-Excavation Activities

Pre-excavation activities included delineation and marking of excavation exclusion zones, potholing combined with in-situ X-ray fluorescence (XRF) measurements of COPC concentrations in soil to estimate the required depth of excavation within each CSA, and preparation of a field drawing identifying the 10 locations within each CSA where discrete subsamples were collected in 2007 or 2008.

BHP Copper project personnel marked a 3-foot exclusion zone extending away from the foundation of any structure, along both sides of any underground utility, and around any septic tank or other underground structure located on the action property. Also marked were exclusion zones around irrigation drip lines of trees and shrubs, and around other items such as gardens and flower beds that the owner or tenant had indicated they did not want disturbed. Areas within the exclusion zones were considered presumptively unavailable for excavation.

Before potholing and soil excavation could commence, the AWAs needed to be cleared of outdoor furniture, trailers, automobiles, etc. The signed Soil Excavation Plan identified whether any removal and/or relocation of personal property was to be performed by the owner/tenant or BHP Copper's excavation contractor. Project personnel photographed all personal property to be temporarily relocated on the property and also placed a unique property identification tag on any personal property the excavation contractor had to temporarily locate off the property.

Potholing was conducted at many properties to estimate the vertical extent of soil that needed to be removed during excavation of the initial soil lift. The number and locations of potholes were based on consideration of the sizes of the AWAs and previous analytical results. At each pothole location, the excavation contractor used a small trackhoe or other appropriate equipment to excavate each pothole to a depth of 6 inches below grade. Any loose soil that sloughed from the sidewalls to the bottom of the pothole was removed or pushed aside to expose undisturbed soil and an in-situ XRF measurement of COPC concentrations was taken at the bottom the pothole. The in-situ XRF measurements were compared against approved soil remediation levels for the COPCs and, if the in-situ XRF measurements indicated that COPC concentrations exceeded approved soil remediation levels, the pothole was deepened another 6 inches and an in-situ XRF measurement was taken. This process was repeated, as necessary, to a maximum pothole depth of 18 inches bgs as the maximum depth of excavation generally did not exceed 2 feet bgs.

Finally, project personnel prepared a field drawing that showed the AWAs within the property and the approximate locations within each CSA where discrete subsamples used to make up composite soil samples were collected in 2007 and 2008. Depending on the size of the property and the configuration of the AWAs, some of the sampling locations were in areas not proposed for excavation. For these situations, project personnel collected in-situ XRF measurements and discrete subsamples from the locations within those areas before soil excavation began. The XRF measurements were recorded on XRF data forms. These pre-excavation efforts served two functions. First, they minimized the time required for subsequent confirmation sampling while property remediation activities were still in progress and second, they alerted project personnel to the potential need for expansion of an AWA if the in-situ XRF measurements indicated that COPC concentrations were significantly above the approved soil remediation levels at any of the locations. The discrete subsamples collected from any unexcavated areas within each CSA were held until soil excavation was completed and were then combined with the discrete subsamples from the excavated portion of the same CSA to make up the composite post-excavation confirmation sample. Collection and analysis of confirmation samples is discussed further in Section 4.2.3.

4.2.2 Soil Excavation Procedures

Soil excavation began once the AWAs at a property had been cleared of obstructions such as personal property, in accordance with the signed Soil Excavation Plan for that property. The excavation contractor used a small trackhoe or other appropriate equipment to either remove an initial 6- to 12-inch lift of soil from each AWA or to excavate each AWA to the depth defined by potholing if performed at that property. At some properties, access limitations prevented use of powered equipment to excavate portions of an AWA. In those circumstances, the excavation contractor used hand tools (i.e., picks and shovels). The excavated soil was either placed directly into a dump truck or trailer designed and equipped for

transporting soil or was temporarily stockpiled within the property and then loaded and transported from the property later.

Following excavation of the initial soil lift, in-situ XRF measurements of COPC concentrations were taken from the bottom of the excavation. XRF measurements of the property-specific COPCs were made by placing the XRF analyzer's mylar-covered analyzer window in direct contact with exposed soil for a specified time period. The in-situ XRF measurements were made to evaluate whether average COPC concentrations within each CSA had been reduced to less than the approved soil remediation levels or remained above the approved soil remediation levels. Because the approved soil remediation level for arsenic consists of CELCR and HQ values representative of conditions throughout an entire property, a field target level of approximately 45 mg/kg was established as an estimated upper bound for the CSA average of in-situ XRF arsenic measurements to ensure the composite soil sample results were less than the approved soil remediation level. For copper, lead, and manganese, the average of the in-situ XRF measurements within each CSA needed to be less than their corresponding predetermined SRLs.

Where the in-situ XRF measurements indicated that COPC concentrations remained above the approved soil remediation levels, the excavation contractor was directed to remove another 6 to 12 inches of soil where COPC concentrations continued to be detected at elevated concentrations by the XRF analyzer. After the soil lift had been removed, a second set of in-situ XRF measurements were taken from the bottom of the second excavated lift. If these in-situ XRF measurements also indicated that COPC concentrations remained in excess of the approved soil remediation levels, an additional 6 to 12 inches of soil was excavated.

The maximum authorized depth for soil excavation under normal circumstances was 2 feet bgs, as specified in the *Tailings Removal Work Plan (Revision 3)* (Brown and Caldwell, 2012a). However, the *Tailings Removal Work Plan (Revision 3)* also provided for excavation beyond the maximum depth of 2 feet when in-situ copper concentrations exceeded 2,000 mg/kg at a depth of more than 2 feet bgs, indicating the possible presence of tailings. Under this circumstance, soil excavation beyond 2 feet bgs would continue until in-situ XRF measurements indicated the concentration of copper in the excavation no longer exceeded 2,000 mg/kg, or the excavation reached a depth of 3.5 feet bgs, whichever occurred first.

After soil excavation had been completed, confirmation composite samples had been collected, and ex-situ XRF cup measurements (see Section 4.2.3) for the confirmation composite samples were below the approved soil remediation levels, backfilling of the excavated areas and property restoration activities began. To avoid potential cross-contamination between CSAs designated for excavation and CSAs that did not require excavation at the same property, tarps were laid out across the non-action CSAs if excavation equipment or soil haul trucks needed to traverse these CSAs. To avoid potential cross-contamination among properties, earthmoving equipment used by the excavation contractor for excavation was rinsed with a low-volume, high-pressure spray system before it was removed from the excavated area. The rinse water was allowed to soak into the exposed soil.

