

Remediation of the Former ASARCO Smelter Site, El Paso, Texas, USA

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ABSTRACT

This paper presents a case history of the environmental remediation, and reintegration of the former American Smelting and Refining Company LLC (ASARCO) Smelter Site (Site) into productive reuse within the City of El Paso, Texas (the City). This project began in late 2009 under one of several environmental trusts set up in the USA to manage liabilities remaining from the bankruptcy reorganization of ASARCO.

The El Paso Smelter began operations in 1887 as a lead smelting operation. Copper production began in 1910, cadmium oxide in the 1930s, zinc in 1948 and antimony in 1970. The zinc plant closed in 1982, lead plant in 1985, antimony plant in 1986, and the cadmium plant in 1992. Copper production idled in 1999 and the entire Site was placed in care and maintenance with the intent to reopen. In 2005, ASARCO declared Chapter 11 bankruptcy. In February 2009, the air permit for the Site the Texas Commission on Environmental Quality (TCEQ) at ASARCO's request. ASARCO emerged from bankruptcy later that year with the smelter being placed into the Texas Custodial Trust (the Trust).

Arcadis U.S., Inc. (Arcadis) was selected to provide turn-key environmental engineering and remediation services for this 185-hectare site, working with the TCEQ, the United States Environmental Protection Agency (USEPA), and other regulatory agencies. The scope of work included project management, engineering, permitting, environmental compliance, construction, air monitoring, waste abatement, and soil, storm water and groundwater remediation.

INTRODUCTION

The former smelter included several processing, material handling, office, and shop buildings in addition to the hot metal buildings and stacks. There were three stacks at the Site for the lead, copper, and acid plants. The Site is in the City on the Texas (USA)/Ciudad Juarez (Mexico) border adjacent the Rio Grande River (Figure 1). The Site is bifurcated by the Interstate 10 freeway (I-10) into the East Property and West Property. Residences and The University of Texas at El Paso (UTEP) are located to the east. Residential and commercial/industrial buildings and facilities are located north of the Site. The downtown of El Paso is to the south.



Figure 1 Former ASARCO Smelter Property (orange dotted line) and Adjacent Land Use

Other key Site features include two large arroyos on the East Property that collect and convey storm water through Parker Brothers Arroyo (PBA) to the Rio Grande. PBA was determined to be a major source of impacts to soil, storm water, and groundwater. Two major railroads are located on either side of the West Property.

Remediation of the Site needed to meet TCEQ standards. The Texas Risk Reduction Program (TRRP) was selected as the regulatory means for remedy compliance. Arcadis developed the elements of the remedy including: design/build of a 150,000 cubic meter (m³) landfill, impacted soil removals and disposal with clean closure of 60 hectares, two permeable reactive barriers (PRBs) for in situ groundwater treatment, placement of a soil and asphalt cap over 30 hectares in the former active area, and installation of several storm water management systems. In addition to the USEPA and TCEQ, Arcadis coordinated with multiple other stakeholders including the United States Army Corps of Engineers, Fish and Wildlife Service, El Paso County, the City, adjacent industrial and residential property owners, and Mexican officials. Constituents of concern (COCs) include: Metals: Sb, As, Cd, Cr, Cu, Fe, Pb, Hg, Se and Zn, volatile organic compounds, semi-volatile organic compounds, polychlorinated biphenyls (PCBs), and total petroleum hydrocarbons.

