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FIRST FIVE-YEAR REVIEW REPORT

Vasquez Blvd. /Interstate 70 Superfund Site
City and County of Denver, Colorado

Prepared By:

United States Environmental Protection Agency
Region 8
Denver, Colorado

Approved: Carol L. Campbell Date: 9/30/09

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LIST OF ACRONYMS

ASARCO	American Smelting and Refining Company Incorporated
ARAR	Applicable or Relevant and Appropriate Requirement
ATSDR	Agency for Toxic Substances and Disease Registry
CDC	Centers for Disease Control and Prevention
CDPHE	Colorado Department of Public Health and Environment
CEASE	Clayton, Elyria, and Swansea Environmental Coalition
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
COCs	Contaminant of Concern
EPA	Environmental Protection Agency
FS	Feasibility Study
FYR	Five-Year Review
IEUBK	Integrated Exposure, Uptake, and Biokinetic Model
IRIS	Integrated Risk Information System
NCP	National Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PPM	Parts per Million
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RA	Remedial Action
RI	Remedial Investigation
RPM	Remediation Project Manager
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
USEPA	United States Environmental Protection Agency
VB/I-70	Vasquez Boulevard and 1-70

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EXECUTIVE SUMMARY

EPA Region 8 has conducted the first five-year review of the remedial actions implemented at the Vasquez Boulevard/Interstate 70 Superfund Site, located in the City and County of Denver, Colorado. The review was conducted from July through mid-September, 2009. The five-year review is a statutory review that covers the period from March 31, 2004 to March 31, 2009. The start of the five-year review period corresponds to the start of the remedial action.

The VB/I-70 Site includes approximately 4.5 square miles in the north-central section of the City and County of Denver, Colorado (Figure 1). For the purposes of the remedial investigation and remedy development, EPA segregated the Site into three operable units. Operable Unit 1 (OU1) is defined as residential yards within the VB/I-70 Site with levels of lead or arsenic in soil that present an unacceptable risk to human health. Operable Unit 2 (OU2) consists of the area where the former Omaha & Grant Smelter operated and includes all environmental media impacted by releases of hazardous substances from the smelter. Operable Unit 3 (OU3) is the area where the former Argo Smelter operated, and includes all environmental media impacted by releases of hazardous substances from that smelter. Separate investigations have been or are being conducted, and separate remedies have been or will be implemented for each operable unit.

The Selected remedy in the Record of Decision (ROD) for Operable Unit 1 consisted of three components: 1) a community health program; 2) soil removal; and 3) soil sampling. The ROD also established the soil action level for lead at 400 ppm and the action level for arsenic at 70 ppm. Soil removals were conducted where the average concentrations from three composite soil samples taken at a property exceeded these levels. The pre-remedial actions and the remedial action activities resulted in the sampling of approximately 4,300 properties and soil removal from approximately 800 properties. The remedial action was completed in 2008 and the final Remedial Action Report for Operable Unit 1 was approved on September 25, 2008. The Remedial Action Report identified the need for institutional controls for properties where the remedial action could not be completed.

The remedy at OU1 is not protective for properties not cleaned up or sampled during remedial action because institutional controls for these properties have not been implemented. As a result, there is no notification process in place for current property owners who may plan intrusive activities on these properties, or for properties that have changed ownership since remedial action was completed, or may change ownership in the future. The following actions need to be taken to ensure protectiveness:

- Successful implementation of institutional controls identified in the Remedial Action Report (EPA 2008) for those properties where remedial action could not be completed due to access issues with the property owners. These institutional controls should include a notification process for current property owners, including notifications tied to building permit applications. The institutional controls should also include a notification process for properties that have changed ownership since completion of the remedial action and for future property transfers.

- A change to the ROD to incorporate institutional control requirements.

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Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Vasquez Blvd. /I70 Superfund Site		
EPA ID: CO0002259588		
Region: VIII	**State:** CO	**City/County:** Denver/Denver

SITE STATUS		
NPL Status: ☒ **Final** ☐ **Deleted** ☐ **Other (specify)**		
Remediation Status: ☐ **Under Construction** ☐ **Operating** ☒ **Complete** (OU1 only)		
Multiple OUs? ☒ **Yes** ☐ **No**	**Construction Completion Date:**	
Has site been put into reuse? ☒ **Yes** ☐ **No**		

REVIEW STATUS	
Reviewing Agency: ☒ **EPA** ☐ **State** ☐ **Tribe** ☐ **Other Federal Agency:**	
Author Name: Sam Garcia	
Author Title: RPM	**Author Affiliation:** EPA
Review Period: July 6, 2009 to August 24, 2009	
Date(s) of Site Inspection: Not Performed	
Type of review: ☒ **Statutory** ☐ **Policy (Post-SARA)**	
Review Number: ☒ **First** ☐ **Second** ☐ **Third** ☐ **Other (specify)** _____	
Triggering Action: ☐ **Actual RA Onsite Construction at OU** ☐ **Construction Completion** ☐ **Other (specify):**	☒ **Actual RA Start at OU** ☐ **Previous Five-Year Review Report**
Triggering Action Date: March 31, 2004	
Due Date: March 31, 2009	

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1.0 INTRODUCTION

The U. S. Environmental Protection Agency (EPA) has conducted a Five-Year Review (FYR) for the Vasquez Boulevard and Interstate 70 (VB/I-70) Superfund Site (Site), which is located in the City and County of Denver, Colorado. The purpose of a five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports. In addition, five-year review reports identify issues found during the review, if any, and identify recommendations to address them.

The EPA has prepared this five-year review report pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

"If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews."

The EPA interpreted this requirement further in the NCP. 40 CFR §300.430(f)(4)(ii) states:

"If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action."

