RAP Executive Summary	ID No.: SWR No. 31235
	Report Date: August 2016

Use this worksheet to summarize the report. Be sure to complete and submit the Checklist for Report Completeness. **Attach a chronology of activities associated with the affected property.**

Briefly describe the affected property and PCLE zones, the conclusions from the assessment activities, identify any affected or threatened receptors, and describe any other major considerations taken into account when developing this response action plan. If any portion of the response action is necessitated due to an aesthetic or nuisance condition, identify the nature of that condition and identify that portion of the response action proposed to address it. If any media that contains a PCLE zone is not addressed in this RAP, provide justification.

Site Background

This Response Action Plan (RAP) provides the description, basis, and assumptions used to complete the remediation of the Former ASARCO Smelter Site in El Paso, Texas (Site) in compliance with the requirements for a Remedy Standard B closure under the Texas Risk Reduction Program (TRRP).

Operational History

The Site occupies approximately 430 acres in the southwestern portion of the City of El Paso straddling Interstate Highway 10 (I-10) adjacent to the international border defined by the Rio Grande, as illustrated on **Figure 1**. Note: All site figures are presented in the Figures Attachment immediately following the RAP text. The Figures Attachment is in addition to the Attachment 1A (Maps and Cross Sections) required by the RAP.

The Site has been home to several operations since 1887 including lead and copper smelting, production of cadmium oxide, and zinc and antimony processing. ASARCO began closing plant components, starting with the zinc plant in 1982, the lead plant in 1985, the antimony plant in 1986, and the cadmium plant in 1992. The copper smelter continued to operate until February 1999.

Regulatory History

An Agreed Order dated August 29, 1996 was issued by the Texas Natural Resource Conservation Commission (TNRCC), currently the Texas Commission on Environmental Quality (TCEQ), to address deficiencies in ASARCO's operations that may have resulted in releases of chemicals of concern (COCs) to the environment. The Agreed Order committed ASARCO to conducting a Remedial Investigation (RI) of potential releases of COCs to the environment from the Site and to performing corrective actions to address any environmental concerns. The RI was completed in four phases between 1997 and 2003. The Phase I RI provided the first documentation of Category I, Category II, and Category III materials to identify final disposal requirements. In accordance with the agreed remedy, these categories are defined below:

- Category I: soils and solids identified as containing elevated concentrations of COCs and located in an area where they have the potential to affect human health and the environment. Category I soils and solids are identified in the field from the following lines of evidence:
  - Concentrations of COCs 3 to 4 times above their respective industrial screening levels (*i.e.*, human health protective concentration levels [PCLs] for surface soil based on

direct contact [$^{Tot}Soil_{Comb}$]);
    - Source and location of materials based on current demolition and historical disposal practices (*e.g*., old waste disposal areas);
    - Debris in the form of fine-grained grey material usually combined with bricks, concrete, wood debris, and slag pieces from demolition of structures that were previously in direct contact with smelter processes;
    - Soil and slag material with staining and, in some cases, odor; and
    - Category I materials can affect groundwater quality.
- Category II: soils and solids identified as containing elevated concentrations of COCs but at levels that will not affect groundwater if managed properly. Category II soil and solids are identified in the field from the following lines of evidence:
    - Concentrations of COCs above their respective industrial screening levels;
    - Containing large pieces or quantities of slag, stained concrete, bricks and rocks/boulders separated from Category I removals.
- Category III: materials that are inert and contain low, if any, concentrations of COCs below their respective screening levels and, therefore, do not pose a threat to human health or the environment.

In 2005, the TCEQ issued a Corrective Action Directive (TCEQ, 2005) identifying the boundaries of the area of contamination (affected property) and the required elements of the corrective action to be completed. **Figure 2** presents the historical building locations, investigation areas (IAs), and the area of contamination presented in the 2005 Corrective Action Directive. Later that year, ASARCO declared Chapter 11 Bankruptcy. As part of the bankruptcy proceedings between ASARCO, the United States Department of Justice, the U.S. Environmental Protection Agency (USEPA), and the State of Texas, an agreed remedy based on the 2005 Corrective Action Directive was developed for the Site and documented in the 2009 Expert Report prepared by TCEQ (2009). The Texas Custodial Trust (TCT) was established in December 2009 to oversee the cleanup and eventual sale of the property. The response action presented in this RAP addresses remedial actions to be completed on the Site in fulfillment of the 2005 Corrective Action Directive and TCEQ's 2009 Expert Report.

