

# 1 INTRODUCTION

The Gila River Indian Community (GRIC) Department of Environmental Quality (DEQ) requested assistance from the U.S. Environmental Protection Agency (EPA) Region 9 Emergency Response Section (ERS) with the assessment, removal and/or remediation of toxaphene-contaminated soil at the Gila River Toxaphene Boundary Site (Boundary Site). The ERS, under the authority of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) and the Superfund Amendment and Reauthorization Act of 1986 (SARA), directed the Ecology and Environment, Inc. (E & E) Superfund Technical Assessment and Response Team (START) to conduct a removal assessment at the Boundary Site, located on the Gila River Indian Reservation in Arizona. The purpose of the assessment was to determine the magnitude and extent of toxaphene contamination at the site and to determine volumes of soil requiring removal or treatment.

This report describes field activities conducted from October 21 through October 25, 2002 by the START for the EPA, and the results of those activities. The specific field sampling and chemical analysis information pertaining to this assessment is addressed in the *Gila River Toxaphene Boundary Site - Removal Assessment Field Sampling Plan and Quality Assurance Sampling Plan (SAP)*, October 2002.

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## 2 SITE BACKGROUND

### 2.1 Site Location

The Boundary Site is located on the boundary of the GRIC along the west side of 51<sup>st</sup> Street near the intersection of 51<sup>st</sup> and Komatke Lane (Figure 2-1, Site Location Map). The site is approximately 2 ½ miles northeast of the Gila River and approximately ½ mile west of Phoenix South Mountain Park in Section 20, Township 1 South, Range 2 East of the Gila and Salt River Baseline and Meridian. The geographic coordinates of the site are 33E 19' 30" north latitude and 112E10' 06" west longitude.

### 2.2 Site Description

The Boundary Site assessment studied an approximately 13 acre area, that includes parts of Allotment Parcels 4569B, 4776B and 4776A, immediately west of 51<sup>st</sup> Street at the northern edge of the GRIC boundary, (Figure 2-2, Site Map). The assessment area encompassed two residential parcels, the Yazzie Homesite and the Thomas Homesite (shown on the cover illustration), and the area directly across the GRIC boundary northeast of and adjacent to the Thomas Homesite. An airstrip, that extends southwest from the site, terminates between the Yazzie and Thomas Homesites and a shallow concrete drainage channel runs roughly parallel with the airstrip along the northwestern side of the site.

The Thomas Homesite is currently vacant with the exception of the ruins of a building in the central portion of the site and debris along the southern edge of the site. A soil cap on the Thomas Homesite, installed after an EPA removal in 1985, has experienced significant disturbance - an approximately 3,280 ft<sup>2</sup> portion of the cap was removed near a building pad, a 9 ft<sup>2</sup> pit exists adjacent to the building ruins, and various post holes and erosion rills are present in the cap. The Yazzie Homesite is vacant, although pipes, evidence of a septic system and former utility service, were observed by the START..

### 2.3 Site History

The site was used by crop dusters as a base of operations from 1959 until the early 1980s. Crop dusters used the airstrip that terminates between the Yazzie and Thomas Homesites and planes reportedly “blew-out” residual pesticides at the end of the airstrip. Aerial photographs documented what appeared to be a turnaround area for planes on the Thomas Homesite and

parking of planes on the Homesite's northern edge as well as adjacent to the northwest corner of the Yazzie Homesite. Additionally, work areas, buildings and storage areas for the crop dusters were located on a parcel northeast of the Thomas Homesite. An above ground storage tank, presumably for fuel, was documented in a 1972 aerial photograph but is no longer present.

## 2.4 Previous Investigations

In 1984, the EPA ERS conducted a CERCLA emergency removal action, excavating soil on the Thomas Homesite with toxaphene concentrations greater than 1,000 milligrams per kilogram (mg/kg). Soil that remained in place was treated *in-situ*, initially by adjusting the pH, and watering and turning the soil to enhance natural attenuation. Later, more active soil bioremediation was conducted: the site was leveled, soil was neutralized and nutrients were added to it, a drip irrigation system was installed, and the site was covered with plastic sheeting to enhance anaerobic biodegradation processes. After this treatment, estimated to have reduced toxaphene levels by 45 percent, the site was capped with 200 yd<sup>3</sup> of soil. No plan for maintenance of the cap was instituted.