METHODOLOGY

Trust Purpose and Goals

As part of the bankruptcy settlement, ASARCO placed 52 million US\$ in the Trust to address remedial activities. The TCEQ selected Roberto Puga, P.G. as the Site Custodial Trustee. The beneficiaries of the Trust are the USEPA and TCEQ. The Trust is charged with: 1.) Demolition of Site infrastructure; 2.) Environmental restoration of Site soils, groundwater, and storm water to TCEQ standards that are protective of human health and the environment with the oversight of TCEQ and USEPA; and 3.) Disposition of the property, preferably through a sale. The Trust is also responsible for managing all aspects of contracting and directing the technical work, accounting, investing, and managing the assets of the Trust. The Trust recovered more than \$35 million \$US from Site assets with the sale of onsite precious metals, property, and slag disposal space in the

Site’s waste disposal cells to adjacent, affected property owners. This revenue increase allowed the Trust to enhance remedial actions including the clean-up of PBA, clean-up of large portions of the Site to have unrestricted reuse, and implementing a sustainable and green ground water remedy.

Major Site remediation was completed in 2016 with a few follow-up activities completed from 2017 through 2020. Final remediation tasks are projected to occur in 2020/21. The Trust has agreed, in principle, to sell the property to UTEP; the property sale is projected to close in 2020.

Health and safety of workers at the Site is also a critical part of the Trust’s charter. To date, the Trust has completed more than 454,000 man-hours of on-site remediation and demolition work with zero Occupational Safety and Health Administration recordable injuries.

Site Characterization

Following a 1994 site visit, the Texas Natural Resource Conservation Commission (now TCEQ) negotiated an Agreed Order with ASARCO to investigate and remediate environmental impacts to soils, surface water, and groundwater. The ASARCO-led remedial investigation (RI) occurred between 1997 and 2008 with hundreds of borings, thousands of samples, and over 100 groundwater monitoring wells both on- and off-Site in Investigation or Assessment Areas (Figure 2).

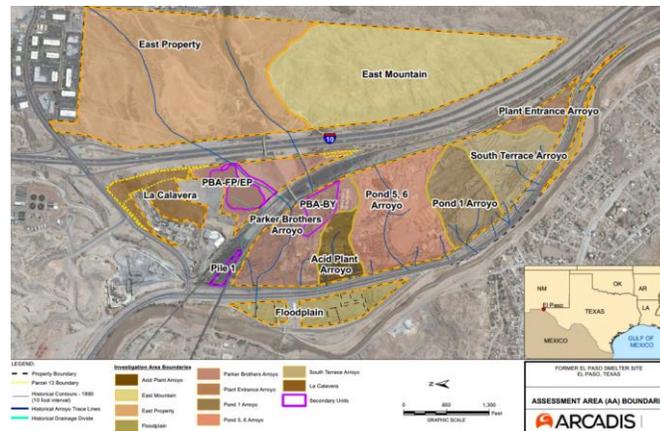


Figure 2 Assessment Areas for ASARCO RI

The Trust completed a comprehensive review of ASARCO’s RI and remedial actions. A Remedial Action Work Plan (RAWP) (Malcolm Pirnie, 2011) was prepared to confirm ASARCO’s investigative work and to fill data gaps identified during the data review.

Two primary surface water receptors located west of the Site are the Rio Grande and the American Canal. During fall and winter flows in the Rio Grande decrease significantly as water is diverted into the American Canal.

Five ephemeral drainage arroyos are present on the Site that generally correspond to the Assessment Areas (Figure 2). The arroyos have been filled over time with a variety of materials including slag, debris, and native soils. These arroyos convey most groundwater flow and transport of COCs through the Site. The PBA accounts for approximately 85% of the groundwater flow and

contaminant flux. Groundwater beneath the Site occurs primarily within an unconfined alluvial aquifer approximately 1.8 to 18 meters (m) thick underlain by less permeable bedrock. Activities in the RAWP were implemented concurrently with demolition of the Site structures and summarized in a Supplemental RI Report (Arcadis, 2014) indicating adequate data was collected to proceed with the remedy.

Demolition

In late 2010, a site-wide demolition contractor, Brandenburg Industrial Service Company of Chicago, Illinois was selected. Brandenburg was managed on the Site by ERM, who oversaw demolition health and safety, engineering and asset recovery. Arcadis provided all air monitoring during demolition. The contract with Brandenburg specified that they perform the demolition in exchange for salvaging metals from the structures and payment of 1 million US\$ to the Trust from the recycling credits.