EPA is the lead agency for this action and is conducting the FYR. The Colorado Department of Public Health and Environment (CDPHE) is the support agency. This review was conducted from July 6, 2009 through August 24, 2009. This is the first FYR for the Vasquez Blvd./I-70 Site. The triggering action for this statutory review is the initiation of the remedial action on March 31, 2004. The FYR is required due to the fact that hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

2.0 CHRONOLOGY OF EVENTS – OPERABLE UNIT 1

The following table provides a chronology of events for OU1.

Table 1. Chronology of Events –OU 1

Date	Event
July 1993	State of Colorado and ASARCO Incorporated entered into a consent decree for the Globe Superfund Site. As part of that settlement agreement, ASARCO agreed to remediate soils in residential properties surrounding the Globe Plant where levels of cadmium, lead, and/or arsenic exceeded acceptable limits established by the State
1997	CDPHE begins a limited soil sampling program in the Elyria and Swansea neighborhoods in the future VB/I-70 Superfund Site

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Date	Event
1998	CDPHE requests EPA participation in the VB/I-70 project. EPA mobilizes an Emergency Response team to conduct an extensive soil sampling effort and time-critical removal actions for the houses where soil poses immediate health risks to local residents
March – August 1998	EPA conducts Phase I and Phase II soil sampling on residential properties
September 1998	EPA issues an Action Memorandum for a time-critical removal action
July 22, 1999	EPA places the VB/I-70 Site on the National Priorities List (NPL)
August 1999 – November 2000	EPA conducts residential soils Remedial Investigation and Phase III soil sampling
2001	Remedial Investigation and Feasibility Study Reports finalized
March 6, 2003	EPA issues an Action Memorandum for non-time-critical removal action
March 14, 2003	Remedial Design for soil removal completed
March 27, 2003	Community health program remedial design completed
May 2003	EPA releases Proposed Plan outlining its preferred cleanup option
July 2003- March 2004	EPA conducts non-time-critical soil removal actions
Sept. 25, 2003	Record of Decision signed
January 21, 2004	Consent Decree finalized between ASARCO, CDPHE and EPA
March 31, 2004	Remedial Action started
July 2004	Community health program development started
Dec. 2004	Community health program development completed
Jan. 2005	Training of community health workers completed
Feb. 2005 – Feb 2007	First home visit, community health program completed
June 2005 – Sept. 2006	Conducted biomonitoring clinics
2006	ASARCO completes removal of soil from 100 properties per Consent Decree
2008	Remedial Action completed
Sept. 25, 2008	Final Remedial Action Report approved

3.0 BACKGROUND

3.1 Location and Operable Units

The VB/I-70 Site is located in the north-central section of the City and County of Denver, Colorado (Figure 1). For the purposes of the remedial investigation and remedy development, EPA segregated the Site into three operable units. Separate investigations have been or are being conducted, and separate remedies have been or will be implemented for each operable unit. The operable units are:

Operable Unit 1 (OU1): OU1 is defined as residential yards within the VB/I-70 Site with levels of lead or arsenic in soil that present an unacceptable risk to human health. OU1 constituted EPA's highest priority at the VB/I-70 Site because it had the highest potential for human exposure to contaminants of concern located in the residential yards. EPA is the lead agency for remedial response activities at OU1. EPA and CDPHE signed the ROD for OU1 in 2003. Remedial action was initiated on March 31, 2004.

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Operable Unit 2 (OU2): OU2 consists of the area where the former Omaha & Grant Smelter operated and includes all environmental media impacted by releases of hazardous substances from the smelter. The Omaha & Grant Smelter was located on the property now home to the Denver Coliseum and other businesses. The City and County of Denver have begun a remedial investigation for the OU to assess potential heavy metals contamination in the soils, groundwater, surface water and sediments at, and adjacent to, the Site. However, contamination is likely limited to surface and subsurface soil. A proposed plan and ROD are scheduled to be completed in 2010. Because remedial action has not started, this OU will not be evaluated as part of the FYR.

Operable Unit 3 (OU3): OU3 is the area where the former Argo Smelter operated and includes all environmental media impacted by releases of hazardous substances (primarily heavy metals) from that smelter. The majority of the OU3 area is paved and has been extensively redeveloped since the smelter stopped operating. EPA has initiated the remedial investigation and feasibility study for OU3, to evaluate if smelter generated wastes were buried on the Site and whether they pose a health risk to future construction workers or groundwater. EPA issued a proposed plan in November, 2007. However, current groundwater data is in the process of re-evaluation and additional sampling may occur. As a result, a proposed plan may be re-issued, and a ROD is scheduled for completion in 2012. Because remedial action has not started, this OU will not be evaluated as part of the FYR.

Each operable unit has a unique physical location and historic operation. Thus, actions taken at one operable unit have been taken independently of actions at other portions of the Site. The current status of remedial investigation activities at OU2 and OU3 would have had no adverse effect on remedial activities conducted at OU1. OU1 is the only operable unit at the VB/I-70 Site where remedial action has been initiated, and is therefore the focus of this five-year review.

Though not included in the VB/I-70 Site, the ASARCO Globe Site (Globe Site) is located immediately to the west, across the South Platte River, and is contiguous with the VB/I-70 Site. The Globe Site consists of 78 acres containing residential and commercial properties and 53 current and former manufacturing facilities. The ASARCO Globe Plant has been the site of various base and precious metal refining operations since 1886. The plant primarily operated as a lead smelter from 1901 until 1919. It produced arsenic trioxide from 1919 until 1926, and cadmium production commenced in 1926 and continued until 1993. The Globe Plant has ceased operations but the environmental cleanup activities continue with CDPHE as the lead agency. Though the plant was operating at the time of the remedial actions at OU1, adverse impacts on OU1 remedial activities would be unlikely because cadmium was the primary product produced, and cadmium was not identified to be above risk-based cleanup levels for soils in OU1.