Description of Affected Property

The property is divided into ten assessment areas (AAs) with two AAs located east of the I-10/Union Pacific Railroad (UPRR) rights-of-way (ROWs) and eight AAs located west of the I-10/UPRR ROWs.

Approximately 250 acres of the Site is located east of the I-10/UPRR ROWs and divided into two AAs: East Mountain AA (107 acres) and East Property AA (140 acres). The East Mountain AA is characterized as a bedrock outcropping with steep slopes and weathered, rocky topography. Erosion and sheer drainages makes the East Mountain AA unusable for commercial/industrial (C/I) or residential development. These physical characteristics and proximity to the American Canal and Rio Grande result in migration pathways involving stormwater runoff. The East Mountain AA does not have any significant groundwater.

The East Property is the only AA for which there are plans for residential development. The East

Property AA also contains a 24-acre parcel associated with the 100-year floodplain for the South Arroyo of the Parker Brothers Arroyo (PBA), which will be planned as open space and habitat for ecological receptors. Portions of the East Property AA historically served as a storage site for smelter waste (Category I material) and slag (Category II material). The smelter waste was placed in the Category I Waste Disposal Area, and the slag was placed in portions of the South Arroyo. The materials deposited in the South Arroyo and the Category I Waste Disposal Area served as potential sources of COCs to groundwater. These materials have since been removed and the area is labeled as "Category I and II Removal Area" on **Figure 1.** Category I and II materials were also placed in Area 4 of the East Property AA, which is adjacent to the North Arroyo, as shown on **Figure 1**. However, there are no indications of groundwater being affected in this area. Groundwater in the East Property AA flows on-site from the east along two arroyos (North Arroyo and South Arroyo). Groundwater seepage to surface water does not occur in the East Property AA.

Six of the AAs located west of the I-10/UPRR corridor comprise the ASARCO plant site including Plant Entrance Arroyo AA, South Terrace Arroyo AA, Plant 1 Arroyo AA, Plant 5/6 Arroyo AA, Acid Plant Arroyo AA, and a portion of the PBA. The plant site is characterized as an extensively disturbed industrial property that was leveled over the operational life of the smelter by filling in the plant-site arroyos with soil, slag, and demolition debris. Some of the materials used to fill the arroyos serve as sources of COCs to groundwater beneath the plant site. All stormwater runoff from the plant site is contained on the property in three lined stormwater retention ponds capable of storing up to 12 million gallons of stormwater runoff as part of the Stormwater Collection and Reuse System (SWCRS). All structures associated with the former smelter have been demolished and removed from the plant site, including the two stacks. The future land use for the plant site will be restricted to C/I. The presence of subsurface sources of COCs within the plant site results in the soil-to-groundwater pathway influencing risk management decisions. Groundwater within the plant site generally originates on-site.

The PBA is divided into an upper and lower portion by the UPRR tracks, as illustrated on **Figure 3**. The PBA has several potential source areas for COCs including the PBA channel, the Ephemeral Pond, the Fines Pile, the Boneyard, and portions of PBA within the plant site where the former wastewater treatment plant, former cadmium plant, and former acid storage tanks were located (**Figure 3**). The portion of the PBA located within the plant site footprint will be addressed along with the other five plant site AAs. The Ephemeral Pond is located within the upper channel, while the Fines Pile is located adjacent to the upper channel as illustrated on **Figure 3.** The Parker Brothers Arroyo (Figure 3) is the main drainage feature for the entire property. Stormwater runoff from the plant site, East Property AA, northern half of the East Mountain AA, and the entire PBA discharge to the Rio Grande through the PBA channel at outfall SW-5**.** The PBA channel also provides drainage for upland properties to the east of the Site. Groundwater within the PBA largely flows from the East Property AA and on-site portions of the PBA.