Demolition began in April 2011. By the end of 2012, most large structures had been demolished. Planning and implementation of the chimney demolition began in early 2013. Significant coordination with public entities at the local, state, federal, and international level due to the Site’s location on the USA-Mexico border was required. The planning culminated in the successful demolition of both chimneys in April 2013. This was the tallest industrial chimney demolition event in USA history.

Asset Recovery

The Trust worked to market Site assets during demolition to enhance the financial situation of the Trust. An international effort (Figure 3) was implemented to find the best markets for the Site’s recoverable assets. The Trust is in the closing phase of a real estate sale of the Site to UTEP. The proceeds of the sale are slated for the long-term operation, monitoring, and maintenance of the remedial systems at the Site.

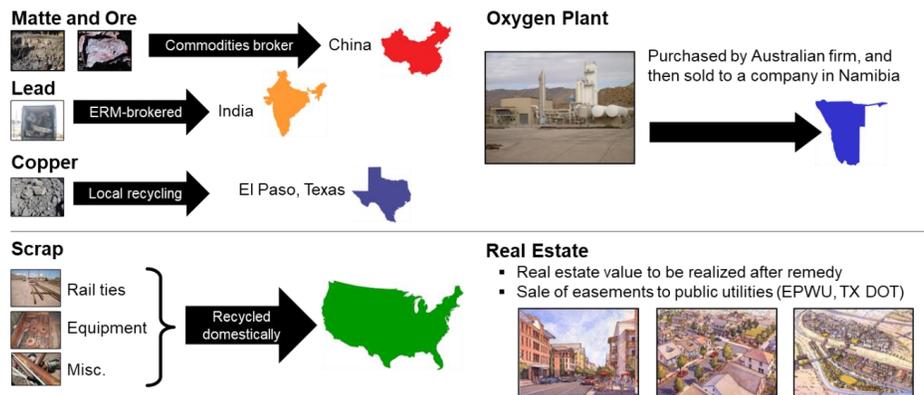


Figure 3 Types of markets found to maximize return on recovered Site assets

RESULTS AND DISCUSSION

The groundwater remedy is integrated closely with and relies on components of the soils remedy. The groundwater remedy includes components to: 1.) Reduce hydraulic head and gradients in all arroyos, and especially within the PBA; 2.) Reduce contaminants utilizing a series of zero valent iron (ZVI) PRBs in the PBA; 3.) Flush contaminants from the downgradient floodplain, minimizing future contaminant transport into the Rio Grande and American Canal; and 4.) Use Restrictive Covenants to ensure that groundwater beneath the Site is not used for drinking water purposes. In general, the former Plant Site arroyos are addressed through the reduction in water levels and gradient afforded by the soil and asphalt covers. A groundwater extraction well placed in the South Arroyo on the East Property removes uncontaminated groundwater from upgradient and acts as a hydraulic barrier (Figure 5). Unimpacted groundwater is transported via pipeline and discharged in the lower PBA. This provides a reduction in overall flow and gradients within the PBA and keeps “clean water clean”.

The ZVI PRBs were constructed where the highest contaminant concentrations had been identified historically, and where the bedrock topography channelizes groundwater flow through a concentrated area. The PRB technology relies on groundwater flow through an emplaced zone of permeable reactive medium, resulting in the passive treatment of groundwater as it flows through the medium, essentially creating a “barrier” to contaminant transport over the lifetime of the PRB. The effective removal of arsenic from groundwater using ZVI has been demonstrated extensively in laboratory tests and field demonstrations (e.g., Wilkin et al., 2009, and Beak & Wilkin, 2009). The primary removal mechanisms included adsorption to and co-precipitation with fresh forms of iron that are produced as the ZVI corrodes (Beak & Wilkin, 2009). The PRBs are trench systems approximately 2.4 m wide and varying depths between 2.7 to 4.9 m (PRB-1) and 4.3 to 6 m (PRB-2) with ZVI and clean sand as the active in situ treatment media. Low permeability material covers the ZVI in each PRB to bring the top elevation back to existing grade. PRB-1 is approximately 36 m in length, while PRB-2 is approximately 30 m in length (Figure 5).