4.2.3 Confirmation Sampling and Analysis

For each excavated CSA at a property, confirmation composite soil samples were collected after any of the following conditions had been met:

- in-situ and ex-situ XRF measurements for the COPCs in a CSA indicated compliance with the approved soil remediation levels;
- soil had been excavated to the maximum depth authorized; or
- impediments (e.g., bedrock or caliche) resulted in refusal that prevented excavation to the depth required to achieve the approved soil remediation levels.

Each confirmation composite sample was formed by combining equal volumes from 10 discrete subsamples collected throughout a CSA. The 10 discrete subsamples were collected in a manner consistent with those collected in 2007 and 2008 during Phase IV composite soil sampling activities. In cases where only a portion of the CSA was excavated, the discrete subsamples included unexcavated portions as well as excavated portions of the CSA in order to provide a representative sampling of the entire CSA. Where discrete samples could not be collected because refusal was encountered during excavation and all soil was removed down to the bedrock or caliche surface, the number of discrete subsamples comprising a composite sample was less than 10.

At each discrete subsample location, a 6-inch interval of soil was collected starting from either ground surface or the bottom of the excavation. At sample locations within excavated portions of a CSA, the bottom of the excavation might range from a depth of 0.5 to 3.5 feet bgs, so the sampled interval in those instances could be 0.5 to 1.0 feet bgs, 3.5 to 4.0 feet bgs, or any 0.5-foot interval in between. The discrete subsamples were collected using a trowel, disposable scoop, or equivalent sampling device.

Where non-disposable sampling equipment was used, that equipment was decontaminated prior to and immediately after use at each subsample location to avoid cross-contamination between sampling locations in accordance with the *Tailings Removal Project Sampling and Analysis Plan (Revision 2)* (Brown and Caldwell, 2012b). Fluids generated during sampling equipment decontamination were placed in Department of Transportation (DOT)-approved 55-gallon drums and stored in a designated waste storage area at the NSA property (No. 124) used as BHP Copper's Project Office.

Soil collected at each discrete subsample location was placed in a 1-quart re-sealable plastic bag that was labeled in accordance with provisions of the *Tailings Removal Project Sampling and Analysis Plan (Revision 2)*. Once the 10 discrete subsamples for a CSA had been collected, the bagged subsamples were transported to a trailer at the Project Office for combination into a confirmation composite sample that would be submitted to the laboratory for analysis if the ex-situ XRF measurements for the composite sample were less than the field target level of approximately 45 mg/kg for arsenic or the predetermined SRLs for the other COPCs.

The confirmation composite samples were formed in the following manner:

- Each discrete subsample was thoroughly homogenized by rotating and shaking the plastic bag in which the discrete subsample had been collected.
- An equal portion was then removed from each of the 10 discrete subsample bags and placed in a 1-gallon plastic bag using a disposable spoon.
- The 10 discrete subsample aliquots in the 1-gallon plastic bag were then thoroughly homogenized in the manner described above.
- Once homogenized, the bag was held right-side up and the soil was adjusted so that it was evenly distributed across the bottom of the bag. The empty portion of the bag was then folded around the bottom portion of the bag to keep the soil in place and the bag was rotated so the bottom faced upward. This procedure yielded a soil layer approximately 0.5 inches thick.
- The XRF analyzer was then positioned with the analyzer window in direct contact with the plastic bag. The analyzer was activated and three XRF measurements were made along the bottom of the bag at approximately equal distances from one other and from the edges of the bag. Results of the three XRF measurements for the property-specific COPCs along with the average of those measurements for the bag sample were recorded for the applicable CSA on the XRF data form for the property.
- If the average XRF measurements indicated that COPC concentrations met the approved soil remediation levels, a portion of the composited sample was placed in a cup designed for XRF analysis and three ex-situ XRF measurements for the cup sample were taken and recorded on the XRF data form along with the average for those measurements.

- If the average ex-situ XRF cup measurement indicated COPC concentrations met the approved soil remediation levels, the cup containing the sample was wiped clean, appropriately labeled, logged on a chain-of-custody (COC) form, and submitted to the laboratory for analysis.
- Where a field duplicate sample was required, a second cup sample was prepared from the same plastic bag as the primary sample, labeled, logged on a COC, and submitted to the laboratory for analysis.

Analytical results for the confirmation composite soil samples collected at each remediated property are discussed in Section 5.

4.2.4 Property Restoration

The excavation contractor replaced the soil excavated from a property with soil that had been tested and found to have metals concentrations that were below their respective residential SRLs, as specified by the *Tailings Removal Project Sampling and Analysis Plan (Revision 2)* (Brown and Caldwell, 2012b). After placement and grading, the excavation contractor compacted the backfilled soil and then covered it with 2 inches of crushed landscape rock, unless the property owner requested the final surface remain exposed soil. Several types and sizes of crushed landscape rock were available for use during property restoration and selection of cover rock was made by the owner of each action property. The varieties of crushed landscape rock available for property restoration included the following:

- 3/8-inch Coral
- ½-inch Coral
- 3 to 6-inch Gila Rock
- 3/8-inch Kalamazoo Apache Brown
- ½-inch Kalamazoo Apache Brown
- 5/8-inch Kalamazoo Apache Brown

Analytical results for samples of the various types and sizes of crushed landscape rock are presented in Section 5.3. Excavated areas that were covered with 2 inches of crushed landscape rock were identified in the Soil Excavation Plan. For portions of a property having a significant potential for erosion (i.e., steep slopes), up to 3 inches of crushed rock was used as cover material.

The excavation contractor then placed any personal property that had been temporarily relocated back in its original position on the property as indicated in the Soil Excavation Plan, or in another position if so requested by the property owner. After restoration activities had been completed, project personnel took photographs of the relocated personal property and those portions of the property where soil excavation and restoration activities had been conducted. BHP Copper, the excavation contractor, and the property owner then met and signed a Property Restoration Form indicating that the personal property had been properly relocated and that the work areas were properly restored.

