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11.7 Former Foster Air Force Base, Victoria, TX

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11.7.1 Site Description and Conceptual Site Model

The Former Foster Air Force Base (AFB) Victoria, TX was used for single jet engine training during the Korean Conflict. Prior to becoming an AFB, the site was Foster Army Airfield and was used during World War II for basic flight training. The AFB was inactivated in 1959 and is now the Victoria Regional Airport. Releases of chemicals to the environment from past activities of the Department of Defense are being investigated and remediated under the Formerly Used Defense Site (FUDS) program by the US Army Corps of Engineers (USACE) with regulatory oversight by the Texas Commission of Environmental Quality (TCEQ). This case study presents an example of a relative bioavailability assessment (RBA) for PAHs. The Tier 2 protective concentration levels (PCLs) for the site, under the Texas Risk Reduction Program, and the RBA results have been approved by the TCEQ with additional review provided by the USEPA. The RBA was incorporated into the Remedial Investigation phase of the project.

The project is a former skeet shooting range used by the Army for training from 1941 to 1945. The site is shown on Figure 11-9 and is an outline of the range fan. The two half circles were where the target shooters were positioned for shooting at skeet targets, also known as clay pigeons.



Figure 11-9. Figure 1 Former Foster Air Force Base skeet shooting range location.
Source: (USACE 2016)

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Contaminants of potential concern (COPCs) at the site are lead and polycyclic aromatic hydrocarbons (PAHs), which are related to operations of the former shotgun range sites. PAHs are associated with the weathered clay target debris that remain at the site. The targets are a brittle disc made from heat and pressure treated coal tar pitch and limestone. The PAHs remain in the coal tar pitch/limestone matrix of the clay target fragments, just in smaller and smaller fragment sizes that become part of the soil matrix. Results of a sieving study of site soils where PAH concentrations decreased with decreasing particle size, confirmed this assumption of the conceptual site model (CSM). The mechanical weathering of clay target

fragments, therefore, is considered the predominant mechanism for the movement of PAHs from large fragments to the soil matrix. Lead in soil originates from residual lead shot pellets and there are some areas of the site with lead above Texas PCLs, but lead will not be addressed further in this case study.

The objective of the PAH bioavailability assessment was to reduce uncertainty in the human health risk assessment associated with direct contact with contaminated soil and develop a site-specific cleanup goal for PAHs at the site. Accurate characterization of bioavailability of PAHs released at this site will also be useful for other small arms ranges that used clay targets. There are many of these types of ranges in the Military Munitions Response Program (MMRP) addressed under the Defense Environmental Restoration Program (DERP), but there has been no data collected which addressed the bioavailability of PAHs in target fragments.

11.7.1.1 PAHs on Site

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As described above the source of PAHs at the site is clay targets that were used at the former shooting range. A mixture of PAHs exists at the site, those above the TCEQ Tier 1 Commercial/Industrial Total Soil Combined (combined pathways of includes inhalation, ingestion, and dermal exposure pathways, $^{Tot}Soil_{Comb}$) PCLs, include benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. A baseline risk assessment was performed and risks for the current and future land use were above 1×10^{-4}.

Lateral characterization of PAHs was based on 79 surface soil samples (0 to 0.5 ft bgs) based on five-point composite samples collected from a grid, some of which were individual grab samples collected around the perimeter of the site. Vertical characterization was completed at three locations with borings from 0 to 5 ft. All PAHs were detected in the 0 to 2 ft bgs interval. Concentrations of BaP ranged from 0.009 mg/kg to 657 mg/kg with a mean concentration of 34.5 mg/kg. Maximum detections of other PAHs ranged from 76 mg/kg (dibenz(a,h)anthracene) to 666 mg/kg (chrysene).

The concentrations of background PAHs taken from an unimpacted area near the site were < 0.117 mg/kg, the analytical method reporting limit.

11.7.1.2 Site Soil Type

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The soil within the Former Foster AFB is mostly clay, silt, sand, localized gravel and caliche.

11.7.1.3 Land Use

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The current and likely future land use at the site and surrounding area is commercial/industrial as a Regional Airport. Direct contact with impacted soil is the most significant human exposure pathway, inhalation of fugitive dust and dermal exposure are accounted for in the proposed PCL risk-based calculations as well.

