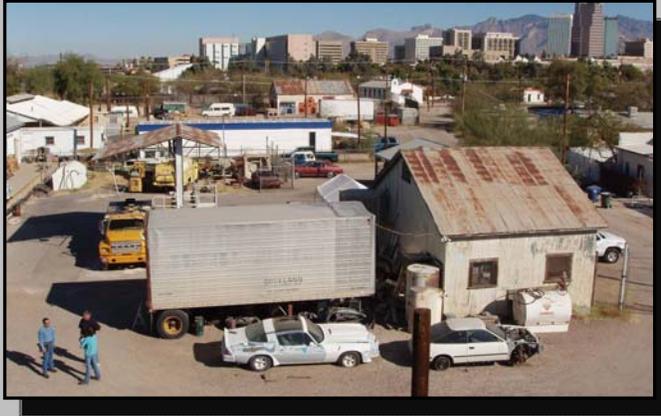


SCS ENGINEERS



Brownfields Site Assessment Summary

**Former Flint Oil Property
505 (500, 511, or 527)
West Simpson Street
Tucson, Arizona**

Presented to:

**City of Tucson
Environmental Services
Engineering & Technical Support
Brownfields Program**



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INTRODUCTION

Flint Oil is located in the heart of the Barrio Viejo Neighborhood in downtown Tucson, Arizona. The neighborhood is heavily involved in the revitalization of downtown Tucson and has a strong interest in the redevelopment activities planned for the site and surrounding area. The site is one of a number of Brownfields projects located in and around downtown, including the warehouse district, the railroad and various spurs, vacant/abandoned inner city structures and businesses, and closed Rio Nuevo landfills. Once the Flint Oil property is remediated it could be home to residential or commercial developments that are planned to revitalize the area around the downtown Tucson Convention Center.

The site was occupied by fuel and oil distributors for more than 80 years. In order to evaluate the site for potential impacts from many years of storage and/or use of bulk oil, fuel, solvents, and other materials on the site, several phases of environmental investigations were performed as part of the site characterization activities, including a Phase I Environmental Site Assessment (ESA), several surface and subsurface soil sampling investigations, a geophysical survey, and waste characterization of concrete pads. The buildings on the site have been demolished, except for an historic office structure that may have been originally built and occupied by the railroad in the early 1900s. This report documents investigations performed on the site to date.

PHASE I ENVIRONMENTAL SITE ASSESSMENT (OCTOBER 2006)

A Phase I ESA was performed to evaluate the existing and historical conditions on the site to identify evidence of recognized environmental conditions (RECs) (SCS 2006). Historical information reviewed indicated that the site was deeded to Southern Pacific Company, later called Union Pacific Company, by the City of Tucson in 1879. The railroad company owned the site until 2002, at which time the site was deeded back to the City of Tucson. At least three bulk distributors of fuel, oil, and associated products leased and occupied the site from about 1925 to 2007, the most recent of which was Flint Oil Company, beginning in 1960.



At the time the Phase I ESA was performed, the site was occupied by Flint Oil Company, and contained an office building, a shop garage used for maintenance and vehicle repairs, a warehouse and canopy on an elevated concrete platform, a garage used for storage, and vehicles and equipment. Vent pipes and pumps for three 6,000-gallon new oil underground storage tanks (USTs) installed in 1983 and removed in 1999 were still located on the northern portion of the site; a report in fire department files indicated that soil samples collected beneath the USTs following their removal and closure did not show evidence of a release of petroleum hydrocarbons.

Seven 12,500- to 25,000-gallon vertical aboveground storage tanks (ASTs) on concrete pads and three concrete pads for former ASTs were located on the southern portion of the site. Five of the ASTs were used for diesel fuel and gasoline and two former solvent ASTs were no longer in use. A loading rack was located in the central portion of the site. Six other ASTs (less than 1,000-gallon sizes) for unleaded gasoline, new oil, and used oil were also on the site. In addition, prior to 1974 the three vacant concrete AST pads were occupied by ASTs and there were up to five additional ASTs at the current location of the storage garage.



Approximately 200 drums for various kinds of fuel and oil were observed on the property; more than half of these drums were

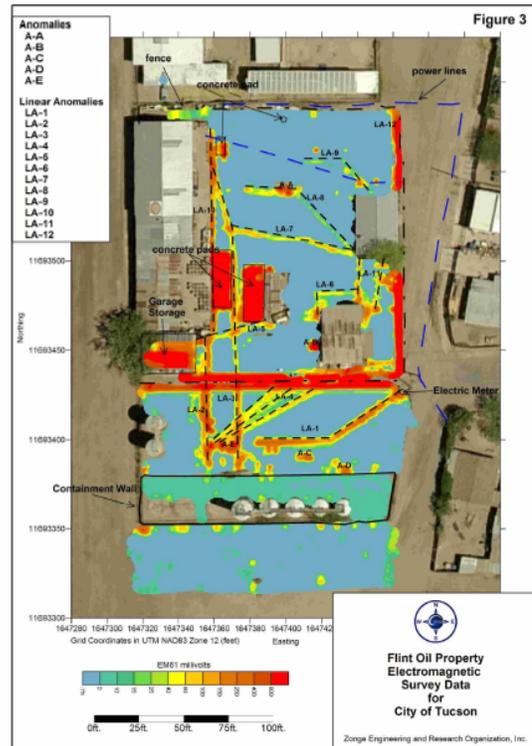


empty, and were stored and returned to the supplier for conditioning and refilling. A variety of other materials were observed in use or stored on the property, such as vehicle batteries, paint, refrigerants, aerosols, antifreeze, cleansers, and grease and other lubricants.

Stained soil or pavement was observed at the fill ports for the five vertical fuel ASTs, at one of the AST pumps, at three new oil ASTs on the elevated platform, in the shop garage, around the stack of empty drums on the southern portion of the property, on the elevated platform, in the warehouse, and on the asphalt pavement in the northern portion of the property.

GEOPHYSICAL SURVEY (FEBRUARY 2008)

A geophysical survey was performed on the site in February 2008 in order to identify subsurface features of potential concern, including locations of underground piping, unknown USTs, and possible septic systems, cesspools, or other sewage disposal features that may have been associated with non-residential use (Zonge 2008). The site was no longer occupied at the time the geophysical survey was performed, and the ASTs, vehicles, and other equipment had been removed from the site. The survey identified several linear anomalies that were interpreted to be buried utilities. Five isolated anomalies were identified, but none were deemed large or strong enough to be interpreted as a buried UST. Some of these were found to correspond to known features, such as piping clusters or other surface metal.



SURFACE SOIL SAMPLING ACTIVITIES (FEBRUARY TO SEPTEMBER 2008)

Initial surface soil sampling was performed in February 2008 to investigate the nature and extent of potential impacts to soil associated with areas of observed staining, former drum storage areas, former fuel or other product fill or dispenser locations, vehicle maintenance garages, areas adjacent to the warehouse platform, runoff areas, and locations of ASTs and associated equipment (SCS 2008). Additional phases of sampling were performed in July, August, and September 2008 to further investigate the nature and extent of potential impacts to soil based on the results of the previous sampling investigations (SCS 2009a).



A total of 77 grab surface soil samples were collected during these investigations. Hydrocarbon odors, surface staining, or thick oily material was observed at several locations. The samples from the initial investigation were analyzed for hydrocarbons, polynuclear aromatic hydrocarbons (PAHs), eight total RCRA metals, volatile organic compounds (VOCs), and semi-VOCs (SVOCs). Subsequent samples were analyzed using these analyses or a selected subset of these analyses based on which compounds had been detected in previous samples.

Compounds detected in the samples included hydrocarbons; the PAHs anthracene, chrysene, fluoranthene, benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[g,h,i]perylene, indeno[1,2,3-cd]pyrene, and pyrene; and the metals arsenic, barium, cadmium, chromium, lead, and mercury. The VOC and SVOC analyses did not identify detected compounds in the analyzed samples.

The laboratory analytical results for these and subsequent samples were compared to the current Arizona Residential Soil Remediation Levels (RSRLs) and Non-Residential Soil Remediation Levels (NRSRLs). Three levels of RSRLs are currently in use, depending on whether or not the compound is a non-carcinogen (RSRL), suspected or known carcinogen (10^{-5} and 10^{-6} RSRL), and whether the current or currently intended use of the property is a school or childcare facility (10^{-6} RSRL). Because the future use of the site is not known, the sample results were compared to all RSRL risk levels. There are currently no Arizona RSRLs or NRSRLs for hydrocarbons, total chromium, or benzo[g,h,i]perylene. The arsenic RSRLs and NRSRL are the same concentration.

Thirty-two of the samples had concentrations of compounds that exceeded the current RSRLs or NRSRLs. The NRSRLs were exceeded for arsenic (12 samples), lead (5 samples), and benzo[a]pyrene (1 sample). The non-carcinogen RSRLs were exceeded for lead (8 samples) and cadmium (1 sample). The 10^{-5} RSRL was exceeded for benzo[a]pyrene (2 samples). The 10^{-6} RSRLs were exceeded for benzo[a]pyrene (10 samples), indeno[1,2,3-cd]pyrene (2 samples), benz[a]anthracene (1 sample), and benzo[b]fluoranthene (1 sample).

TRENCHING AND SHALLOW SUBSURFACE SOIL SAMPLING (FEBRUARY TO SEPTEMBER 2008)

Twenty backhoe trenches were excavated at selected locations on the site in August 2008 (SCS 2009a). Trenches were placed in identified areas of concern and in areas with previous surface soil sample results that exceeded Arizona SRLs. The trench depths ranged from about 2 to 3 feet below ground surface (bgs). Five soil samples were collected from the floor of selected trenches based on field observations and previous surface soil sample results. In September 2008, six samples were collected at three locations adjacent to former ASTs in the south portion of the site using a hand auger at depths of 0.5 and 1 foot bgs. In February and September 2008, three soil samples were collected from two existing excavations adjoining the former loading rack at depths of 2 and 5 feet bgs. In general, no evidence of odors or staining was observed in the trenches or other shallow subsurface locations other than previously identified surface staining.



Fourteen samples were collected during these investigations. Selected samples were analyzed for hydrocarbons, PAHs, total RCRA metals, VOCs, and/or SVOCs. No PAHs, VOCs, or SVOCs were detected in the samples analyzed for these compounds. Compounds detected in the samples included hydrocarbons, arsenic, barium, chromium, lead, and mercury. The NRSRL for arsenic was exceeded in three samples at 0.5 and 1.0 feet bgs adjacent to the former ASTs on the south portion of the site.

SOIL BORINGS (NOVEMBER 2008)

In order to evaluate deeper subsurface soil at selected locations throughout the site, a total of 15 direct push soil borings were performed in November 2008 at or adjacent to locations of concern. Continuous soil cores were collected from ground surface to 15 feet bgs, except for one boring that had refusal at 13.5 feet bgs and two borings that were drilled to 20 feet bgs because there were field indications of impacts to soil at 15 feet bgs.



One soil boring located near an apparent port for the former ASTs on the south portion of the site exhibited strong hydrocarbon odors at 15 feet bgs and faint hydrocarbon odors at 10 and 20 feet bgs. Faint hydrocarbon odors were also detected in several other borings at depths between 5 and 15 feet bgs. Based on field observations, one to four samples were collected from each boring at selected 5-foot depth intervals for a total of 28 soil samples. Selected samples were analyzed

for hydrocarbons, PAHs, arsenic and lead, VOCs, and SVOCs based on the previous results for surface samples at that location and field indications of odors in the borings.

Detected compounds in the samples included hydrocarbons; the PAHs benzo[a]pyrene, indeno[1,2,3-cd]pyrene, benz[a]anthracene, pyrene, fluoranthene, fluorene, naphthalene, and phenanthrene; and arsenic and lead. Four of the samples, collected at depths of 5 and 15 feet bgs, had concentrations of compounds that exceeded the current RSRLs or NRSRLs. The NRSRL was exceeded in one sample for arsenic. The 10^{-6} RSRLs were exceeded for benzo[a]pyrene (1 sample) and for benz[a]anthracene (2 samples).

In addition, one of the samples from 15 feet bgs contained VOCs (ethylbenzene, n-butylbenzene, sec-butylbenzene, 4-isopropyltoluene, naphthalene, n-propylbenzene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and total xylenes) and SVOCs (2-methylnaphthalene, naphthalene, and phenanthrene). None of the detected VOCs or SVOCs exceeded the SRLs. None of the other surface or subsurface samples collected on the site and analyzed for VOCs or SVOCs contained detectable concentrations of these compounds.

DEMOLITION ACTIVITIES (APRIL 2009)

SCS observed demolition activities at the site in April 2009 in order to limit disturbance to areas that contained known soil contamination by lead, arsenic, and PAHs, to monitor dust control measures, and to observe the demolition areas for evidence of staining or odors that could indicate additional areas of contamination (SCS 2009b). The former warehouse, two former garage structures, utility pipes and conduits, asphalt pavement, and concrete pads were demolished and removed for disposal. A hydraulic lift cylinder in the former shop garage, a drain in the former storage garage, and a former below ground wastewater drainage feature west of the shop garage were excavated. No indications of contamination were observed in association with these features. Asphalt pavement north and east of the shop garage was left in place due to the elevated concentrations of lead and arsenic in those areas.



Areas disturbed by demolition activities were smoothed out and graded by the contractor. The soil remaining from beneath the elevated concrete pad for the former warehouse was left in place, although some of the soil was used to fill low areas or areas that were excavated. The contractor also graded areas overgrown with weeds on the site.

SCS previously collected three composite samples of concrete pads on the site in July 2008 for waste characterization purposes (SCS 2009a). The samples were analyzed using the toxicity characteristic leaching procedure (TCLP) for lead and arsenic, both of which occur at elevated concentrations in soil on the site. There are no toxicity characteristic levels for PAHs, which were also present in soil on the site. Lead and arsenic were not detected above the laboratory reporting limit for the TCLP in the three samples. Therefore, these samples did not exceed the TCLP threshold level for arsenic or lead and the concrete would not be considered hazardous based on the toxicity characteristic for those metals.

SCS collected four samples from the soil fill beneath the elevated warehouse concrete pad, one sample from beneath the hydraulic lift cylinder in the shop garage, one sample from beneath the floor drain of the storage garage, and one sample from beneath the subsurface wastewater drainage feature. The samples were analyzed for hydrocarbons, PAHs, eight total RCRA metals, and VOCs. The two samples from the hydraulic lift and the floor drain were also analyzed for polychlorinated biphenyls (PCBs).

Hydrocarbons were detected in three of the elevated concrete pad samples, the hydraulic lift sample, and the wastewater drainage feature sample. The PAHs benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, fluoranthene, phenanthrene, and pyrene were detected in one sample from the elevated warehouse pad fill soil. The metals arsenic, barium, cadmium, chromium, lead, and mercury were detected in the samples. None of the detected compounds exceeded SRLs; there are no current SRLs for hydrocarbons. VOCs and PCBs were not detected above the laboratory reporting limits.

SOIL BORINGS AND SURFACE SAMPLE COLLECTION (JUNE 2009)

A direct push drill rig was used to perform 19 soil borings to maximum depths of 5 feet bgs and three borings to maximum depths of 10 feet bgs at the site in June 2009 (SCS 2009b). In addition, SCS collected three surface soil samples south of the former Flint Oil property. The borings and sample locations were selected to define the extent of soil impacted by PAHs, lead, and arsenic above Arizona SRLs along the former Flint Oil property boundaries, the area south of the property boundary, in an area where a bottom sample was not previously defined, and in areas that were covered with pavement prior to demolition activities.



Continuous soil cores were collected to the total boring depths. Soil samples were collected from surface or near surface soil and from 5 feet below grade in 19 borings. At these locations, samples were collected from surface soil if it did not appear to be disturbed by demolition activities. If the surface soil appeared

disturbed, the sample was collected from immediately below the disturbed interval. In two borings, the sample was collected from below the surface asphalt layer at 0.5 feet bgs. In addition, soil samples were collected from 5 feet bgs and 10 feet bgs in three borings. Two samples were collected from each of the 22 borings for a total of 44 soil samples.

Evidence of staining or odors was not observed in the borings. The depth of disturbed soil at locations where there had been removal of pavement, grading, or addition of soil during demolition activities ranged from approximately 0.5 to 2 feet bgs. The borings located northeast and east of the former shop garage contained a layer of asphalt pavement at the ground surface; one boring also had a second layer of asphalt at about 2.5 feet bgs.

Compounds detected in the samples included the PAH benzo[a]pyrene and the metals arsenic and lead. Four surface samples and one sample from 5 feet bgs contained detectable

concentrations of benzo[a]pyrene; these concentrations exceeded the 10^{-6} RSRL. Arsenic was detected in all but three of the 44 samples, with two samples at 5 feet bgs exceeding the RSRL and NRSRL. Lead was detected in all of the 44 samples; the concentrations did not exceed the SRLs in any of the samples.

BROWNFIELDS GRANT RESULTS

The Brownfields EPA Grant was used to characterize the Flint Oil property in order to identify areas that could present a threat to human health or the environment. This characterization was necessary in preparation for redevelopment under the Rio Nuevo Downtown Redevelopment Project. The investigations indicated that areas of the site contain arsenic, lead, cadmium, and PAHs above the Arizona SRLs.

Arsenic exceeded the RSRL and NRSRL at the ground surface in areas east of the elevated platform, east and northeast of the shop garage, and in the AST area on the south portion of the site. The lateral extent of contamination has generally been defined in most of these areas. Five locations exceeded the RSRL and NRSRL in the subsurface at depths ranging between 0.5 to 5 feet bgs; the lateral and vertical extent of contamination at these subsurface sample locations is partially defined. The vertical extent was not defined at six locations where the surface soil sample concentrations exceeded SRLs and subsurface soil was not sampled; however, the vertical extent at these locations is not expected to extend deeper than 0.5 to 5 feet bgs.

Lead exceeded the RSRL and/or NRSRL at the ground surface in areas east of the elevated platform; north, east, and south of the storage garage; north and northeast of the shop garage; and in the AST area on the south portion of the site. The lateral extent is generally defined in most of these areas. Lead did not exceed the SRLs in subsurface soil samples. The vertical extent of lead contamination was less than 0.5 to 5 feet bgs at eight locations. The vertical extent was not defined at five locations where surface soil sample concentrations exceeded SRLs and subsurface soil was not sampled; however, the vertical extent at these locations is not expected to extend deeper than 0.5 to 5 feet bgs.

Cadmium exceeded the RSRL at one surface location west of the shop garage; cadmium was not detected in subsurface soil samples. The lateral extent of contamination was generally defined, but the vertical extent was not determined; however, it is not expected to extend deeper than 2 to 5 feet bgs.

The PAH benzo[a]pyrene exceeded the NRSRL at one surface sample location in the north-central portion of the site. Two surface samples in the southeast and central portions of the site exceeded the 10^{-5} RSRL for benzo[a]pyrene. Fourteen surface soil samples in the northwest, central, southwest, and southeast portions of the site contained benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, and/or indeno[1,2,3-cd]pyrene above the 10^{-6} RSRL. It should be noted that the RSRLs for the 10^{-6} risk level only apply to known human carcinogens (which were not detected above the 10^{-6} RSRL) and to those sites where the current or currently intended use is a school or child care facility.

The lateral extent of PAH contamination is defined in most areas on the site, but was not defined in three areas where it may extend off the Flint Oil property. The vertical extent of PAHs exceeding the SRLs was less than 5 feet bgs at three locations, less than 10 feet bgs at two

locations, and less than 15 feet bgs at one location. The vertical extent was not defined at 13 locations where surface soil sample concentrations exceeded SRLs and subsurface soil was not sampled; however, the vertical extent at these locations is not expected to extend deeper than 5 to 15 feet bgs, and is likely shallower.

At three locations, surface sample concentrations of PAHs did not exceed SRLs, but benzo[a]pyrene and benz[a]anthracene in deeper samples exceeded the 10^{-6} RSRLs. The vertical extent of contamination at these locations was between 0.5 to 10 or 15 feet bgs and between 10 and 20 feet bgs. The vertical extent was not defined at one location, but is expected to be less than 20 feet bgs. At these three areas, the lateral extent of subsurface contamination may not be completely defined.

Based on the distribution of soil contamination on the site, contamination due to PAHs versus lead, arsenic, and cadmium generally occurs in different portions of the site, with some overlap. The reason for this is likely due to use and storage of different types of materials in different portions of the site, and the fact that arsenic may be due to naturally-occurring background levels in some locations. In addition, although there was subsurface contamination by the PAH benz[a]anthracene at 15 feet bgs in two locations on the south portion of the site, only one surface sample contained this PAH above SRLs; it was not determined whether this location was related to the subsurface contamination.

Remediation of soil should be performed in those areas of the site that exceed SRLs. The cleanup level used should be determined by the COT based on the planned future uses of the property. Because the demolition activities performed on the site disturbed areas that contained concentrations of contaminants above SRLs, soil should be removed in those areas to the depth that they have been disturbed. Confirmation sampling should be performed during remediation to confirm the extent of contamination has been fully defined.



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