4.2.5 Waste Characterization and Disposal

Waste generated during soil remediation activities included debris, excavated soil, excavation contractor-generated waste, and sampling equipment decontamination water. Except for household hazardous waste, debris (household garbage, brush, construction/demolition debris, etc.) that was cleared from AWAs was placed in drop-off bins located within the NSA or transported directly to a permitted solid waste landfill for disposal. The excavation contractor managed debris from properties where the owners were unable to remove the materials and placed them in the drop-off bins.

Water generated during decontamination of non-disposable soil sampling equipment was temporarily contained in DOT-approved 55-gallon drums. Waste profile samples of the drummed decontamination water were collected and submitted to the laboratory for analysis of the following:

- Resource Conservation and Recovery Act total metals by USEPA Method 6020A;
- benzene, toluene, ethylbenzene, and xylenes by USEPA Method 8260B;
- polynuclear aromatic hydrocarbons by USEPA Methods 8270C/8310;
- pH by USEPA Method 9040C; and
- flashpoint by Method SW 1010.

Upon receipt of the waste profile analytical results indicating the drummed decontamination water was non-hazardous, it was manifested and transported by the waste disposal contractor to a permitted non-hazardous waste facility for disposal. Copies of the waste profile analytical report and the non-hazardous waste disposal manifest are provided in Appendix A.

As part of the extensive project planning effort leading up to execution of remediation activities, a determination of whether excavated soil generated at action properties would be classified as hazardous or nonhazardous waste for purposes of disposal was necessary. Composite samples collected from selected NSA properties that were proposed for soil excavation were tested using USEPA Test Methods 1311 and 6010B to determine if arsenic and lead concentrations in soil exceeded the Toxicity Characteristic Leaching Criteria set forth in Title 40 of the Federal Code of Regulations, Part 261.24. Three separate sampling events were performed during 2004, 2007, and 2008 to support this determination.

In 2004, two soil samples were analyzed for arsenic and lead using the Toxicity Characteristic Leaching Procedure (TCLP). The samples selected for analysis contained the highest and second-highest arsenic concentrations reported in the 373 soil samples collected from the NSA in 2004. Results of the TCLP analyses (Table 4-1) indicated that lead was not detected at concentrations above its practical quantitation limit (PQL). Arsenic was detected at concentrations slightly above the PQL, but well below its hazardous waste regulatory level of 5 milligrams per liter (A.A.C. R18-8-261 [A]).

During preparation of the June 2008 *Tailings Removal Project Work Plan* (Brown and Caldwell, 2008), 11 soil samples were analyzed for arsenic and lead using TCLP. The samples selected for analysis were representative of the range of arsenic and lead concentrations reported in the 326 composite surface samples collected from properties within the NSA during 2007. The samples selected for TCLP analysis included the sample with the highest arsenic and lead concentrations reported in the 326 composite samples. The results of the TCLP analyses, presented in Table 4-2, indicated that arsenic and lead were not detected in the 11 samples at concentrations above their respective PQLs.

Twelve 10-part composite surface soil samples, one duplicate composite surface soil sample, two subsurface soil boring samples, and one duplicate subsurface soil boring sample were collected and analyzed using the TCLP for the eight metals listed at A.A.C. R18-8-261.24 (i.e., arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). The samples were collected in 2008 from areas that were reported to have contained among the highest arsenic and lead concentrations in the NSA, based on concentrations reported in the 326 composite surface samples and 73 subsurface samples collected in 2007. None of the samples collected in 2008 contained leachable metals at concentrations exceeding their respective regulatory levels at A.A.C. R18-8-261 (A). Two samples contained arsenic at concentrations above its PQL and one contained mercury at concentrations above its PQL. The rest of the samples did not contain metals at concentrations above their respective PQLs. The TCLP results for these samples are presented in Table 4-3.

The TCLP sample analysis results indicated that metals concentrations in NSA soils were well below their applicable TCLP regulatory limits and were non-hazardous for purposes of disposal. Based on this determination, soil excavated during property remediation activities was transported to the BHP Copper Pinto Valley facility where it was placed in predetermined locations and managed in accordance with the facility's Aquifer Protection Permit.

The excavation contractor was responsible for properly managing all debris, including general trash, other solid waste, and personal protective equipment generated during soil excavation, backfilling, and restoration activities. Erosion-control materials (silt fences, straw wattle, hay bales, etc.) constituted the largest volume of contractor-generated waste materials. These materials were transported directly to a permitted solid waste landfill for disposal.

4.3 Properties with Improved Access

During execution of the excavation project, improved access conditions at Property Nos. 41, 53, 75, 77, 78, 80, 83, 122, and 127 allowed BHP Copper to expand the composite soil sampling to include areas that had not been sampled during the Phase IV soil sampling program. As a result, five of these properties (Nos. 41, 77, 78, 122, and 127) had originally been designated as non-action based on results of the *2009 Phase IV Risk Assessment Report* (Brown and Caldwell, 2009), but were re-designated as action properties in 2012. The expanded sampling of three properties (Nos. 75, 80, and 83) confirmed the original designation of those properties as action properties. One property (No. 53) was originally designated a no-access property but became an action property following sampling in 2012. Each property was subsequently remediated according to procedures described in subsections 4.1 and 4.2.

At Property No. 41, a portion of the property which had been inaccessible for sampling in 2007 became accessible in 2012 following removal of a dangerous dog by the property owner. The formerly inaccessible portion of the property was designated CSA-3, in addition to two CSAs sampled in 2007. Revision of the risk assessment for Property No. 41 to incorporate the new composite sample resulted in designation of the property as an action property.

Property No. 53 was originally designated a no-access property based on observations made in 2007 which indicated this property did not contain any areas of exposed soil where composite soil samples could be collected. Re-evaluation of the property by BHP Copper in 2012 indicated the presence of two small areas where composite soil samples were collected. Risk assessment results based on composite sample data for the two CSAs indicated that Property No. 53 should be designated as an action property.

Although Property No. 75 had been designated as an action property based on sampling of a limited area in 2007, a majority of the property was unsafe for project personnel to enter at that time because it was covered with a significant amount of demolition debris. In 2012, the property owner removed the demolition debris and the entire property became accessible for sampling and soil excavation. Risk assessment results based on the new composite sample data confirmed the designation of Property No. 75 as an action property.