3.2 Land and Resource

The VB/I-70 Site includes approximately 4.5 square miles in the north-central section of the City and County of Denver, Colorado (Figure 1). OU1 encompasses approximately four largely residential neighborhoods in north-central Denver: Swansea, Elyria, Clayton, and Cole. OU1 also includes the southwest portion of the Globeville neighborhood and the northern portion of the Curtis Park Neighborhood. These neighborhoods are located to the east of the former Argo Smelter (OU3) and the former Omaha and Grant Smelter (OU2), as well as the recently closed ASARCO Globe Smelter. There are approximately 4,000 residential properties, most of which are single-family homes. However, multifamily and commercial/industrial properties also exist in the OU. According to the 2000 census, approximately 17,545 people live within OU1, including approximately 2,400 children 6 years old or younger.

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3.3 History

The VB/I-70 Site came to the attention of EPA following studies directed by CDPHE at the adjacent Globe Site in 1997. On July 15, 1993, the State of Colorado and ASARCO Incorporated entered into a Consent Decree to resolve a suit filed by the State of Colorado for damages to natural resources under CERCLA. As part of that settlement agreement, ASARCO agreed to remediate soils in residential properties surrounding the Globe Site where levels of cadmium, lead, and/or arsenic exceeded cleanup limits established by the State in the Record of Decision for the Globe Site.

The 1993 Consent Decree required ASARCO to collect soil samples from residential yards in the Globeville neighborhood and to expand the remediation area until it established the extent of contamination from the Globe Site. In conducting the investigation, ASARCO continued to find random occurrences of arsenic at elevated levels in residential yards at increasingly greater distances from the Globe Site.

3.4 Initial Response and Basis for Taking Action

3.4.1. Time-Critical Removal Action

In 1997, CDPHE began a limited soil sampling program in the Elyria and Swansea neighborhoods, located just east of Globeville, across the South Platte River. These results indicated that high concentrations of arsenic in soil extended far beyond the Globeville neighborhood. Accordingly, CDPHE requested EPA's assistance in immediately responding to the elevated levels of arsenic and lead in soil found in the Elyria and Swansea neighborhoods. In 1998, EPA's first action at the Site was to mobilize an Emergency Response team to conduct an extensive soil sampling effort and time-critical removal actions for the houses where soil concentrations posed immediate health risks to local residents.

The Emergency Response consisted of three phases. Phase I included an extensive screening level soil sampling effort. The objective was to collect soil samples from as many residential properties as possible to identify properties that were potential time-critical soil removal and replacement candidates. Phase I sampling occurred during March and April 1998. EPA also collected soil samples from all schools and parks located within the initial study area. Samples were analyzed for arsenic, lead, cadmium and zinc. From the Phase I data, EPA identified 37 properties as potentially requiring time-critical removal action.

The Phase II sampling occurred in July and August 1998. Additional soil samples were collected from any residential properties that had a maximum surface soil concentration equal to or greater than 450 parts per million (ppm) for arsenic or 2000 ppm for lead; i.e., the removal action candidates. Those properties with one or more composite samples exceeding the removal action levels for either arsenic or lead were identified for soil removal. In all, EPA sampled 1,393 properties as part of the Phase I and II programs. As a result of the Phase II sampling, EPA identified 21 additional properties potentially requiring time-critical removal action.

In September 1998, EPA issued an Action Memorandum that established the basis for conducting a time-critical removal action. The Action Memorandum required that soil be removed and replaced at any property with an average arsenic soil concentration greater than 450 ppm and/or lead soil concentration greater than 2000 ppm. These removal "action levels" were chosen to protect young children from adverse health effects related to short-term (sub-chronic) exposure. EPA conducted soil removals at 18 properties in October and November of 1998.

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Based on the results of the Phase I and Phase II sampling programs, EPA determined that numerous residential properties within the VB/I-70 Site contained concentrations of arsenic or lead at levels that could present unacceptable health risks to residents with long-term exposures. Anticipating the need for long-term response, EPA placed the VB/I-70 Site on the National Priorities List (NPL) on July 22, 1999.

EPA conducted Phase III remedial investigation activities from August 1999 through November 2000. This sampling program supported the physio-chemical characterization of soils, the baseline human health risk assessment, and soil sampling of additional properties. During Phase III, 3,007 properties were sampled, including the re-sampling of properties sampled during Phases I and II. As part of the Phase III remedial investigation, sampling was conducted at discreet soil depths to evaluate where the highest soil concentrations occurred. The evaluation determined that soil concentrations were highest in the uppermost 2 inches of the soil profile, and supported soil removal down to a 1-foot depth limit. Based on the phase III data, 30 additional properties were identified for soil removal. A total of 48 residential properties were remediated by EPA using time-critical removal authority.

3.4.2. Non-Time-Critical Removal Action

On March 6, 2003, EPA issued an Action Memorandum that established the basis for conducting a non-time-critical removal action. The Action Memorandum required the removal and replacement of soil at any property that had an arsenic soil level greater than 240 ppm and/or lead soil levels greater than 540 ppm. These "action levels" were determined from the baseline risk assessment to address the properties that presented the highest risk of adverse health effects to children and adult residents. From the Phase III sampling results, EPA identified 143 properties as requiring a soil cleanup, and in 2003, EPA conducted cleanups at 133 of these properties. The properties not addressed by this non-time-critical removal action were included in the list of properties to be addressed by the remedial action under the OU1 ROD.

4.0 REMEDIAL ACTION

4.1 Remedy Selection

An EPA contractor prepared the plan for the Community Health Program. EPA issued the Community Health Program design in March 2003. This plan provided the general planning documents and standardized procedures needed to implement the Community Health Program. The City and County of Denver was given the responsibility for implementing the Community Health Program.