The remaining portions of the Site include the La Calavera AA (LC AA), located north/northeast of the UPRR tracks and the plant site, and the Floodplain AA, located west of Paisano Drive and the plant site. LC AA is an open area adjacent to the PBA, as illustrated on **Figure 1**. LC AA and

adjacent off-site properties were historically impacted by aerial deposition of dust from slag crushing operations and stack emissions. The USEPA performed remedial investigations and remediation of off-site impacted properties (Roy F. Weston, Inc., 2001). The concentrations of arsenic and lead in the surface soil of the LC AA remain above C/I PCLs (PCLs for the Site were developed in the *Conceptual Site Model, Pathway Evaluation, and Protective Concentration Level Report* [Arcadis, 2016a]). COCs in surface soil, however, have not migrated vertically and do not pose a threat to groundwater. Groundwater within the LC AA is within a separate drainage basin from on-site groundwater and sources of potential groundwater impacts. Groundwater monitoring well EP-86 provides water quality information for groundwater in the LC AA including background information on concentrations of COCs in groundwater at the Site.

The Floodplain AA is located west of the plant site and Paisano Drive, adjacent to the Rio Grande. Similar to the LC AA, the Floodplain AA was impacted by deposition of fugitive dusts from slag crushing operations and stack emissions. Lead is present in surface soil of the Floodplain AA at concentrations above its C/I $^{Tot}Soil_{comb}$ PCL, but there is no evidence of vertical migration to groundwater. Groundwater flow from the plant site and the PBA is the source of groundwater in the Floodplain AA, as well as recharge from the Rio Grande for portions of each year. As a result, groundwater in the Floodplain AA is affected by COCs that originate from the plant site and PBA. The COCs in the groundwater of the Floodplain AA are available for discharge to the Rio Grande.

Site Characterization

Soil, groundwater, and surface water have been impacted at the Site by sources of COCs in excess of site-specific PCLs. Sources of COCs include:

- Industrial process areas (see **Figure 2**)
  - Acid Plants No.1 and No.2
  - Sinter Plant and Sample Mill
  - Unloading and Bedding Buildings
  - Converter Building, Contop and Baghouse
  - Plant Entrance (stormwater drainage)
  - Former Lead Plant
  - Former Cadmium Plant
  - Former Zinc Plant
  - Former Antimony Plant
- Pond Sites: Pond 1, Pond 5, and Pond 6 (see **Figures 1 and 2**)
- Slag and Process Waste Storage/Disposal (see **Figures 1, 2 and 3**)
  - Plant Site Arroyos (South Terrace Arroyo, Pond 1 Arroyo, Pond 5/6 Arroyo, and Acid Plant Arroyo)
  - PBA – Boneyard
  - PBA – Fines Pile
  - PBA – TCT's portion of Pile 1
  - East Property - Category I Waste Disposal Area
  - East Property - Category II Material Disposal Area

- Emissions from slag processing (crushing) and stacks
- Other sources such as leaking underground storage tanks and polychlorinated biphenyl (PCB)-containing transformers

Principal COCs in soil and groundwater collectively are arsenic, cadmium, chromium, copper, lead, mercury, selenium, and zinc. Arsenic and selenium are the principal COCs in surface water.

PCL Exceedance (PCLE) zones were established for soil and groundwater at the Site based on multiple routes of exposure for each AA. A summary of the PCLs/exposure routes for each AA is presented below.

Assessment Area	C/I $^{Tot}Soil_{Comb}$ (mg/kg)	Res $^{Tot}Soil_{Comb}$ (mg/kg)	$^{GW}Soil_{Ing}$ (mg/kg)	$^{SW-GW}Soil$ (mg/kg)	$^{Air}Soil_{Inh-VP}$	$^{Sed}Soil$	$^{Eco}Soil$	^{SW}SW (mg/L)	Sed (mg/kg)	^{SW}GW (mg/L)	^{Sed}GW (mg/L)	$^{GW}GW_{Ing}$ (mg/L)
East Mountain	X				X	X						
East Property		X	X				X					X
Plant Entrance	X									X	X	X
South Terrace Arroyo	X		X	X						X	X	X
Pond 1 Arroyo	X		X	X						X	X	X
Pond 5/6 Arroyo	X		X	X	X					X	X	X
Acid Plant Arroyo	X		X	X	X					X	X	X
PBA	X		X	X		X				X	X	X
LC	X											X
Floodplain	X					X				X	X	X