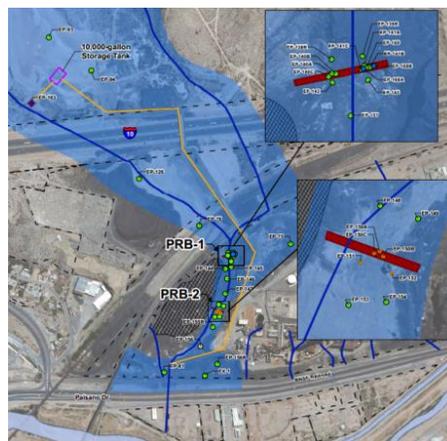


Figure 5 PRB and GHB Locations within PBA

A restrictive covenant called a Plume Management Zone (PMZ) will be recorded on the property deed (and off-site property deeds where the PMZ exists) to ensure groundwater beneath the Site is not used as drinking water. The PMZ provides a mechanism to meet the remedial endpoints at alternate points of exposure, as opposed to meeting the remedial endpoints at the property boundary.

Storm Water Remedy

The storm water remedy includes the following components: 1.) Reuse of the existing West Property zero discharge collection and containment system; 2.) Coordination with adjacent property owners to size and configure collection and routing structures for storm water conveyance under the freeways and railroads draining either to the American Canal south outlet or PBA north outlet; 3.) Clean-up of the arroyos on the East Property to residential standards to facilitate unrestricted drainage; 4.) Construction and maintenance of gabion check dams in steep rocky drainages on the East Property to capture potentially impacted sediments; and 5.) Construction of a wide, shallow grade, impermeable channel in PBA through the Site that ultimately discharges to the Rio Grande. Figure 6 shows the recently completed channel.



Figure 6 PBA Channel (looking west) with Cell 4 to the North in May 2020

Post Remedy Land Use

The Site is in the process of being sold to UTEP for expansion of the UTEP campus. The cleaned up East Property with the expansive arroyos makes ideal land to be redeveloped into classrooms, dormitories, laboratories, retail space and hotels. A long-needed connector road is also possible creating additional access to I-10. The West Property can also be redeveloped with commercial-industrial buildings and/or recreational facilities over the soil and asphalt cover systems.

CONCLUSION

Many lessons were learned during the progression of this project, several which were implemented. From an owner's perspective, the most important are:

- Formulate a project end-vision early focusing remediation goals and stakeholder buy-in.
- Create a proactive outreach program to integrate stakeholder needs into the project.
- Realize the importance of monetizing site assets and take advantage of world markets to maximize revenues from sale of the site assets.
- Have a strategic procurement plan to obtain needed expertise for a project of this magnitude to meet schedule and cost goals.
- Be flexible in scoping the work elements to engage available expertise from different entities.
- Utilize as many local resources as possible to benefit the local economy.
- Create educational opportunities to foster local teamwork. UTEP students were hired as interns to make technical contributions to this project.
- Coordinate bi-national regulatory agencies, media, grass-root groups, and work with elected officials to keep new ideas and buy-in flowing.
- Recognize the project will attract a lot of interest requiring distribution of project information via a website or social media (see www.recastingthesmelter.com)
- Build ample on-site landfill capacity to avoid expensive off-site trucking and disposal fees.
- Utilize on-site borrow sources for construction materials to reduce costs.
- Facilitate an ongoing and consistent effort to avoid expensive interruptions by taking a design-build approach to develop and implement the remedy.

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