Similar conditions applied to Property No. 83, where the presence of debris in 2007 only allowed sampling of two CSAs representing a limited portion of the property. Resampling of the entire property was conducted in 2012 after debris removal was completed by others. Risk assessment results based on the new composite sample data confirmed the designation of Property No. 83 as an action property.

At Property Nos. 77, 78, 122, and 127, improved access resulted from clearance of vegetation conducted by BHP Copper in 2012 with authorization from the property owner. With full access established, resampling of some or all of the CSAs on these properties was conducted in 2012. Risk assessment results based on the new composite sample data indicated that these properties should be re-designated as action properties. As a result, these four properties (and Property No. 41) were withdrawn from the August 2011 *Section 181 Report and Request for NFA Determination* (Brown and Caldwell, 2011a).

Like the four properties described in the previous paragraph, improved access to Property No. 80 resulted from clearance of vegetation conducted by BHP Copper in 2012 with authorization from the

property owner. Risk assessment results based on the new composite sample data representing the entire property confirmed the designation of Property No. 80 as an action property.

Section 5

Confirmation Sample Results

5.1 Post-Excavation/Pre-Backfill Sampling Results

Once soil excavation at an action property was deemed complete, confirmation composite soil samples were collected from each CSA that had been partially or completely excavated as described in Section 4.2.3. The purpose of these confirmation composite samples was to demonstrate that COPC concentrations representing property conditions following excavation (but prior to backfill and property restoration) met the soil remediation levels approved by the ADEQ. Analytical results for these samples are presented in Table 5-1, which also includes post-remediation risk results for arsenic that are discussed in Section 6.

One or more confirmation composite samples were collected at 75 of 77 action properties where soil excavation was conducted. At two properties (Nos. 12 and 31), all three CSAs were excavated to refusal so insufficient soil remained for collection of confirmation composite samples. At five properties (Nos. 20, 39, 52, 55, and 62), one CSA at each property was excavated to refusal and a confirmation composite sample could not be collected. At the 75 action properties where post-excavation confirmation sampling could be conducted, a total of 167 primary and 19 field duplicate confirmation composite samples were collected at the 75 properties.

Arsenic was included as a COPC at all but three (Nos. 94, 100, and 104) of the 75 action properties where samples were collected. The only COPC included in the post-excavation sample analyses was lead at Property Nos. 94 and 104 and manganese at Property No. 100. Arsenic was not included in the post-excavation analyses because the 2007 Phase IV sample results at these properties met the approved SSRL for arsenic. At the 72 properties where arsenic was the primary COPC, one or more of the other soil remediation COPCs (copper, lead, and manganese) were included in the sample analyses if they had previously been identified as metals of concern.

Confirmation composite samples collected during remediation activities were submitted to Apex Environmental Laboratory in Tempe, Arizona, an Arizona Department of Health Services licensed environmental laboratory (No. AZ0768). The samples were analyzed for total metals concentrations using USEPA Methods 3050B and 6020A (Inductively Coupled Plasma-Mass Spectrometer).

All the confirmation composite sample data generated during soil remediation activities underwent data verification and third-party data validation, in accordance with provisions of *Amendment No. 4, Quality Assurance Project Plan, Northwest Study Area* (Brown and Caldwell 2012c). All data verification and validation was performed by Laboratory Data Consultants of Carlsbad, California. One hundred percent of the confirmation composite sample data underwent data verification. Ninety percent of those sample data also underwent Level III data validation, and 10 percent underwent Level IV data validation.

Results of data validation indicated that 100 percent of the confirmation composite sample results were suitable for their intended use. As a result, all of these data were incorporated into the post-remediation data evaluation and risk calculations performed to demonstrate compliance with the approved soil remediation levels for the NSA (see Section 6).

As the data in Table 5-1 indicate, all confirmation composite samples collected at the listed action properties met the approved soil remediation levels for the analyzed COPCs, except for one sample collected at Property No. 44 and one sample collected at Property No. 127. Each of these properties met approved SRLs following backfill and are discussed further below.

At Property No. 44, the arsenic result for the confirmation composite sample collected at CSA-2 (230 mg/kg) caused that property to exceed the approved SSRL for arsenic prior to backfilling. This sample reflects a unique situation where the 9 of the 10 subsample locations in CSA-2 were excavated to refusal, allowing collection of only a single subsample, at a location where excavation was terminated at the maximum depth of 3.5 feet bgs as described in Section 4.2.2 of this Completion Report. Field personal identified the sample area as the remains of a "burn pit" where historic incineration activities had occurred. Unlike soil present elsewhere on the property, the material sampled at 3.5 fee bgs at this location consisted of ash and metal debris (nails, etc.) Accordingly, the elevated arsenic remaining at 3.5 bgs in the single subsample location is unrelated to tailings impacts. After the excavation was backfilled with replacement soil meeting approved SRLs, the risk result for arsenic was less than the SSRL (Table 6-1) at Property No. 44. Discussion of how post-remediation compliance with the approved soil remediation levels was demonstrated is presented in Section 6 of this Completion Report.

At Property No. 127, the manganese result for the confirmation composite sample collected at CSA-1 (4,550 mg/kg) exceeded the approved SRL of 3,300 mg/kg. This exceedence resulted from elevated manganese concentrations at several of the 10 discrete subsample locations within CSA-1 when soil excavation was terminated at the maximum depth of excavation (3.5 feet bgs) as described in Section 4.2.2 of this Completion Report. The excavation was backfilled with replacement soil meeting approved SRLs; thus post-remediation conditions following backfill meet the approved soil remediation levels at this property (Table 6-1). Discussion of how post-remediation compliance with the approved soil remediation levels was demonstrated is presented in Section 6 of this Completion Report.

5.2 Replacement Soil Sampling Results

Replacement soil used as backfill material during post-excavation restoration activities at the 77 action properties was sampled regularly throughout the duration of soil remediation activities in accordance with provisions of the *Tailing Removal Project Sampling and Analysis Plan (Revision 2) (*Brown and Caldwell, 2012b). The *Tailing Removal Project Sampling and Analysis Plan (Revised)* (Brown and Caldwell, 2011c) in use at the start of remediation activities specified collection of replacement soil samples at a rate of one per 1,000 cubic yards of replacement soil used as backfill. That rate was subsequently increased to one sample per 500 cubic yards. Overall, a total of 34 composite samples were collected to characterize the replacement soil used to backfill the excavated areas within the action properties.