In 1996, URS Greiner, Inc. (URS), a contractor for the EPA States, Tribes and Site Assessment Office, conducted a CERCLA Site Inspection of the Boundary Site. Five soil samples were collected from the soil cap on the Thomas Homesite; toxaphene concentrations ranged from not-detected to 17 mg/kg. URS collected samples from 52 locations on the Yazzie Homesite and along the northeastern end of the airstrip. In the absence of complete information, these samples are all assumed to be surface soil samples. Results documented toxaphene levels ranging from 0.7 to 830 mg/kg. Toxaphene concentrations in 13 of the samples from this investigation exceeded the Arizona non-residential soil remediation level (NR-SRL) of 17 mg/kg; these samples and two additional samples exceeded the residential-SRL (R-SRL) of 4 mg/kg. In addition, 4,4'-DDD was identified in one sample at 12 mg/kg, 4,4'-DDE was detected in 19 samples at concentrations ranging from 0.02 to 7.2 mg/kg, chlordane was detected in 19 samples at concentrations ranging from 0.027 to 12 mg/kg, endosulfan sulfate was detected in one sample at 0.045 mg/kg, and endrin aldehyde was detected in two samples at 0.079 and 0.14 mg/kg. Chlordane was documented in five samples at concentrations that exceeded the R-SRL; no other compounds exceeded any SRLs.

In January and February 2002, GRIC DEQ conducted additional sampling that, in general, confirmed the 1996 data. The thirteen Yazzie Homesite samples were collected from 0.5 to 1

foot below ground surface (bgs); samples from the cap at the Thomas Homesite samples were collected at either 0.5 to 1 foot bgs or 2 to 2.5 feet bgs. At one location on the Thomas Homesite, samples were collected at 0.5 to 1 foot bgs, 2 to 2.5 feet bgs and 5 to 5.5 feet bgs; toxaphene was documented at 18, 130 and <0.2 mg/kg, respectively, in these intervals.

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### 3 FIELD ACTIVITIES

Field work was conducted for this removal assessment from October 21 through October 25, 2002; immunoassay analysis of samples continued off site through October 31, 2002. START field activities consisted of establishing a sampling grid, mapping the site using a global positioning system (GPS), oversight of Geoprobe™ drilling, collecting soil samples, and field analysis of samples using immunoassay technology. Photographic documentation of START activities is included in Appendix E.

#### 3.1 Deviations from the Sampling and Analysis Plan

All work was conducted in accordance with the SAP dated October 2002 with the following exceptions:

- **Section 3.3 Action Levels** - Due to the magnitude and extent of contamination documented at the site during the assessment, the action level for toxaphene used for on-site analysis by immunoassay was changed from the EPA Preliminary Remediation Goal (PRG) of 2.2 mg/kg for industrial soil to the Arizona NR-SRL of 17 mg/kg.
- **Section 4.1 Sample Locations and Figure 4-1** - Due to inaccurate reports of site dimensions, the initial grid established on-site consisted of 100 grid nodes from which samples were collected, rather than 40 grid nodes specified in the SAP. Because of the significantly increased size of the assessment area and constraints imposed by the limited supply of immunoassay test kits, it was not possible to bound contamination at each grid node. West of grid line 9, samples were collected from every other grid node and the nodes sampled on lines 10, 11 and 12 were staggered. Sampling was halted at grid line 12 at the instruction of the On-Scene Coordinator (OSC). South of grid line A, three additional grid lines were established, Z, Y and X. Line Z was not sampled, every other node was sampled on line Y, and samples were collected at four grid nodes on line X to bound contamination. The SAP specified that if samples from two adjacent nodes in a grid section exceeded the action level but samples from the other two nodes did not, then a sample would be collected from the center of the grid section. This was not done due to limitation previously cited.

- **Section 6.2 Underground Utilities Clearance** - The SAP stated that a thin metal rod would be used to probe the top 3 to 4 feet of soil at each sample location. This was not done; the undeveloped nature of the majority of the study area and information from Blue Stake, that utility lines did not run onto the property from the utility lines located along 51<sup>st</sup> Street, obviated the need for probing for utilities at each sample point.
  