The remedial design, issued in March 2003, addressed the residential soil sampling and the implementation of the residential soil removal action. The design provided standards and practices to be followed during the implementation of the remedial action. In addition, a detailed design was prepared for each residential property in cooperation with the homeowner based on the procedures set forth in the soil sampling and soil removal design.

The ROD for OU1 of the VB/I-70 Site was finalized on September 25, 2003 (EPA 2003). The overall remedial action objective (RAO) identified in the ROD is to protect human health. The Selected Remedy in the ROD for OU1 consisted of three components: a community health program, soil sampling, and soil removal.

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4.1.1. Soil Remedy

The following OU1-specific RAOs were developed for arsenic and lead in soil (EPA 2003):

RAOs for Arsenic in Soil:

- For residents of the VB/I-70 Site, prevent exposure to soil containing arsenic at levels predicted to result in an excess lifetime cancer risk associated with ingestion of soil which exceeds 1 x 10^{4}, using reasonable maximum exposure assumptions.
- For residents of the VB/I-70 Site, prevent exposure to soil containing arsenic in levels predicted to result in a chronic or sub-chronic hazard quotient associated with ingestion of soil which exceeds 1, using reasonable maximum exposure assumptions.
- For children with soil pica behavior (see definition on p. 9) who reside in the VB/I-70 Site, reduce the potential for exposures to arsenic in soil that result in acute effects.

RAOs for Lead in Soil:

- Limit exposure to lead in soil such that no more than 5 percent of young children (72 months or younger) who live within the VB/I-70 Site are at risk for having blood lead levels higher than 10 micrograms per deciliter (ug/dL) from such exposure. This provides 95% confidence that children exposed to lead in soil will be protected.

The ROD also adjusted the action levels identified for conducting the non-time critical removal actions from 540 ppm to 400 ppm for lead, and from 240 ppm to 70 ppm for arsenic. This change was based on results of public comment on the initial Proposed Plan, which suggested that the cleanup levels for OU1 should be the same as those adopted for the Globe Site. However, the adjusted ROD action levels were within the range of preliminary remediation goals identified in the Feasibility Study (MFG 2001) based on results of the Baseline Risk Assessment (EPA 2001). Soil removals would be conducted where the average concentrations from three composite soil samples taken at a property exceeded these levels.

The ROD noted that the removed soil could be placed at the ASARCO Globe Plant and used for cover and grading, because, as the ROD also stated, "*For purposes of this remedial action, and consistent with Section 300.400(e)(1) of the NCP, EPA has determined that the ASARCO Globe Plant is a suitable area in very close proximity to the contamination, which is necessary for implementation of the response action.*" (EPA 2003). However, at the time that the ROD was signed, the decision to dispose of contaminated soil removed from OU1 at the Globe Site had not been finalized.

In 2004, EPA, CDPHE, and ASARCO entered into a Consent Decree (USDC 2004) that resolved ASARCO's liability at OU 1 of the VB/I-70 Superfund Site. The Consent Decree required ASARCO to conduct residential soil cleanups at 100 properties, provide a repository within the Globe Site for all residential soils removed during the remedial action, and conduct all operations and maintenance required at the repository as part of the Globe Site.

4.1.2. Community Health Program

The Community Health Program was composed of two separate, yet partially overlapping, elements. The first element addressed risks to area children from non-soil sources of lead and from lead in soils above the action level of 400 ppm. The second element addressed children with soil pica behavior to reduce their risks to arsenic in soil above 47 ppm, the preliminary

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action level determined in the baseline risk assessment for children with soil pica behavior. Participation in one or both elements of the program was strictly voluntary, and there was no charge to eligible residents and property owners for any of the services offered by the Community Health Program. The Community Health Program was implemented on an ongoing basis until the residential soil removal portion of this remedial action was completed. Each of these two main elements of the program is described below:

Lead Exposure Risk Reduction

The program for reduction of lead risks was intended to be general. That is, it was intended to assess risks from lead from any and all potential sources of exposure, with response actions tailored to address the various exposure sources identified. The lead program consisted of three main elements:

- Community and individual education about potential pathways of exposure to lead, and the potential health consequences of excessive lead exposure,

- A biomonitoring program by which any child (up to 72 months old) could be tested to evaluate actual exposure, and

- A program that provides a response to any observed lead exposure that is outside the normal range. This response included any necessary follow-up sampling, analysis, and investigation at a child's home to help identify the likely source of exposure. If the source of lead was found to be from residential soils, the property received a high priority for soil removal. If the main source was judged to be non-soil related, responses would have included education, counseling, and/or referral to environmental response programs offered by other agencies.

Arsenic Exposure Reduction, Soil Pica Behavior

The Community Health Program for arsenic was designed to focus specifically on the potential risks to young children that exhibit soil pica behavior. Pica behavior is a rare behavior whereby children intentionally eat unusually large amounts of soil. The program for arsenic consisted of three main elements:

- Community and individual education about identification and potential hazards of soil pica behavior and the potential health consequences of excessive acute oral exposure to arsenic,

- A biomonitoring program by which any child could be tested to evaluate actual soil pica exposure to arsenic, and

- A program that provided a response to any observed inorganic arsenic exposures that are outside the normal range. This response included any necessary follow-up sampling, analysis, and investigation at a child's home to help identify the likely source of exposure, and to implement an appropriate response that would help reduce the exposure. If the source of arsenic was found to be from residential soils, the property received a high priority for soil removal. If the main source was judged to be non-soil related, responses would include education, counseling, and/or referral to environmental response programs offered by other agencies.