Figure 4 provides an illustration of the PCLE zones in soil, which are largely driven by the distribution of arsenic. Soil sample results are indicated by color coded markers as follows:

- Green markers indicate soil concentrations that are below the critical (lowest) PCL for each assessment area (no action is required).
- Amber markers indicate soil concentrations that exceed the soil-to-groundwater ($^{GW}Soil_{Ing}$) PCL but are below the soil-to-groundwater-to-surface water ($^{SW-GW}Soil$) PCLs and the direct contact PCLs ($^{Tot}Soil_{Comb}$), as applicable. As such, the amber markers identify areas where groundwater use will be restricted with institutional controls to prevent ingestion exposure based on cross media transport.
- Red markers identify locations where COC concentrations exceed the $^{SW-GW}Soil$ and/or $^{Tot}Soil_{Comb}$ PCLs (as well as the $^{GW}Soil_{Ing}$ PCL). Removals and/or physical controls such as capping must also be implemented.

The soil-to-sediment ($^{Sed}Soil$) PCL was not calculated. This pathway was evaluated and, if it is complete, is managed using Best Management Practices (BMPs) to remove sediment entrained in stormwater runoff.

Figure 5 provides an illustration of the PCLE zone in groundwater. As above, the groundwater sample results are indicated by color coded markers as follows:

- Green markers indicate groundwater concentrations that are below drinking water ($^{GW}GW_{Ing}$) PCLs (no action is required).
- Amber markers represent groundwater concentrations above the $^{GW}GW_{Ing}$ PCLs but below the groundwater-to-surface water (^{SW}GW) PCLs. The amber markers indicate areas that will be included in the institutional control prohibiting the use of Site groundwater which will be implemented with the Plume Management Zone (PMZ) (planned to address the ^{SW}GW PCLE zone, see below).
- Red markers identify those areas with COC concentrations above the ^{SW}GW PCLs that will be addressed by the response action to protect the Rio Grande. The RI has demonstrated that most of the contaminant flux is coming from the PBA; therefore, treatment of metals in groundwater through the use of permeable reactive barriers (PRBs) within the PBA is included in the response action. The overall groundwater response action will be performed within a PMZ and will include institutional controls prohibiting the use of groundwater.

Response Actions

The goal of the RAP is to present the response action and long-term operation and monitoring approaches to achieve a Remedy Standard B closure under TRRP for mixed residential and C/I land use at the Site. The RAP is not aimed at decontamination, but rather at a reduction in contaminant mass that leave the site. To achieve Remedy Standard B closure objectives, the RAP addresses the following:

1. Prevention of direct exposure to soil and groundwater with COC concentrations above their respective $^{Tot}Soil_{Comb}$ and $^{GW}GW_{Ing}$ PCLs through a combination of removals (soil excavations and groundwater extraction), treatment alternatives (PRBs and monitored natural attenuation [MNA]), physical controls (caps), and institutional controls (restrictions on land and groundwater use, cap maintenance, etc.).
2. Construction of a lined landfill cell (Cell 4) for placement of Category I material. Cell 4 will be considered a Waste Control Unit (WCU).
3. Control of sources of contamination to groundwater through excavation and placement of identified Category I material into the Cell 4 WCU, capping soil and lining drainages where Category II materials are present (Category II Material Storage Area, plant site arroyos, Fines Pile, Boneyard, Ephemeral Pond, TCT's portion of Pile 1, and lower PBA channel), and modification of the groundwater gradient (through extraction of clean groundwater from a location upgradient of affected on-site soil and groundwater.)
4. Control of discharge of COCs to the Rio Grande by modification of the hydraulic gradient through the placement of a variety of low permeability covers at locations throughout the plant site AAs and through extraction of groundwater from a location upgradient of the PBA.
5. Prevention of future discharge of sediment entrained in stormwater by detaining stormwater runoff on site in retention ponds; removing slag from the PBA channel and installing a liner and stabilization system; constructing gabion structures in the East Mountain AA and rip-rap check dams and gabions or equivalent, as needed, in the upper PBA and Floodplain AAs; and stabilizing plant site slopes.