11.7.2 Methodology Used for Evaluating Bioavailability.

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There is no state guidance for developing site-specific RBA values for PAHs. Previously, this case study presented method development and results of an oral relative bioavailability study of PAHs in clay target fragments that were present on land that once was a skeet shooting range and now is a regional airport. Use of the bioavailability study in the site risk assessment was also described, the study reduced uncertainty in the risk assessment and increased the risk-based levels of concern for PAHs from clay targets at the site. Since publication of this ITRC document, details of the work presented in this case study and at another site, plus a dermal bioavailability study, have been published in the peer-reviewed journal *Environmental Science & Technology* . The paper is titled “Oral and Dermal Bioavailability Studies of Polycyclic Aromatic Hydrocarbons from Soils Containing Weathered Fragments of Clay Shooting Targets” and replaces this section of the previous PAH case study. The paper may be accessed free of charge here.

11.7.3 Use of the Bioavailability Study at the Site

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PCL values are used by the State of Texas as regulatory cleanup levels, at sites addressed under CERCLA they may be

Applicable or Relevant and Appropriate Requirements (ARAR) values. Allowances are made in the TRRP regulations for using site-specific data for bioavailability to develop and propose Tier 2 PCLs for approval by the TCEQ. The process for developing the PCLs and the RBA methodology were reviewed by the TCEQ and the results of the study used to develop Tier 2 PCLs which were approved by the TCEQ. TCEQ personnel were updated on the status of the bioavailability assessment as it progressed.

When site documents were prepared the TCEQ Commercial Land Use Tier 1 value for BaP was 2.4 mg/kg and the proposed Tier 2 PCLs the Former Foster AFB was 16.1 mg/kg. However, in 2017 USEPA revised its toxicological assessment of BaP and revised its slope factor (USEPA 2017f). When this value is used TCEQ PCL algorithms, the Tier 1 PCL is 17 mg/kg and the proposed Tier 2 PCL is 43 mg/kg. Impacts to the remediation footprint at the site from PCL value changes, due to the toxicity value changes, have not yet been determined.

11.7.4 How Might Bioavailability Results Affect Site Decisions?

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A draft Focused Feasibility Study for the former skeet range used the Tier 2 PCLs as remediation goals, and reduced the footprint required for remediation of PAHs by an asphalt cover. The planned remediation at the site is an asphalt cap over contaminated soils. Use of the Tier 2 PCL values will reduce area requiring remediation by about one third, from 49,000 ft^2 to 29,400 ft^2 which if accepted by the state, will save the project approximately $200,000, which is less than the cost of $450,000 for the design, performance and documentation of the Former Foster AFB Pilot and Main Studies. Note that areas requiring remediation using Tier 1 and Tier 2 PCLs are mapped in the draft Former Foster AFB, Focused Feasibility Study (FFS), (USACE 2016). This estimate assumed proportional increase in remediation construction and operation costs of $300,000 as estimated in the FFS. The FFS was prepared prior to USEPA toxicity values for BaP being revised to less conservative levels for carcinogens as discussed above. The impact on actual remediation at the site has not yet been determined. However, use of bioavailability studies at another Formerly Used Defense Site in Texas will have a significant impact, see below.

Results of the bioavailability assessment will be brought to attention of project teams, regulators and stakeholders for consideration at other former skeet target ranges whose activities are overseen by the USACE. Another former range in Texas with residential properties applied the same RBA approach, as the Former Foster AFB site, and the Texas TCEQ approved its Remedial Investigation shortly before publication of this ITRC document. Using the PAH oral RBA described above and also results from studies of skeet target fragment dermal absorbed fraction, the residential Tier 2 PCL approved by the TCEQ is 19 mg/kg for BaP, the default Tier 1 BaP PCL value is 4.1 mg/kg. A Feasibility Study has not yet been prepared, however, data indicate that use of Tier 2 PCLs for PAHs as remediation goals at this residential site may result in elimination of remediation by excavation at 20 out of 25 properties that are above Tier 1 (default) PCL values.

USACE experience with remediating similar properties indicates that cost savings may total over $6.5 million for this former skeet target range. Costs for remediation completed in 2005 of residential soils contaminated with arsenic to 2 ft at a USACE managed Formerly Used Defense Site, included excavation and hauling of contaminated soils, restoration of the yard, including hardscape and landscape replacement. Average costs for the projects were reported on a basis of grids of 20 ft x 20 ft x 2 ft and applied as appropriate to accessible soils of the Texas site to a depth of 6 ft. Extra costs were included for the increased depth of contamination; estimated cost /residence is $324,000. It is not yet known whether it will be necessary to shore any home’s foundations or relocate residents during the remediation which would increase the estimate for each residence.