Similar to the confirmation composite samples described in the previous section, each composite replacement soil sample was made up from 10 discrete subsamples. The replacement soil composite samples were submitted to Apex Environmental Laboratory where they were analyzed for up to 18 metals using USEPA Methods 3050B and 6020A. Analyzed metals included antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, and zinc. The analytical results for these metals analyses are presented in Table 5-2 and copies of the laboratory analytical reports are provided in Appendix B.

Replacement soil composite sample results reported for detected metals were all less than or equal to their corresponding predetermined residential SRLs except for arsenic in two samples. Arsenic was detected at concentrations of 12 and 16 mg/kg in composite samples of replacement soil collected on June 5, 2012 (Table 5-2). Although results for these two composite samples exceed the 10 mg/kg predetermined residential SRL for arsenic, the 95% upper confidence limit (UCL) of the mean arsenic concentration is 8.4 mg/kg for the replacement soil, and the results were less than the approved SSRL for arsenic. The 95-percent UCL values shown in Table 5-2 were calculated using the latest version of the USEPA ProUCL software (version 4.1.00).

Consistent with the confirmation composite sample data, the replacement soil composite sample data generated during soil remediation activities underwent data verification and third-party data validation in accordance with provisions of *Amendment No. 4, Quality Assurance Project Plan, Northwest Study Area* (Brown and Caldwell 2012c). Results of data validation indicated that 100 percent of the composite sample results for replacement soil were suitable for their intended use.

5.3 Cover Rock Sampling Results

Crushed landscape rock used as cover material during property restoration activities at the 77 action properties was sampled regularly throughout the duration of remediation activities in accordance with provisions of the *Tailing Removal Project Sampling and Analysis Plan (Revision 2) (*Brown and Caldwell, 2012b). The *Tailing Removal Project Sampling and Analysis Plan (Revised)* (Brown and Caldwell, 2011c) in use at the start of remediation activities specified collection of cover rock samples at a rate of one per 1,000 cubic yards of crushed landscape rock used as cover material. However, that rate was subsequently increased to one sample per 500 cubic yards. Overall, a total of 17 composite samples were collected to characterize the crushed landscape rock used as cover material at the action properties.

Similar to the confirmation composite samples described for the replacement soil, each composite crushed landscape rock sample was made up from 10 discrete subsamples. The crushed landscape rock composite samples were submitted to Apex Environmental Laboratory where they were analyzed for up to 18 metals using USEPA Methods 3050B and 6020A. Analyzed metals included antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, thallium, and zinc. The analytical results for these metals analyses are presented in Table 5-3 and copies of the laboratory analytical reports are provided in Appendix B.

Crushed landscape rock composite sample results reported for detected metals were all less than or equal to their corresponding predetermined residential SRLs except for arsenic in two samples. Arsenic was detected at concentrations of 16 and 25 mg/kg in composite samples of crushed landscape rock collected on August 22 and November 13, 2012 (Table 5-3). Although results for these two samples exceed the 10 mg/kg predetermined residential SRL for arsenic, the 95% UCL of the mean arsenic concentration is 11 mg/kg for the landscape rock, and the results are less than the approved SSRL for arsenic.

Consistent with the composite confirmation and replacement soil sample data, the crushed landscape rock composite sample data generated during remediation activities underwent data verification and third-party data validation in accordance with provisions of *Amendment No. 4, Quality Assurance Project Plan, Northwest Study Area* (Brown and Caldwell 2012c). Results of data validation indicated that 100 percent of the composite sample results for crushed landscape rock were suitable for their intended use.

Section 6

Demonstration of Compliance with the Approved Soil Remediation Levels

This section presents the results of property-specific risk calculations for arsenic reflecting post-remediation conditions for the 77 action properties, and comparison of the calculated risks to the approved SSRL for arsenic. In addition, confirmation sample results for copper, lead, and manganese are compared to their predetermined SRLs. These comparisons are made to demonstrate compliance with the approved soil remediation levels for the NSA following remediation of the action properties.

Risk results for the 77 action properties were derived using the methodology and assumptions accepted by ADEQ and presented previously in the *Phase IV Human Health Risk Assessment* (Brown and Caldwell, 2009). The *Phase IV Human Health Risk Assessment* addressed the potential for exposure to metals in soil to cause adverse health effects in children and adults, and was the technical basis for the soil remediation levels approved by ADEQ (2009) for the NSA. Therefore, this section does not reiterate aspects of the risk assessment methodology that were documented previously and approved by the ADEQ. The reader is advised to refer to the *Phase IV Human Health Risk Assessment* (Brown and Caldwell, 2009) for that information.

Property-specific risk results addressed in this section include calculated CELCR and HQ values to estimate cancer and non-cancer risks associated with exposure to arsenic in soil. Section 6.1 discusses risk calculations for two post-remediation scenarios evaluated at each of the 77 action properties. The first scenario considers the results of confirmation samples collected from the base of excavated areas prior to backfilling with clean replacement soil, in conjunction with samples collected from the surface of any areas where excavation was not necessary. The second scenario considers the potential risk at the property following the use of clean replacement soil to backfill the excavated areas. Section 6.2 discusses the comparison with the approved soil remediation levels for arsenic, copper, lead, and manganese, and provides the technical basis to conclude that no further action is necessary for the 77 action properties.

6.1 Risk Calculation for Pre-Backfill and Post-Backfill Conditions

Property-specific risks were estimated for post-remediation conditions prior to backfill and post-remediation conditions following backfill using the methodology and assumptions described in the *Phase IV Human Health Risk Assessment* (Brown and Caldwell, 2009). The risk estimates were calculated to demonstrate compliance with the SSRL for arsenic. Comparison of post-remediation sample results to the predetermined residential SRLs for copper, lead, and manganese were also made as appropriate for each action property.