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4.2 Remedy Implementation

4.2.1. Sampling Program

Prior to the ROD, EPA had sampled approximately 75% of the residential properties within the VB/I-70 Site boundary for lead and arsenic. Because the spatial pattern of lead and arsenic contamination varied throughout the Site, it was not possible to assess if a specific property required a soil removal without data from that property. Therefore, EPA implemented a program of on-going soil sampling at residential properties within the Site boundaries that were not previously tested or where testing was not adequate. The sampling program continued through the completion of the soil removal portion of the remedy.

The soil sampling program began with the identification of properties that required sampling. Once EPA obtained access from the property owner, EPA collected soil samples from the property and analyzed for lead and arsenic. The results were evaluated to determine if the property needed soil removal. The soil results were also provided to the property owner. If a soil removal was needed, the property was listed for soil removal.

4.2.2. Residential Soil Removal

EPA removed all accessible soils to a depth of 12 inches at properties where soil removal was needed. The depth determination for soil removal was determined during the RI/FS. The results of these studies found that lead and arsenic concentrations in soil reduced with depth, and at six inches depth, lead and arsenic concentrations in soil were below levels of health concern. The study results verified that the primary mechanism for the distribution of contamination at the site was primarily from aerial dispersion from smoke stake emissions. Based on these studies, it was determined that the removal of 12 inches of soils from residential properties would result in removal of site contaminants. Once soil excavation was completed, the excavation areas were backfilled with clean soil, and pre-remediation yard features restored. Based on remedial investigation data, EPA estimated that soil removal would occur at a total of 853 residential properties within OU1 (508 properties for arsenic only, 108 properties for both lead and arsenic, and 237 for lead only). Actual properties remediated totaled 800.

Time-critical removal action began in 1998, and non-time-critical removal action began in 2003. Remedial action began in 2004 and was concluded in 2008. The following table is a summary of the number of properties remediated each year.

Year	Number of Properties Remediated
1998 (time-critical)	18
2000 (time-critical)	30
2003 (non-time-critical)	133
2004	326
2005	134
2005 - ASARCO	62
2006	56
2006 - ASARCO	38
2008	3
Total	800

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During the remedial action, all contaminated soils were transported to the Globe Site for disposal. This soil was placed with soils removed during the Globe Site residential cleanup. ASARCO agreed to conduct all maintenance of the residential soils repository as part of the Globe Site actions (EPA 2008).

After placement of clean soil in the remediated residential yards, the property was landscaped in accordance with the homeowner-agreed-upon restoration plan. If sod was included in the restoration plan, then the property was watered for a 30-day period to establish the new sod.

4.2.3. Community Health Program

The community health program was developed in consultation with the Working Group, an advisory stakeholders group for the VB/I-70 Site, and implemented by the City and County of Denver. The community health program consisted of two activities, providing biomonitoring services for children and conducting community outreach.

Biomonitoring: The primary goal of the biomonitoring program was to test young children and pregnant women to determine if they had been exposed to lead and/or arsenic. This was accomplished through the following tasks:

- Establishing and staffing periodic testing clinics in each neighborhood,
- Collection and analysis of biomonitoring samples,
- Reporting results to each participant, and
- Recommendations to parents for environmental and medical follow-up actions, if needed.

Thirty-eight clinics were held between November 2004 and October 2006. During this time, 661 individuals participated in the biomonitoring program. Health officials identified twenty children with elevated blood lead above 10 ug/dL, and a total of 94 children were identified with elevated blood lead concentrations; i.e., concentrations ranging from 5 – 10 ug/dL. The 10 ug/dL value was adopted from EPA's OSWER Directive 9355.4-12, which determined that, in Superfund site cleanups, EPA will attempt to limit exposure to soil lead levels such that a typical (or hypothetical) child or group of similarly exposed children would have an estimated risk of no more than 5% of exceeding a blood lead level of 10 (ug/dL) (EPA 1994). The parents of children found with elevated blood lead concentrations were referred to organizations that were able to follow-up with the family on environmental and medical issues.

In addition, in accordance with the Community Health Program requirements in the ROD for lead, exterior lead-based paint assessments were conducted at all properties that received soil removal due to elevated lead concentrations. A total of 297 properties met the criteria for lead-based paint assessments. During the assessment, all structures including garages, fences, and sheds with chipping and peeling paint were tested for lead-based paint. If EPA determined that there was sufficient peeling lead-based paint on the property to cause recontamination of the soil above the action level, then EPA performed an exterior lead-based paint abatement at the property. As a result of the assessments conducted, 120 homes received exterior lead-based paint abatements. This work was performed in accordance with the Colorado "Regulation No. 19, Lead-Based Paint Abatement."

Community Outreach: The City of Denver conducted community outreach on a door-to-door canvassing outreach model, utilizing community health workers to provide individual health education. The community health workers were community members that the City of

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Denver trained to provide health information concerning lead and arsenic exposure. The community health workers provided information on the following:

- Health effects of lead,
- Health effects of arsenic,
- Soil pica behavior,
- Soil sampling and soil removal aspects of the remedy, and
- Biomonitoring program.

Community health workers conducted home visits at 94% of the homes within the site boundaries. In addition to home visits, outreach was conducted to realtors and contractors that live or work within the site communities by mailing them relevant information.

4.2.4. Community Participation

Due to the high degree of public interest, the large population impacted by OU1, and the cultural differences among the communities, EPA and CDPHE expanded community involvement to provide for extensive public input throughout the remedial process. Expanded public involvement included conducting a stakeholder assessment, establishment of a stakeholders working group, providing funding for a technical assistance grant, and additional public meetings and fact sheet mailings.

In August 1998, EPA formed a Working Group of stakeholders to provide an open forum for discussing all technical aspects of EPA's remedial investigation, remedial design and remedial action. The Working Group addressed the Environmental Justice concern of having the community participate in decision making by providing direct access to decision makers. Through the Working Group, data and issues were discussed, allowing for community input into decision-making throughout the development and implementation of the remedial investigations, risk assessment, feasibility study, remedial design, and remedy implementation.