- **Section 6.3 Sampling Procedures** - All sample intervals were collected with the Geoprobe™ although the SAP called for surface samples to be collected by hand auger or trowel. Samples were collected from seven intervals as directed in the SAP with the following exceptions:
  - < Grid node M2 - Refusal was encountered at 4.5 feet bgs and the boring was relocated approximately 5 feet north on transect line 2. However, instead of collecting samples from all intervals again at this location as directed in the SAP, only the 3.5 to 4 foot, 4.5 to 5 foot and 5.5 to 6 foot sample intervals were collected from the relocated boring and submitted for analysis with the upper four interval samples from the original boring.
  - < Grid node G9 - The boring collapsed during sampling and a new boring was established 5 feet south on transect line 9. As above, only the 3.5 to 4 foot, 4.5 to 5 foot and 5.5 to 6 foot sample intervals were collected from the relocated boring and submitted for analysis with the upper four interval samples from the original boring.
  - < Ditch 4 (located at the end of transect line M) - No sample was collected for the 3.5 to 4 foot interval; the sample log book states the interval was not recovered.
  - < Boreholes were not sealed with bentonite; boreholes collapsed immediately upon completion of sampling.
  
- **Section 6.4 Field Analysis Procedures** - The SAP directed that samples from grid nodes from areas previously documented as being contaminated would be analyzed first and that the first two sample intervals from each location would be analyzed. Because the size of the study area increased significantly from the area defined in the SAP, the order in which samples were analyzed was changed in the field. Transect line 1 samples were analyzed first to define the eastern boundary of the site, then samples from transect line 7 were analyzed to begin defining the western boundary of the site. At some sample locations, if field data documented toxaphene concentrations significantly greater than

the action level in the surface sample, then the 1.5 to 2 foot sample was analyzed rather than the 0.5 to 1 foot sample.

- **Section 9.1.1.2 Field Analysis Duplicates** - Nine to twelve of each of the four types of field analysis duplicates were called for in the SAP (approximately 15 percent of samples analyzed), however, based on field analysis results, the numbers of each type of duplicate were adjusted in the field. Six soil duplicates, seven filtered extract duplicates, ten diluted sample duplicates in the same analytical run, and 29 diluted sample duplicates in different analytical runs were analyzed. A total of 52 duplicate samples were analyzed, approximately 21 percent of the total sample number. In addition, once Performance Evaluation (PE) samples were received from the laboratory, PE samples were analyzed by the START with each field analysis run.
- **Section 9.1.4** - Background samples were collected at the request of the OSC to expand and verify background data collected in previous investigations. Surface (0 to 0.5 feet bgs) samples were collected at three locations southwest of the site (Figure 3-2, Background Sample Locations).

### 3.2 Sampling Activities

Soil sampling was conducted from October 21 through October 25, 2002. Under the authority of EPA OSC Donn Zuroski, the START conducted soil sampling and directed U.S. Coast Guard Pacific Strike Team (PST) members Douglas, Buletti and Virrez, who operated the Geoprobe™ direct-push drill rig. Also present on site during the sampling event were Harry Allen, EPA, Michael Daniels, GRIC DEQ, and Diane Hanna, GRIC DEQ.

The START established a grid with 65 by 65-foot sections over the study area; the initial grid, consisting of grid lines A to O and 1 to 8, encompassed approximately 7.8 acres (Figure 3-1, Sample Locations). The origin of the grid was located at grid node A1 (33E 19' 24.69948" north latitude and 112E10' 08.72907" west longitude). Sampling began on October 21<sup>st</sup>; two START members established the grid while another START member working with the PST began sampling. Soil cores were collected with a Geoprobe™ direct-push rig. Samples were collected from each boring location at seven depth intervals: 0 to 0.5 feet bgs, 0.5 to 1 foot bgs, 1.5 to 2 feet bgs, 2.5 to 3 feet bgs, 3.5 to 4 feet bgs, 4.5 to 5 feet bgs, and 5.5 to 6 feet bgs. Each sample

location was documented with a GPS unit. Sampling continued as described through October 25, 2002, with the exceptions noted in Section 3.1. The following table summarizes sampling activities for the field event:

<b>Table 3-1</b> <b>Sample Collection Summary</b> <b>Gila River Toxaphene Boundary Site</b>		
<b>Date</b>	<b>Number of Grid Locations</b>	<b>Number of Samples</b>
10/21/02	13	91
10/22/02	25	175
10/23/02	31	217
10/24/02	40	280
10/25/02	22	132
<b>Totals</b>	<b>131</b>	<b>895</b>

Once the initial sampling grid was completed on October 22<sup>nd</sup>, two START members established the field laboratory and began analyzing samples. Samples from the site were subsequently transferred to the field laboratory at mid-day and the end of each day. Field analysis activities are discussed in Section 3.3.