Risk estimates for exposure of children and adults to arsenic were calculated for each of the action and non-action properties addressed by this Completion Report using a probabilistic risk assessment software program known as Oracle Crystal Ball (Fusion Edition, Release 11.1.2.2.000 [32-bit]). Crystal Ball estimates risk through a series of 10,000 individual calculations, each of which randomly selects a value from within the data distribution for each calculation input (e.g., body weight, soil ingestion rate,

arsenic concentration, etc.). The model output is a range of 10,000 separate cancer and non-cancer risk estimates for arsenic. In accordance with A.A.C. R18-7-206(B)(2), the final arsenic risk estimate for each property is the value at the 95th percentile of all the risk estimates calculated. In other words, 95 percent of the calculated risk estimates will be less than the 95th percentile. Summaries of the model outputs for the 77 action and 6 non-action properties are provided in Appendix D.

The first risk scenario, representing post-remediation conditions prior to backfilling of the excavated areas with clean replacement soil, relied upon the laboratory analytical results for the confirmation composite samples collected immediately following completion of excavation within the action property CSAs. Laboratory analytical results for these confirmation composite samples, as well as the risk estimates for arsenic, are presented in Table 5-1 for all 77 action properties. The laboratory analytical reports and risk estimates for individual action properties are provided in a property-specific Remediation Summary Report (Brown and Caldwell, 2013a) prepared for each action property.

For those occasions where only a portion of a complete CSA required excavation, the associated composite sample included subsamples from the base of the excavated area and subsamples from the surface of the unexcavated area within the same CSA. Therefore, regardless of whether the entire CSA was excavated, or only a portion thereof, the associated composite sample represented the entirety of the exposed surface area of the CSA prior to backfilling of the excavated portions with clean replacement soil.

The second risk scenario represents post-remediation conditions following backfilling of the excavated areas with clean replacement soil. For any given CSA within an action property under this second scenario, the surface interval consists of clean replacement soil in areas where remediation was necessary and unexcavated soil in those areas where remediation was not required. Property residents are more likely to be exposed to soil in this surface interval, rather than to soil at depth (e.g., soil at the base of the excavated areas). Because of the extensive amount of sampling and analysis conducted on replacement soil to verify its appropriateness for use on residential properties (Section 6.2), this same information can be used to understand the actual, current conditions on the 77 action properties.

The second risk scenario relied upon the 95-percent UCL values of the laboratory analytical results for arsenic, copper, lead, and manganese (COPCs) in the composite replacement soil samples (Table 5-2). The area-weighted average concentrations for applicable COPCs within each CSA following backfill, and the corresponding risk estimates for arsenic representing post-remediation conditions following backfill, are presented in Table 6-1 for all 77 action properties. The COPC concentrations within each CSA and the corresponding arsenic risk estimates for individual action properties following backfill are also provided in the property-specific Remediation Summary Report (Brown and Caldwell, 2013a) prepared for each action property.

Figure 6-1 depicts pre-backfill and post-backfill conditions on a typical action property where remediation has been completed. Arsenic concentrations are used for this illustration, but copper, lead, and manganese concentrations (where relevant) are evaluated in the same manner. For the pre-backfill portion of the diagram, the depicted arsenic concentrations are simply the laboratory analytical results of the three confirmation composite samples collected throughout the entire area of the respective CSAs.

In the post-backfill diagram on Figure 6-1, the excavated areas depicted in the pre-backfill diagram are overlain by replacement soil having an arsenic concentration of 8.4 mg/kg, which represents the 95-percent UCL for arsenic (Table 5-2). For CSA-2, which was completely excavated and backfilled with replacement soil, the arsenic concentration of the surface interval for the entire CSA is readily seen to be 8.4 mg/kg. For CSA-1 and CSA-3, where only a portion of each CSA was excavated, it is necessary to perform area-weighted average calculations to derive arsenic concentrations that represent the entire CSA. The area-weighted average arsenic concentrations for these CSAs are based on the 95-percent UCL arsenic concentration for the replacement soil and the confirmation composite sample arsenic

concentration in each respective CSA for the unexcavated portion of the CSA. The measured dimensions of the backfilled and unexcavated areas within each CSA were used to calculate the area-weighted average concentration for that CSA. Examples of these calculations are presented in Figure 6-1 and copies of all such calculations for the action properties are provided in Appendix C.

As the risk results shown in Figure 6-1 for the pre- and post-backfill conditions indicate, use of clean replacement soil improved remediated conditions in the three CSAs of this typical action property from pre-backfill arsenic concentrations of 30 mg/kg, 16 mg/kg, and 28 mg/kg; to post-backfill arsenic concentrations of 14 mg/kg, 8.4 mg/kg, and 20 mg/kg. Both conditions meet the approved soil remediation levels, but the post-backfill conditions are more representative of actual, current conditions to which property residents may be exposed. Both pre-backfill and post-backfill conditions are used for the property-specific risk calculations documented in this report.

6.2 Comparison to Approved Soil Remediation Levels

This section presents a comparison of the post-remediation conditions at the 77 action properties with the approved soil remediation levels. COPC concentrations for both pre-backfill conditions (Table 5-1), and post-backfill conditions (Table 6-1) were used in this comparison. The approved soil remediation levels for the NSA are as follows:

- Arsenic – site-specific SRL stated as cumulative excess lifetime cancer risk (CECLR) of 2 x 10-5 and HQ of 1.0;
- Copper – predetermined residential SRL of 3,100 mg/kg
- Lead – predetermined residential SRL of 400 mg/kg
- Manganese – predetermined residential SRL of 3,300 mg/kg

For copper, lead, and manganese, analytical results of composite samples for individual CSAs were compared directly to their respective predetermined SRLs. If the concentrations of these metals are equal to or less than their predetermined SRLs, then no further action is necessary. In contrast, the approved arsenic soil remediation level was defined by ADEQ in terms a CELCR for cancer risks and HQ for non-cancer risks. As discussed in Section 6.1, composite sample results for arsenic on each property were used to calculate the CELCR and HQ using a probabilistic risk assessment methodology approved by ADEQ. If the calculated CELCR and HQ are equal to or less than 2×10^{-5} and 1.0, respectively, then no further action is necessary.

Based on pre-backfill conditions (Table 5-1), the CELCRs and HQs for arsenic on all properties where arsenic sampling was required are equal to or less than the approved SSRL, with the exception of Property 44. Copper, lead, and manganese concentrations on every action property that required evaluation of these metals were less than their predetermined residential SRLs (Table 5-1), with the exception of one CSA on Property 44 due to lead, and one CSA on Property 127 due to manganese. Properties 44 and 127 are further discussed below. For the other 75 action properties, it can be concluded that no further action is necessary in regard to arsenic, copper, lead, and manganese based on pre-backfill conditions.