The stakeholders attending the Working Group meetings included representatives from all parties that had an interest in OU1 of the VB/I-70 Site. The Working Group included representatives of the City and County of Denver; CDPHE; the Agency for Toxic Substances and Disease Registry (ATSDR); ASARCO; and representatives from the four Denver neighborhoods included in OU1. Stakeholders also included the Clayton, Elyria, and Swansea Environmental Coalition (CEASE), the recipient of a Technical Assistance Grant from EPA.

4.3 Operation and Maintenance

There are no current operation and maintenance activities required for OU1 as part of the remedial action. This is because the Consent Decree (USDC 2004) between EPA, CDPHE and ASARCO required ASARCO to provide a repository within the Globe Site for all soils resulting from the remedial action in OU1, and to conduct all operations and maintenance required at the repository as part of the remedy for the Globe Site (ASARCO 2006).

4.4 Institutional Controls

The Remedial Action Report (EPA 2008) indicated that, of the 4,470 residential properties within the site boundaries, 155 residential properties were not sampled and 33 residential properties

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identified as requiring clean-up were not cleaned up because the homeowner did not provide access to EPA despite contacting the homeowner numerous times. To ensure that future residents at these unaddressed properties are aware of the potential or actual soil contamination, EPA, the City and County of Denver and CDPHE need to implement institutional controls (EPA 2008). The following institutional controls have been proposed, but no decision document has been signed, and institutional controls have not been implemented:

- Issuance of an annual notice letter to the resident stating that the property was part of the VB /I-70 Superfund Site and the property had not been properly evaluated or remediated,
- Annotation of the unevaluated or unremediated properties in the City of Denver's overlay district that identifies properties with environmental concerns. This would notify anyone seeking a building permit on the property, and
- Placement of a notice on the land use record (title), stating that the unevaluated or unremediated property was part of the VB/I-70 Superfund Site and was not properly evaluated or remediated because the homeowner of record refused or did not respond to multiple requests by EPA for access. This institutional control is designed to notify potential buyers of the environmental issues at the property.

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

This was the first five-year review for the site.

6.0 FIVE-YEAR REVIEW PROCESS

6.1 Administrative Components

The Five-Year Review team was led by Sam Garcia of EPA Region 8, who is the Remedial Project Manager (RPM) for the VB/I-70 Site. Team members included Jennifer Chergo and Patricia Courtney of the Region 8 Office of Communications and Public Involvement. Fonda Apostolopoulos of CDPHE assisted in the review as the representative for the support agency.

From July 6, 2009 to August 24, 2009 the review team established the review schedule whose components included:

- Review of relevant documents and data,
- Review of Applicable of Relevant and Appropriate Requirements (ARARs),
- Interviews,
- Verification of institutional control requirements, and
- Preparation of the Five-Year Review Report.

6.2 Community Involvement and Interviews

Representatives from the EPA Region 8 Office of Communication and Public Involvement conducted community interviews for the VB/I-70 Site five-year review on August 17 and 18, 2009. Overall, community interest in the site appears to have diminished significantly. A very

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few community and agency representatives responded to EPA's request for an interview. A summary of interviews conducted with two community members who were involved with the site cleanup for many years and representatives from the City of Denver follows.

Overall, all interviewees had a very positive impression of the cleanup effort and outcome. They all recognized that there was strong community interest in the cleanup and considering the scope of the project, the cleanup process came to a good resolution and satisfied many people. They felt that the cleanup definitely had a positive impact on the community both because the cleanup reduced the risk and because it increased the community's awareness of environmental issues. One respondent noted that the cleanup improved the neighborhood aesthetically. There was particular praise for the usefulness of the Community Health Program to help inform the community about environmental hazards.

Specific criticisms of the cleanup included an observation that the full soil characterization was never made public. Another interviewee mentioned that EPA should have partnered with the neighborhood association better and found a way to pay community members to participate in the process as it takes so much time over many years. It was noted that there were some criticisms from some residents about the replacement soil and landscaping. One respondent said she had heard a few residents complain that their grass died quickly and their replacement soil was of poor quality.

There were a few questions about how the soils deposited at the Globe Plant were being managed and if they were capped. Regarding the properties that were left unaddressed, interviewees all supported some kind of institutional control, and one mentioned that putting a lien on the properties would be a good idea. There was much confusion about what institutional controls EPA was proposing, if any.

6.3 Site Inspection

EPA did not perform site inspections of the VB/I-70 Site as part of this FYR because the contaminated soils removed from the residential properties in OU1 were disposed at the Globe Site and placed with soils remediated during the Globe Site residential cleanup. All maintenance of the residential soils repository is being conducted as part of the Globe Site remedial actions. However, a FYR for the Globe Site is being conducted in a similar timeframe as this FYR. The CDPHE Project Manager for the Globe Site (a State lead site), who is also the State representative for the VB/I70 Site, conducted an inspection of the Globe Plant Site Operable Unit (OU4) as part of the Globe Site FYR. OU4 contains the residential soils from the VB/I70 Site. The following is an excerpt from the inspection performed for the Globe Site FYR (CDPHE 2009):

"The State Project Manager performed a site visit on March 18 and 26. The purpose of the site visit was to assess the protectiveness of the remedy. The Environmental Covenant that is in place includes restricted access and prohibitions on use or disturbance of the area. No activities were observed that would have violated the covenant. The cover and surrounding area were undisturbed."

Therefore, it can be concluded that the requirements in the Consent Decree for the VB/I-70 Site and the environmental covenant with the State for the Globe Site have been met.