Based on results from field analysis, the sampling grid was expanded: grid lines 9 and P were added on October 23<sup>rd</sup>; grid lines X, Y, Z, 10 and 11 were added on October 24<sup>th</sup>; and grid line 12 as well as sample locations at the ends of grid lines K, L, M and N and the background samples were added on October 25<sup>th</sup> (Figure 3-2, Background Sample Locations). All sampling was completed on October 25, 2002, at which time the START, EPA and USCG demobilized from the site.

### 3.3 Field Analysis Activities

The START conducted field analysis of samples to delineate extent of contamination. Samples were analyzed using the RaPID Assay® cyclodienes immunoassay (IA) test kit. The START analyzed samples in the field from October 22 through October 25, 2002 and at the START warehouse in San Francisco from October 29 through November 4, 2002. The START analyzed

235 samples, 52 duplicate samples, and 4 background samples. In addition, once Performance Evaluation (PE) samples were received in the field from the laboratory, PE samples were analyzed with each IA analysis run (analytical runs 6 through 15).

Each analytical run consisted of a zero concentration sample, 0.1, 0.75 and 2.0 parts per million (ppm) cyclodiene standards (as dieldrin) and a 10 ppm control sample, all run in duplicate and up to 23 samples and QA samples. Results were calculated on Immunoassay Data Sheets for each run (Appendix A). Evaluation of QA samples (calculation of Relative Percent Difference [RPD] and Percent Coefficient of Variance [%CV]) was conducted as samples were analyzed. When RPD or %CV goals were not met, data was evaluated to determine where error may have occurred and samples were re-analyzed in another run when determined necessary (QA Calculation Sheet, Appendix B).

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## 4 ANALYTICAL RESULTS

The START submitted 37 samples, 3 duplicate samples and 1 PE sample to APPL, Inc. (APPL) in Fresno, California for analysis of chlorinated pesticides by EPA method 8081A. Among those samples submitted to APPL were one sample that had concentrations of toxaphene that were non-detect according to field analysis results, one sample at the level of each of the three IA calibration standards and one sample that exceeded the IA calibration range. Roughly equal numbers of samples analyzed by each of the two START analysts were submitted for definitive analysis.

### 4.1 Data Quality

All data generated by APPL was validated by a START chemist following *Quality Assurance/Quality Control Guidance for Removal Activities, Sampling QA/QC Plan Validation Procedures*, OSWER Directive 9360.4-1, April 1990. Data was found to be acceptable with qualification as definitive level data and determined to be usable to meet project data use objectives. The START data validation report along with complete, qualified summary data is included in Appendix C. IA data generated was reviewed by the START and found to be acceptable with qualification for project data use objectives. In the course of the review of IA data, the START identified that the wrong primary dilution factor (100x dilution was calculated instead of the correct 50x dilution) was used in calculations on the IA data sheets. Correction of this error affects all IA data reported previous to this report. Corrected data sheets with data qualifiers are included in Appendix A.

The START evaluated the field-generated IA data and laboratory data by linear regression analysis using Lotus1-2-3® (Appendix D). The correlation coefficient ( $R^2$ ) for all data within the calibration range of the IA test was 0.916 and the linear equation for the data is: Lab Data =  $0.86 \times \text{IA data} + (3.2)$ . The  $R^2$  value, the measure of the degree to which the two data sets show a linear correlation, indicates an excellent correlation between the two data sets. While the IA data set could be adjusted on the basis of the strong linear relationship with the lab data, the START does not recommend adjusting the IA data. The precision of the laboratory data was judged to marginally meet project data quality objectives due to low spike recovery for toxaphene and the fact that only one matrix spike/matrix spike duplicate pair for toxaphene was spiked at an adequate concentration for determination of recovery. These issues, as well as the fact that

toxaphene contamination tends to be highly heterogeneous within a sample (due to its tendency to strongly adsorb to soil and low mobility) which can cause dissimilarity in data, in START's opinion do not support adjusting the IA data.