When considering post-backfill conditions (Table 6-1), the CELCRs and HQs for arsenic on all action properties where arsenic sampling was required are equal to or less than the approved SSRL. Additionally, copper, lead, and manganese concentrations on every action property that required evaluation of these metals were less than their predetermined residential SRLs (Table 6-1). Therefore, no further action is required for any of the 77 action properties, based on post-backfill conditions. As discussed in Section 6.1, post-backfill conditions are a better representation of the conditions at each action property because they include consideration of the clean replacement soil that was used to backfill excavated areas.

Further evaluation of pre-backfill conditions on Property No. 44 reveals that the sole cause for not meeting the approved soil remediation levels for arsenic and lead are the confirmation composite sample results for sampling within CSA-2 (Table 5-1). Most of this CSA was excavated to refusal, leaving insufficient soil to collect 9 of 10 subsamples that make up a composite sample. Sufficient soil was available to collect a subsample at only 1 of the normal 10 subsample locations. This situation indicates low potential for risk to human health, as there is little soil to which a receptor may become exposed. Further, this subsample was collected from a depth of 3.5 feet bgs, which is the maximum excavation depth prescribed by the *Tailings Removal Project Work Plan (Revision 3)* (Brown and Caldwell, 2012a). Therefore, this single subsample is not representative of the CSA as a whole, and the sampled soil is 3.5 feet below the ground surface, beneath clean replacement soil used to backfill the property. As noted in Section 5.1 of this Completion Report, the elevated arsenic result for the single subsample reflects the presence ash and metal debris of a historic "burn-pit" rather than soil and is not related to tailings impacts. As stated above, when considering post-backfill conditions, Property No. 44 meets all approved soil remediation levels.

Manganese exceeded its residential SRL under pre-backfill conditions in one CSA at Property No. 127. To further evaluate this situation, manganese concentrations representing pre-backfill conditions (Table 5-1) were used as input for the Oracle Crystal Ball software program to calculate an HQ of 0.5 for manganese at Property 127. An HQ is the ratio of the calculated dose to the reference dose; the model output for this calculation is provided in Appendix D. Since manganese is not a carcinogen and an HQ of 1 would indicate that no adverse health effects are expected as a result of exposure, an HQ of 0.5 indicates that the calculated dose is less than the reference dose at which no adverse health effects are expected. Therefore, it can be concluded that no further action is necessary at Property 127 based on pre-backfill conditions. Further, as stated above, when considering post-backfill conditions, Property 127 meets all approved soil remediation levels.

Section 7

Community Involvement

BHP Copper's community involvement activities have been consistent with the scope and schedule of activities planned and conducted in the NSA. The community involvement activities were built on practices and lines of communication that were initiated prior to 1996 when BHP Copper acquired the West Plant Site. Initially, BHP Copper's community involvement activities were primarily related to property improvements at the West Plant Site. However, the activities broadened in 2003 to include NSA activities after BHP Copper entered the ADEQ's VRP and the NSA was established. As described in the following summary, community involvement has included multiple opportunities for detailed exchanges with residents and property owners within the NSA, with residents outside the NSA, and numerous community leaders.

7.1 Community Liaison

BHP Copper has maintained a community liaison in the Town of Superior for most of the time since the NSA Project was initiated in 2003 through completion of active property remediation activities in November 2012. The public trailer at the Project Office location on Main Street was regularly staffed during active property remediation. The community liaison was supported by an agent and resident from the Town of Superior. Both individuals were bilingual and participated in open houses and door-to-door meetings with residents and property owners of the NSA. These representatives remain available to meet with stakeholders and answer their questions in a timely manner.

7.2 Project Team Interaction with Community Members

In addition to efforts by the community representatives, the BHP Copper Project Field Superintendent and Project Manager were among other NSA Project personnel who were available throughout active property remediation activities to meet members of the community on an appointment and drop-by basis to discuss the project. Many individuals from within and outside the NSA availed themselves of this opportunity to obtain information and resolve concerns regarding the project.

In addition, to promote overall project safety and awareness, BHP Copper distributed NSA Project-customized coloring books to parents and children within the NSA. The coloring books provided information about how to stay safe when heavy equipment is being used in the neighborhood.

7.3 Fact Sheets and Project Updates

Fact sheets were produced and distributed to inform the community of significant events during the course of the NSA Project. A fact sheet was distributed before sampling began in 2004. It included a map showing the NSA and provided a brief history of the NSA Project, including BHP Copper's entry into the VRP and the 2004 Work Plan that was developed for ADEQ's approval. It also presented information about arsenic and it discussed BHP Copper's plans for conducting a risk assessment. Another fact sheet was published in the summer of 2007 to inform the community of BHP Copper's plans to conduct the Phase IV sampling program and the related property-specific risk assessments. A third fact sheet was published in the summer of 2008 to inform the community of the proposed *Tailings Removal Project Work Plan*. A fourth fact sheet was published in the summer of 2011 to provide a project update including information on the *Tailings Removal Project Work Plan*. All of the fact sheets were produced in English and Spanish. The fact sheets included information about pending open houses and provided

contact information for BHP Copper and ADEQ representatives. The fact sheets were distributed through multiple channels, including but not limited to, door hangers, direct mail, and e-mail.

Project update summaries were prepared on a regular basis throughout active property remediation activities regarding status and progress of the NSA Project. The summaries also provided contact information for residents and owners of action properties who had not yet agreed to participate in the project. These bilingual summaries were mailed to all NSA residents and property owners.

7.4 News Releases

News releases were published in the Superior Sun to announce open houses, which were timed to acquaint the community with pending events and to provide opportunity for public comment. In addition, a news release was published in the Superior Sun on July 20, 2005 to update the community on the status of the NSA Project. The release briefly described the scope of the 2004 sampling program and the results of the risk assessment that had been submitted to the ADEQ in August 2004. The release also informed the public that the ADEQ was continuing to review the *Risk Assessment Report* and the additional information that BHP Copper had submitted at the ADEQ's request.