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6.4 Applicable Relevant and Appropriate Requirements Review

As part of the FYR, ARARs for the VB/I-70 OU1 Site were reviewed. The primary purpose of this review was to determine if any newly promulgated or modified requirements of federal and state environmental laws have significantly changed the protectiveness of the remedies implemented at the Site. The ARARs reviewed were those included in the ROD. EPA evaluated changes in toxicity data and risk assessment methodologies by reviewing the input parameters used for determining the soil cleanup standards in the ROD to verify that none of these input parameters had changed. The results of the ARAR review are discussed in Section 7.2.

6.5 Document Review

The document review consisted of the review of relevant documents including the ROD (EPA 2003), the Consent Decree (USDC 2004), the Final Remedial Action Report (EPA, 2008), the Final Remedial Investigation Report (WGI 2001), Feasibility Study Report for Operable Unit 1 (MFG 2001), and the Baseline Human Health Risk Assessment (EPA 2001).

6.6 Data Review

Institutional controls are in the planning stage and have not been implemented for those properties where remedial investigations and/or remedial actions were not performed due to access issues. Because there is currently no notification process in place for properties where ownership may have changed, EPA conducted a review of the property records for these properties to determine if any have changed hands since completion of the RA activities. The on-line Real Property Records database, maintained by the City and County of Denver, was used to review the chain of title for properties where EPA had not completed soil sampling or soil removals due to access issues. Review of 31 of the 33 properties where soil concentrations were identified above action levels but not removed due to access issues indicated that four of these properties have changed hands since January 2008. Review of 153 of the 155 properties that were not sampled due to access issues indicates that 21 properties have changed hands since January 2008. Two properties in each category were not checked due to documentation problems at the time the check was performed.

In addition, this FYR documents that EPA changed the cleanup levels for lead and arsenic between the initial soil sampling events and the final soil removals at OU1. During the time-critical soil removal activities, EPA set the cleanup levels at 450 ppm for arsenic and 2000 ppm for lead. However, during the non-time-critical soil removals, EPA lowered the cleanup levels to 240 ppm for arsenic and 540 ppm for lead. Remedial actions performed after finalizing the ROD used cleanup levels of 70 ppm for arsenic and 400 ppm for lead. To verify that the pre-ROD soil data were analyzed with sufficient accuracy to identify properties with soil above the ROD cleanup levels, the method detection limits (MDLs) were reviewed in the Remedial Investigation Report (WGI 2001). The Remedial Investigation Report (WGI 2001) indicates that, based on an MDL study, the MDL for arsenic was 11 milligrams per kilogram (mg/kg, equivalent to ppm), and the MDL was 52 mg/kg for lead, both well below the final cleanup levels. Furthermore, all properties sampled during earlier time-critical phases (Phases I and II) were re-sampled during the remedial investigation (Phase III). Thus the data was determined to be accurate for identifying properties with soil concentrations above the ROD cleanup levels. All residential soil cleanups, regardless of the cleanup levels used during the remedy, removed the top one foot of soil at all sites where EPA performed soil removals.

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7.0 TECHNICAL ASSESSMENT

The following conclusions support the protectiveness determination for the VB/I-70 Site:

7.1 Question A: Is the remedy functioning as intended by the decision documents?

No. Review of the Remedial Action Report (EPA 2008) and supporting documentation indicates that the OU1 remedial action for residential properties that received soil removal work because of concentrations above action levels has been completed. The remedy for those properties is functioning as intended by the ROD requirements. The remedy involved physical soil removal from 800 properties and replacement with clean soil backfill. Therefore, it can be concluded that soil cleanup levels have been achieved on these properties. However, 33 properties with soil contamination above action levels have not been remediated, and 155 properties were not sampled for contaminants during the remedial action, because of access issues with the property owners.

The denial of access to these properties for remedy implementation has implications on assessing the protectiveness of the remedy, and has necessitated the consideration of institutional controls for these properties. At the time of this FYR, institutional controls are being evaluated for those properties where remedial investigations and/or remedial actions were not performed (EPA 2008). These institutional controls could be administered by the City and County of Denver and would likely include notification of property owners that their property is within the VB/I-70 Superfund Site. Denver may also make annotations to property records that it maintains, to reflect that possible environmental contamination may exist on the property. However, because the ROD did not address institutional controls, and these institutional controls are not yet in place, the possibility of exposure to contamination above the risk-based cleanup levels exists for these properties. A review of the title records for the properties where soil was not sampled, and the properties where soil contamination above soil action levels was not removed, indicates that property transfers are occurring. But there is no process currently in place to notify these new property owners of possible contamination on their properties. Because institutional controls are now necessary, and because the ROD does not include these institutional control requirements, the conclusion of this FYR is that the remedy is not functioning as intended by the decision documents.

There are no long-term operation and maintenance activities associated with OU1 because the contaminated soils were disposed at the Globe Site. It is understood that soils from OU1 have been incorporated with residential soils removed from the Globe Site. Therefore, the operation and maintenance requirements for the OU1 soils will be evaluated as part of the FYR for the Globe Site. There are also no opportunities for optimization because the physical remedy has been completed.

7.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of remedy selection still valid?

Yes. A review of the ARARs listed in the ROD indicated that most of the ARARs are action specific and guided the implementation of the remedial action. EPA completed the remedial action work in conformance with these ARARs. However, the ROD did include an ARAR requiring an environmental covenant with the State of Colorado if EPA disposed of soils from OU1 at the Globe Site. Review of the Remedial Action Notice of Completion Report (ASARCO 2006) indicates that ASARCO obtained this covenant on October 4, 2004. Review of the FYR for the Globe Site (CDPHE 2009) indicates that the environmental covenant is still in place.