Figure 6 provides a summary of soil response actions including excavation areas, capped areas, lined arroyo channels, WCUs, stormwater ponds, and gabion structures. Excavations were

performed on the East Property AA to bring the area north of the South Arroyo into compliance with $^{Tot}Soil_{Comb}$ PCLs for residential land use. All other AAs were compared to C/I PCLs to determine extents of capping or removals to bring them into compliance with TRRP requirements. Caps will be completed with re-grading plans to eliminate infiltration from ponding.

Figure 7 provides an overview of the groundwater response action. The PCLE Zone in groundwater at the Site extends from the South Arroyo in the East Property AA to the Rio Grande in the Floodplain AA as shown on **Figure 5**. Different response action approaches will be used for the on-site and off-site portions of the groundwater PCLE Zone.

Groundwater Response Action

A PMZ will be established for the groundwater response action and will extend from EP-84 in the South Arroyo (shown on Figure 1 of **Attachment 3A**) to the eastern bank of the Rio Grande as illustrated on **Figure 8**. The PMZ will address COCs in groundwater in the PBA and in the plant site:

- *East Property*. All groundwater up-gradient of the PMZ on the East Property is unimpacted by on-site sources of COCs, as evidenced by concentrations of COCs in groundwater below background levels for monitoring wells EP-96, EP-97, and EP-129.
- *PBA AA and Floodplain AA Groundwater Response Action*. The groundwater response action for the PBA AA and Floodplain AA will include operation of an extraction well in an area of unaffected groundwater near the North Arroyo in the East Property AA to reduce the gradient and minimize the amount of groundwater that comes into contact with remaining impacted material in the PBA AA. Two PRBs have been installed within the PBA channel to reduce the mass of dissolved metals in groundwater coming from the Fines Pile, Ephemeral Pond, and Boneyard. The PBA channel, including the Ephemeral Pond, will be lined to prevent infiltration of stormwater. Groundwater modeling results project that it will take approximately 15 to 30 years for the groundwater within the PBA AA and Floodplain AA to achieve the ^{SW}GW PCL at the downgradient edge of the PBA. Because gradient control will reduce COC loading to groundwater to the floodplain, groundwater at the downgradient edge of the PMZ is also projected to achieve ^{SW}GW PCLs over approximately 30 years.
- *Plant Site Groundwater Response Action*. Gradient control only will be performed for COCs in groundwater beneath the Plant Site AAs. Reduction of infiltration of water from the surface and the groundwater hydraulic gradients toward groundwater discharge points at the plant site arroyos will be achieved by surface regrading to prevent future ponding and capping a majority of the area with a combination of low permeability covers. The reduced gradients and volume of groundwater originating from the plant site will reduce discharge of groundwater to the Rio Grande.

Groundwater monitoring will be focused on monitoring groundwater quality in and around capped areas including the Category II Material Storage Area, the Fines Pile, the Boneyard, and the plant site; the WCUs including the Cell 1, Cell 2, Cell 3, and Cell 4 landfills; and the downgradient edge of the PMZ. Groundwater monitoring associated with the PMZ will be performed to evaluate its effectiveness. Groundwater monitoring wells at the down-gradient edge of the PMZ will be established as alternate Point of Exposure (alternate POE) wells. Groundwater monitoring wells MW-2, MW-9S, MW-11S, EP-112, and EP-133; EP-128; EP-4; EP-6; and EP-7 will be used as the alternate POE wells. These wells and associated upgradient attenuation monitoring point (AMP) wells MW-132D, EP-58, EP-64, and EX-4 in the Floodplain AA; EP-154, EP-155R,

EP-156R, and EX-1 in PBA AA; and EP-114 in Acid Plant Arroyo AA will be monitored for COC concentrations.

For discharges from the Plant Site AAs, PMZ monitoring will be based on groundwater elevation data (and resulting calculated hydraulic gradients) and not groundwater concentration data. The response action is not aimed at decontamination, but rather at a reduction in the contaminant mass leaving the site due to a reduction in the groundwater gradient. The groundwater modeling results predict that an 80 percent (%) reduction in gradients within the Plant Site AAs and PBA AA, along with treatment of groundwater in the PBA AA to the critical PCL, will achieve the ^{SW}GW PCL at the groundwater-to-surface water alternate POEs. Water elevations will be monitored in well EP-162 in East Property AA; wells EP-20 and EP-72R in South Terrace Arroyo AA; EX-8 and Well No. 1 in Pond 1 Arroyo AA; New Well No. 2 and New Well No. 5 in Pond 5/6 Arroyo AA; EP-49, EP-51, EP-100, EP-114, and New Well No. 3 in Acid Plant Arroyo AA; and EP-54, EP-78, EP-120, and EX-1 in PBA AA.