## 4.2 Discussion of Results

The START compared the soil sample data to the EPA industrial PRG (I-PRG) and the Arizona R-SRL and NR-SRL to determine the extent of toxaphene contamination at the site. Summaries of both IA and laboratory data are presented in Table 4-1 and data is presented graphically by interval in comparison to action levels in Figures 4-1 through 4-6.

Toxaphene concentrations exceeding all action levels were documented over the majority of the site in surficial soils (0 to 0.5 feet bgs) and at the 0.5 to 1 foot bgs interval (Figures 4-1 and 4-2). Toxaphene concentrations in the 1.5 to 2 foot bgs interval samples exceeded action levels primarily in the northeast quadrant of the site with a few points that exceeded action levels in the southwest quadrant (Figure 4-3). By the 3.5 to 4 foot bgs the only areas of contamination exceeding action levels were documented along the eastern side of the site in rows 1 and 2 of grid lines F through P (Figure 4-5). The areas of elevated toxaphene contamination to depth correspond to the location of the crop dusting facility and are consistent with reports that planes "blew-out" residual pesticides in the area at the end of the airstrip. The fact that most contamination is limited to near surface soils is consistent with the properties of toxaphene: it strongly adsorbs to soil and has low water solubility.

Toxaphene was documented at low levels in the three background samples collected southwest of the site. Laboratory data for the background samples ranged from 0.14 to 4.4 mg/kg and IA data ranged from non-detect to 2.8 mg/kg. These results are consistent with reports from the GRIC DEQ that toxaphene concentrations in areas surrounding the site range from 2 to 5 mg/kg.

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## 5 POTENTIAL AREAS OF EXCAVATION AND/OR TREATMENT

The START determined grid sections that may require excavation and/or remediation and the depth of excavation for each section based upon the data from this assessment. For estimation purposes, it was assumed that if a grid node exceeded the action level then all grid sections surrounding that node would be excavated. The actual area excavated could be decreased with further field testing at the time of excavation or treatment implementation. Table 5-1 lists the volume of soil, by interval, that may require excavation and/or treatment for each action level. Proposed excavation areas for grid sections exceeding the NR-SRL are shown in Figures 5-1 through 5-6, the R-SRL are shown in Figures 5-7 through 5-12, and the I-PRG are shown in Figures 5-13 through 5-18.

<b>Table 5-1 Excavation and/or Treatment Volumes Gila River Toxaphene Boundary Site</b>							
Action Level	Volume to be Excavated/Treated by Interval <sup>1</sup>						Total Volume
	0 - 0.5	0.5 -1	1.5-2	2.5-3	3.5-4	4.5-5	
<b>NR-SRL<sup>2</sup> - 17 mg/kg</b>	8,055	15,806	3,443	1,878	1,252	626	<b>31,060</b>
<b>R-SRL<sup>3</sup> - 4 mg/kg</b>	11,182	21,127	9,077	4,225	2,191	1,878	<b>49,680</b>
<b>I-PRG<sup>4</sup> - 2.2 mg/kg</b>	12,356	25,040	12,207	4,538	4,538	3,599	<b>62,278</b>

<sup>1</sup> Excavate/treat to start of next interval where: Volume = cubic yards and Intervals = feet below ground surface  
<sup>2</sup> Arizona Non-Residential Soil Remediation Level  
<sup>3</sup> Arizona Residential Soil Remediation Level  
<sup>4</sup> EPA Region IX 2002 Preliminary Remediation Goal for industrial soil

Given the volumes of soil potentially requiring excavation and/or treatment, it is not feasible to conduct *ex situ* bioremediation of the contaminated soil in treatment cells. The soil volume alone, excluding amendments, for soil contaminated above the NR-SRL would necessitate approximately 14 cells with dimensions of 100 feet by 100 feet by 6 feet; this would exceed the areal extent of the current site.

Background data from this investigation, which documented toxaphene up to 4.4 mg/kg, and information from the GRIC DEQ that concentrations of toxaphene up to 5 mg/kg have been documented on surrounding properties indicate that the EPA I-PRG, and possibly the Arizona R-SRL, are unsuitable removal/treatment action levels for this project.