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EPA evaluated changes in toxicity data and risk assessment methodologies by reviewing the input parameters used for determining the soil cleanup standards in the ROD to verify that none of these input parameters had changed. The cleanup levels identified for remedial action in the ROD for both lead and arsenic were conservative, in that the cleanup levels adopted were lower than levels originally proposed to be protective based on the Baseline Human Health Risk Assessment (EPA 2001). The non-pica-behavior, risk-based cleanup level calculation for arsenic was determined to be 240 ppm. However, based on public and CDPHE comments received, EPA reduced the cleanup level to 70 ppm, consistent with clean-up levels at the adjacent ASARCO Globe Site. Even though the site-specific risk-based cleanup level was not adopted for cleanup of OU1, the risk factors used to perform the risk assessment were reviewed to determine if the values have changed since the risk assessment was performed. The baseline risk assessment used an oral slope factor for arsenic of 1.5 mg-kg/day and a chronic reference dose of 0.0003 mg/kg/day. Review of EPA's Integrated Risk Information System (IRIS) database indicates that these input values have not changed, so that the risk calculations performed for arsenic are still valid.

EPA used its Integrated Exposure, Uptake, and Biokinetic Model (IEUBK) for calculating the risk-based cleanup level for lead at OU1. The risk-based cleanup level calculated for lead was 1,100 ppm, which EPA subsequently reduced to 540 ppm (i.e., the middle of the range of soil concentrations) to be more conservative. However, based on public comments received on the proposed plan, the lead cleanup level was changed to 400 ppm, which is the soil cleanup level obtained by using the default input parameters in the IEUBK model. For this FYR, the default input parameters in the IEUBK model were reviewed to verify that these values had not changed since completion of the ROD. The review indicates that the default values used for the IEUBK model have not changed, and therefore the 400 ppm default soil cleanup level adopted in the ROD is still valid. Based on the above discussion, the risk assessment methodologies and exposure estimates employed at the time of the ROD have not changed.

There have been no significant changes in the residential neighborhoods that comprise OU1 so there are no expected changes to the physical conditions or exposure pathways that would affect the protectiveness of the remedy.

In conclusion, the exposure assumptions, toxicity data, cleanup levels, risk assessment methodologies and RAOs used at the time of remedy selection are still valid.

7.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No. The selected ROD remedy for OU1 consisted of three components: a community health program, soil removal, and soil sampling. Review of the Remedial Action Report (EPA 2008) indicates that the RAOs developed at the time of the ROD were implemented. In addition, there have been no significant changes in the residential neighborhoods that comprise OU1 so there are no expected changes to the physical conditions or exposure pathways that would bring new information to light with respect to the protectiveness of the remedy.

7.4 Technical Assessment Summary

According to the documents and data reviewed, the site inspection and interviews, the remedy is functioning as intended by the ROD for those residential properties where soil sampling was performed and contaminant concentrations were below the action levels, and for those properties where soil was found above the action levels and soil removals were performed. However, 33

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properties with soil contamination above action levels have not been remediated and 155 properties were not sampled for contaminants during the remedial action, because of access issues with the property owners. Though institutional controls are planned for these properties, no institutional controls have been implemented. Therefore, the remedy is not performing as intended by the decision documents for these remaining properties.

There have been no changes to the physical condition of the site that would affect the protectiveness of the remedy. Most ARARS for soil contamination cited in the ROD have been met. There are no changes to the toxicity factors for the contaminants of concern that were used in the baseline risk assessment, and there have been no changes to the standardized risk assessment methodologies that could effect the protectiveness of the remedy. There is no new information that calls into question the protectiveness of the remedy.

8.0 ISSUES

Table 2 below summarizes these issues.

Table 2. Issues

Issues	Affects current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1. Institutional Controls for OU1 identified in the RA Report are not yet implemented for properties where RA activities were not completed. These ICs may include notification of property owners, notifications tied to building permit applications, and notifications tied to property transfers since RA completion and in the future	Y	Y
2. Institutional Controls for OU1 not identified in the ROD	Y	Y

9.0 RECOMMENDATIONS FOR FOLLOW-UP ACTIONS

The recommendations for follow-up are summarized in Table 3 below.

Table 3. Recommendations for Follow-up Actions

Issue	Recommendations and Follow-up Actions	Party Responsible	Milestone Date	Affects Protectiveness (Y/N)	
				Current	Future
1.	Implement Institutional Controls for OU1 to possibly include notification of property owners, notification tied to building permit applications and notification tied to property title transfers where RA activities were not completed	EPA	TBD	Y	Y

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Issue	Recommendations and Follow-up Actions	Party Responsible	Milestone Date	Affects Protectiveness (Y/N)	
				Current	Future
2.	ROD change to incorporate Institutional Controls for OU1	EPA	TBD	Y	Y

10.0 PROTECTIVENESS STATEMENT

The remedy at OU1 is not protective for properties not cleaned up or sampled during remedial action because institutional controls for these properties have not been implemented. As a result, there is no notification process in place for current property owners who may plan intrusive activities on these properties, or for properties that have changed ownership since remedial action was completed, or may change ownership in the future. The following actions need to be taken to ensure protectiveness:

- Successful implementation of institutional controls identified in the Remedial Action Report (EPA 2008) for those properties where remedial action could not be completed due to access issues with the property owners. These institutional controls should include a notification process for current property owners, including notifications tied to building permit applications. The institutional controls should also include a notification process for properties that have changed ownership since completion of the remedial action and for future property transfers.

- A change to the ROD to incorporate institutional control requirements.

The long-term protectiveness of the remedial action will be verified through periodic evaluation of the institutional controls.

11.0 NEXT FIVE-YEAR REVIEW

The next five-year review for the Vasquez Blvd./Interstate 70 Site is required by September 2014 , five years from the date of this review.

12.0 REFERENCES

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Figure 1
Vasquez Boulevard/ I-70 Site
Location Map