7.5 Community Leader Briefings

BHP Copper and its consultants met periodically with community leaders to discuss the status of the project and to give them notice of significant events such as direct outreach and open houses as discussed below. Most of the meetings were conducted one-on-one or in small groups and have included:

- Past and present Mayors;
- Past and present Town Council members;
- Past and present Town Managers;
- Past and present Superior Chamber of Commerce Presidents;
- Past and present members of the Pinal County Board of Supervisors;
- The Superintendent of Schools; and
- The Superior Senior High School Principal.

During active property remediation activities, BHP Copper met on several occasions with the Town of Superior Mayor and the Town Manager to update them on project activities and to discuss any concerns or issues that were raised by the Town. A tour of the NSA was provided to the Mayor and Vice Mayor to describe the NSA Project and the safety controls that were being implemented.

7.6 Direct Outreach

BHP Copper's field teams went door-to-door to meet directly with property owners and tenants on four occasions during the course of the NSA Project. In 2004 and 2007, the teams went door to door to advise the property owners and tenants of BHP Copper's plans to conduct soil sampling and to ask the tenants and/or property owners to sign access agreements authorizing BHP Copper to collect samples from its properties. On both occasions, open houses were held to give the residents additional opportunities to learn about BHP Copper's plans and to comment on those plans. In 2008, the teams went door-to-door to advise the tenants and property owners of a pending open house, discuss the 2007/2008 sample results, and tell them whether BHP Copper was or was not recommending remediation of its property. As active property remediation efforts were being initiated in 2011, and through completion of these efforts in late 2012, the teams went door to door to advise tenants and property owners of remediation that was recommended for its properties.

For both the 2007/2008 and 2011/2012 efforts, where excavation was recommended, team members explained the process for developing excavation plans and the need for signed excavation agreements. The team members left agreement forms with the tenants and property owners if the tenants and property owners did not sign agreements at that time. Agreement forms and other related documents were delivered by mail to out-of-town and out-of-state property owners when meetings could not be arranged.

The direct outreach teams included representatives from BHP Copper, B.J. Communications, and Brown and Caldwell. Teams were active within the NSA at a variety of times and usually over the course of several days (weekdays and weekends) to meet with property owners and tenants at their homes. The meetings provided an opportunity for the team members to respond to general questions about the project and to specific concerns of the property owners and tenants. Subsequent meetings were arranged in instances where the team members needed to gather additional information to provide adequate responses.

7.7 Open Houses

Four open house events were conducted in the Town of Superior. The first open house was conducted on January 20, 2004, before the first sampling program began in February 2004. The second open house was conducted on May 9, 2007 before the Phase IV sampling began in June 2007. The third open house was held on August 28, 2008 to announce BHP Copper's proposed *Tailings Removal Project Work Plan* (Brown and Caldwell, 2008). The fourth open house was conducted on May 31, 2011 to provide updated information regarding BHP Copper's *Tailings Removal Project Work Plan*, the approved remediation levels, and the voluntary biomonitoring program. Results of the voluntary biomonitoring program will be submitted confidentially to the ADEQ.

Each open house was promoted through a display advertisement and calendar announcement in the local paper. A flyer also was provided electronically to community leaders for distribution at their discretion, and field teams talked with property owners and tenants about the open houses during direct outreach efforts. The open houses usually included ADEQ representatives and featured a series of information stations where attendees could seek answers related to BHP Copper's plans, study results, health concerns, and oversight by the ADEQ. In addition, forms were provided so that the attendees could submit written comments.

Section 8

Conclusions

BHP Copper conducted soil remediation activities on 77 action properties within the NSA located in Superior, Arizona to address tailings-impacted soils and to successfully reduce the concentrations of metals of concern on each of those properties. The effectiveness of the remediation was positively confirmed by comparing the results of comprehensive soil sampling conducted on each of the properties to soil remediation levels that were approved by the ADEQ. These activities are detailed in this report and the accompanying Remediation Summary Reports (Brown and Caldwell, 2013a) prepared for each of the 77 action properties.

BHP Copper also completed soil sampling on 6 properties not previously available for evaluation to assess the potential presence of tailings-impacted soils. As detailed in this report and the accompanying Data Summary Reports (Brown and Caldwell, 2013b), these 6 properties meet the ADEQ's approved soil remediation levels without requiring remediation.

The work was conducted by BHP Copper with a priority focus on the safety of NSA residents and project workers, and was performed in close coordination with the ADEQ, in accordance with work plans and procedures that were reviewed and approved by the agency. In conjunction with the ADEQ, planning for the work included review of potential contaminant sources and a thorough assessment of all COPCs, which was then followed by an extensive and systematic screening process to identify metals of concern specific to each NSA property. BHP Copper Inc. implemented a multi-phased and tiered sampling program that focused on arsenic, copper, and lead (i.e., Tier 1) but included 16 additional metals and cyanide (i.e., Tiers 2 and 3), based on frequency of detection and the likelihood of exceeding predetermined residential SRLs.

Based on this systematic chemical screening procedure, only arsenic, copper, lead, and manganese were identified as COPCs within the NSA. Property-specific COPCs for the *Phase IV Human Health Risk Assessment* (Brown and Caldwell, 2009) and for the soil remediation activities addressed in this Completion Report were identified based on soil testing conducted by BHP Copper in 2004.

A comprehensive series of pre- and post-remediation composite soil sampling was conducted throughout all accessible areas within the 77 action properties, to ensure that the data would be representative of all exposed soil on each property. Equally comprehensive sampling was done for each of the 6 non-action properties. Sampling always included, but was by no means limited to, those portions of each property where residents were most likely to be exposed.

Using the data derived from the activities described above, property-specific risk calculations were performed for arsenic and comparisons of COPC concentrations and risk values were made to the approved soil remediation levels. Those evaluations demonstrated that current conditions on the 77 action properties and 6 non-action properties addressed by this report meet the approved soil remediation levels and pose no adverse effect to NSA residents. The risk calculations were conducted using the procedures and assumptions previously developed in conjunction with ADEQ for the Phase IV Human Health Risk Assessment (Brown and Caldwell, 2009). These assumptions included all potentially complete exposure pathways and are based on representative exposure concentrations, conservative exposure assumptions, and conservative toxicity factors, thus minimizing uncertainty and establishing a high level of confidence in the results. Based on the information presented in this report and the various property-specific reports cited above, compliance with the approved soil remediation levels is demonstrated for all 83 properties, and no further action is necessary.

Section 9

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