Figure 8 provides a summary of institutional controls required to prevent future exposure to COCs in soil and groundwater at the Site. Institutional controls will include: restricting land use to C/I at applicable areas, as well as planning for open space use in the East Property AA; further restricting development in certain Site areas such as the WCUs and capped areas; and prohibiting groundwater use within the PMZ.

The soil response action is scheduled to be completed in 2016, and a Response Action Completion Report (RACR) for soils, or Soil RACR, will be submitted by the end of that calendar year. Covenants will be filed outlining institutional controls requiring C/I land use at applicable areas and prohibiting groundwater use within the PMZ. Monitoring will be performed as part of the long-term operation, maintenance, and monitoring (OM&M) program associated with the soil closure and will include inspection and maintenance of the caps along with monitoring of groundwater to verify cap performance.

It is estimated that approximately 30 years is required for the groundwater response action within the PMZ to achieve PCLs at the Floodplain AA, and thus in the Floodplain AA monitoring of the PRB performance will be reported in Response Action Effectiveness Reports (RAERs) submitted between 2016 and 2045. It is estimated that in 2046 a groundwater RACR will be submitted. Post Response Action Care Reports (PRACRs) will be prepared an annual basis until overall closure for the groundwater is achieved in approximately 2056.

What is the selected remedy standard for this affected property? ___ A X B

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List all media that contain a PCLE zone and specify the proposed response action for each media. Indicate the type of removal, decontamination, physical control and/or institutional control action that is proposed.

Media	COCs[1]	Removal	Decontamination	Control			
				Physical Control	Modified Groundwater Response Objective[2]		
					PMZ	WCU	TI
Soil	Metals (Sb, As, Cd, Cu, Pb, Hg, and Se) and PCBs	East Property AA, Plant Entrance AA, Plant Site AAs, PBA AA, LC AA and Floodplain AA		East Property AA, Plant Site AAs, and PBA AA	Site-wide	Plant Site AAs and PBA AA: Landfill Cells 1, 2, 3, and 4	
Groundwater	Metals (Sb, As, Cd, Cr, Cu, Pb, Hg, Mb, Ni, Se, Tl, and Zn) and Cl-, F-, NO3, and SO4	East Property AA	PBA AA	East Property AA and PBA AA	Site-wide	Plant Site AAs and PBA AA: Landfill Cells 1, 2, 3, and 4	
Surface Water	Metals (As, Pb, Se) and Cl- and SO4			East Property AA, Plant Site AAs, PBA AA, and Floodplain AA			

Is there a media that contains a PCLE zone that is not addressed in this RAP? X Yes ___ No

If yes, provide justification for not addressing the PCLE zone in this RAP.

Off-site affected properties that contain PCLE zones are owned by Texas Department of Transportation (TxDOT) (I-10 and Hwy 375 right-of-ways), UPRR, Burlington Northern/Santa Fe (BNSF) Railway, and the International Boundary Water Commission (IBWC). Response actions at these off-site properties are being performed separately and are not addressed in this RAP. However, response actions performed under this RAP will be coordinated with response action activities being performed at the TxDOT, UPRR, and BNSF properties. Additionally, the IBWC has received a $22M settlement from ASARCO to address impacts to the American Canal.

On-site land use: [X] Residential [X] Commercial/Industrial
Off-site land use: [ ] Residential [X] Commercial/Industrial (check all that apply)

[1] Specify either a specific COC or, if the response action is the same for all COCs in one type, specify the type of COC (for example, VOCs, SVOCs, metals).
[2] If a modified groundwater response objective is proposed, check the type(s) of proposed modifications.

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Is this a re-submittal or revision of a previous RAP? X Yes ___ No

If yes, explain why the RAP is being revised or resubmitted.

Responding to TCEQ/USEPA comments dated August 5, 2016.

Were all the appropriate notifications made in accordance with §350.55? X Yes ___ No

If no, explain why notifications were not made: