HOLLYFRONTIER.

December 30, 2015

Mr. John Kieling
Chief, Hazardous Waste Bureau
New Mexico Environmental Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505

RE: Submittal of the *SWMU/AOC Group 3 Additional Corrective Action Investigation Report – Revised* for the Navajo Refining Company, L.L.C., Artesia Refinery
RCRA Permit No. NMD048918817

Dear Mr. Kieling:

Enclosed is the *SWMU / AOC Group 3 Additional Corrective Action Investigation Report – Revised* for the Artesia Refinery. This revised report completely replaced the previous Additional Corrective Action Investigation Report documents the filling and capping of the Main API Separator (SWMU 22) and incorporates data obtained during installation of additional monitoring wells associated with SWMU 22. This report also provides updated screening of data from the other SWMUs included in Group 3 based on the most recent guidance document from the New Mexico Environment Department (NMED). The revised report is being submitted in both hard copy and electronic format.

If you have any questions or comments regarding this request, please feel free to contact me at 575-746-5487 or Robert Combs at 575-746-5382.

Sincerely,

Scott M. Denton
Environmental Manager
Navajo Refining Company, L.L.C.

c: Robert Combs, NRC
Pamela R. Krueger, ARCADIS

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Artesia Refinery

SWMU/AOC Group 3 Additional Corrective Action Investigation Report – Revised

RCRA Permit NMD048918817

December 2015

ARCADIS

Pamela R. Krueger
Senior Project Manager, Arcadis

SWMU/AOC Group 3 Additional Corrective Action Investigation Report - Revised

RCRA Permit NMD048918817

Prepared for:
New Mexico Environment Department,
Hazardous Waste Bureau

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Our Ref.:
TX000825.0005

Date:
December 2015

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Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Scott Denton
Environmental Manager, Navajo Refining Company, L.L.C.

List of Acronyms

ACAI	Additional Corrective Action Investigation
API	American Petroleum Institute
AOC	Area of Concern
bgs	below ground surface
CAI	Corrective Action Investigation
CBO	Carbon Black Oil
CGWSL	Critical Groundwater Screening Level
COC	Constituent of Concern
CSO	Clarified Slurry Oil
CSSL	Critical Soil Screening Level
CW	Construction Worker exposure scenario
DAF	Dilution Attenuation Factor
DRO	Diesel Range Organics
EPA	Environmental Protection Agency
FCC	Fluid Catalytic Cracker
ft	feet
GC/MS	Gas Chromatograph/Mass Spectrometer
GRO	Gasoline Range Organics
H_2S	Hydrogen Sulfide
HSWA	Hazardous and Solid Waste Amendments of 1984
IDW	Investigation Derived Waste
Ind/Occ	Industrial / Occupational exposure scenario
LPG	Liquefied Petroleum Gas
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
MTBE	Methyl-tert-butyl ether
NCL	North Colony Landfarm
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NRC	Navajo Refining Company, L.L.C.
ORO	Oil Range Organics
ORP	Oxidation-Reduction Potential
PIANO	Paraffins, Isoparaffins, Aromatics, Napthenes, and Olefins
PID	Photo-ionization Detector
PRG	Preliminary Remediation Goal
PSH	Phase-separated Hydrocarbons
PVC	Poly-vinyl chlorinated
RCRA	Resource Conservation and Recovery Act
RSL	Regional Screening Level

SSL	Soil Screening Level
SVOC	Semivolatile Organic Compound
SWMU	Solid Waste Management Unit
TEL	Tetra-Ethyl Lead
TPH	Total Petroleum Hydrocarbons
UST	Underground Storage Tank
UTL	Upper Tolerance Limit
VOC	Volatile Organic Compound
WQS	Water Quality Standards

Executive Summary

The Navajo Refining Company, L.L.C. (NRC) owns and operates the Artesia Refinery, located in Artesia, New Mexico. The facility has been in operation since the 1920's and processes crude oil into asphalt, fuel oil, gasoline, diesel, jet fuel and liquefied petroleum gas (LPG).

The Refinery is regulated under the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA). In October 2003, the Secretary of the New Mexico Environment Department (NMED) issued a Post-Closure Care Permit (Permit) to for the Refinery, which has U.S. Environmental Protection Agency (EPA) ID number NMD048918817 (NMED, 2003). A modified Permit was issued in December 2010 (NMED, 2010b).

Among other action items, the Permit authorizes and requires NRC (the Permittee) to conduct site investigations at Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) listed in the Permit. The purpose of each investigation is to evaluate for the presence, nature and extent of hazardous and regulated constituents pursuant to Section 20.4.1.500 of the New Mexico Administrative Code (NMAC). The Permit establishes the general and specific standards for these activities.

The SWMUs and AOCs included in the 2003 Permit were divided into three related groups of areas to efficiently address the investigation needs at each SWMU or AOC. SWMU / AOC Group 3 includes the following units:

- Clarified Slurry Oil (CSO) Tanks (SWMU 17)
- North Bundle Cleaning Pad (SMWU 20)
- South Bundle Cleaning Pad (SWMU 21)
- Main American Petroleum Institute API Separator (SWMU 22)
- South Alkylation Unit (SWMU 23)

A Corrective Action Investigation (CAI) was conducted in 2011 for SWMU/AOC Group 3 according to the approved CAI Workplan dated August 2010 (Arcadis, 2010). The findings from the 2011 investigations were presented in the AOC Group 3 Corrective Action Investigation Report (CAI Report) dated July 2011 (Arcadis, 2011). The CAI

Report was approved by NMED, with modifications, in a letter dated December 28, 2011 (NMED, 2011). Requested modifications to the CAI Report were made and submitted along with a comment response letter on March 12, 2012 (Arcadis, 2012a).

Based on the recommendations of the CAI Report, an Additional Corrective Action Investigation (ACAI) Workplan was developed and submitted to NMED on April 30, 2012 (Arcadis, 2012b). As stated in that workplan, the primary focus of the ACAI was to further delineate phase-separated hydrocarbon (PSH) and dissolved phase groundwater impacts identified during the CAI. The ACAI Workplan stated that the Main API Separator (SWMU 22) would be demolished and removed from the ground; however, upon further engineering review, it was determined that the removal of the below-ground concrete structure was not feasible. NRC discussed rescinding that portion of the ACAI Workplan with NMED prior to the NMED approval of that workplan. NMED requested additional evaluation of soil in the vicinity of the Main API Separator. A letter providing additional data evaluation for this SWMU was submitted to NMED in February 2013 (Arcadis, 2013a). In the approval with modifications letter regarding the ACAI Workplan (NMED, 2013), NMED suggested that additional investigation of SWMU 22 be deferred until access was more feasible.

The approved ACAI Workplan was implemented in 2013 and the ACAI Report was submitted to NMED in April 2014 (Arcadis, 2014). The ACAI report documented the investigation activities completed and the results of the soil, groundwater and PSH investigations at the Clarified Slurry Oil Tanks (SWMU 17) and the North Bundle Cleaning Pad (SWMU 20) conducted.

Among the recommendations stated in the ACAI Report, NRC committed to submittal of a workplan to install two additional monitoring wells within SWMU 22, per the NMED request. Preliminary utility clearance was performed and a letter workplan was for the installation of the requested wells was submitted to NMED on November 13, 2014 (HollyFrontier, 2014b). NMED provided approval, with modifications, to the well installation workplan in December 2014 (NMED, 2014b).

One of the modifications required by NMED was that instead of submitting an addendum to the ACAI Report following the well installation, NRC should submit a revised ACAI Report. The NMED requested that the revised ACAI Report be submitted no later than March 27, 2015. However, delays in well installation were encountered, as described in this report, and extensions to the submittal deadline were requested (HollyFrontier, 2015a and 2015b). NMED approved both extensions

(NMED, 2015a and 2015c), extending the submittal date for the revised ACAI Report to December 31, 2015.

This report is a revision to the April 2014 ACAI Report and documents the activities and results of the initial ACAI as well as the activities associated with the additional investigation of SWMU 22.

Scope of Services Performed

The ACAI included the following activities:

- Clarified Slurry Oil Tanks (SWMU 17 / Group 3 AOC1):
    - Collection of PSH samples from five existing recovery and monitoring wells (RW-7, RW-8, MW-94, MW-67, and NCL-34) in the area of SWMU 17. The PSH samples were analyzed for paraffins, isoparaffins, aromatics, napthenes, and olefins (PIANO) and the results were compared to the results of the PIANO analysis of the PSH sample collected from SWMU17-BH01 during the CAI for this SWMU.
    - Excavation, removal and permanent closure of the former slurry slinger recovered oil underground storage tank (UST) located between Tanks 63 and 65. The UST was cleaned and inspected during excavation and was removed from the ground. Confirmation soil samples were collected from the excavation to evaluate potential historical releases.
    - Removal and disposal of liquids from within the steel liners inside three concrete sumps located along the south side of the former slurry slinger building. Cleaning of steel liners followed by physical removal of the liners from the concrete sumps. Collection of rinsate samples from the steel liners to confirm completeness of cleaning activities.
- North Bundle Cleaning Pad (SWMU 20 / Group 3 AOC2):
    - Collection of PSH samples from one existing monitoring well and one existing recovery well (MW-97 and RW-2). The PSH samples were submitted for PIANO analyses and the results were compared to the results of the PIANO analysis of the PSH sample collected from SWMU20-BH01 during the CAI.

- Installation of one boring, which was converted to a temporary monitoring well, north of SWMU 20 for delineation of PSH and/or dissolved phase hydrocarbon constituents of concern (COCs). Collection of soil and groundwater samples for laboratory analyses. Plugging and abandonment of the temporary monitoring well boring following completion of sampling.

- Main API Separator (SWMU 22 / Group 3 AOC4):

  - Installation of two soil borings and conversion of those borings to permanent monitoring wells near the Main API Separator. Collection of soil samples during well installation for analysis of COCs. Collection of groundwater samples from the two monitoring wells for analysis of COCs.

  - Draining, cleaning, and inspection of the Main API Separator. Filling of the concrete separator with inert material (lean cement) and installation of a reinforced concrete cap on top of the fill.

- South Alkylation Unit (SWMU 23 / Group 3 AOC5): Continued semiannual groundwater monitoring at the two existing monitoring wells MW-109 and MW-110. The analytical results from semiannual groundwater monitoring from these two wells have been submitted with each annual groundwater monitoring report. Trends in concentrations of COCs are discussed in the annual groundwater monitoring reports.

This revised ACAI Report includes an additional updated evaluation of previous soil and groundwater results using the most recent SSLs published by NMED (NMED, 2015b).

The CAI Workplan and CAI Report referred to each of the areas included in SWMU / AOC Group 3 by a different number than that listed in the Permit. Both references are provided in parentheses in the description of the scope of work listed above. However, throughout the remainder of this revised ACAI report, each area is referenced by the Permit SWMU number.

Summary of Results and Conclusions

The ACAI of AOC Group 3 has been completed, including the requested additional investigation of SWMU 22. The following paragraphs present a summary of the investigation and analytical results for each area investigated.

Clarified Slurry Oil Tanks (SWMU 17)

The analytical results of soil samples collected during the CAI were compared to the updated SSLs published by NMED in 2015 (NMED, 2015b). The following conclusions are based on the updated screening:

- Shallow soil samples collected from within and around SWMU 17 as part of the CAI and ACAI indicate that no impacts above Ind/Occ or CW SSLs are present in the shallow soils.

- Deeper soil samples collected from within and around SWMU 17 indicate the presence of hydrocarbon and arsenic impacts near the soil-groundwater interface.

Groundwater sample data indicate the presence of both PSH and dissolved phase impacts from historic releases in the area.

PSH in wells in the vicinity of SWMU 17 appears to be similar to jet fuel and is believed to be present from historical and recent releases of JP8 from an underground pipeline in the area. PSH in the vicinity of SWMU 17 does not appear to be associated with the CSO tanks.

The recovered oil UST associated with the former slurry slinger operation has been excavated and does not appear to have been a source of hydrocarbon impacts to soil or groundwater. Confirmation samples from the excavation indicate the presence of elevated hydrocarbons in the area, which may be associated with historical releases from the nearby diesel tanks.

The former effluent sumps located along the south side of the former slurry slinger building have been cleaned and the metal sump boxes have been removed. Rinsate samples from the steel boxes indicate that the boxes were adequately cleaned.

North Bundle Cleaning Pad (SWMU 20)

A soil boring was installed to the north of the North Bundle Cleaning Pad and completed as a temporary well. Soil and groundwater samples were collected to provide further delineation of impacts in this area. The soil sample analytical results from both the CAI and the ACAI were screened using the SSLs published by NMED in 2015 (NMED, 2015b). The following conclusions are based on the updated screening:

- One shallow soil sample collected from 7.5 to 10 feet below ground surface (ft bgs) collected from the northeastern corner of SWMU 20 contained TPH DRO above the SSL. The shallower soil sample (0 to 1 ft bgs) from this same location did not contain any COCs above the Ind/Occ or CW SSLs. The remaining shallow soil samples indicate that no impacts above Ind/Occ or CW SSLs are present in the shallow soils.

- Deeper soil samples collected from within and around SWMU 20 as part of the CAI and ACAI indicate the presence of hydrocarbon-related COCs and elevated arsenic concentrations near the soil-groundwater interface.

Groundwater sample data indicate the presence of both PSH and dissolved phase impacts from historic releases in the area.

PSH in wells in the vicinity of SWMU 20 appears to be gasoline and diesel range hydrocarbons. The lack of PSH in wells surrounding SWMU20-BH01 indicates the PSH is horizontally delineated in the immediate area of SWMU 20.

Main API Separator (SWMU 22)

The ACAI work plan (Arcadis, 2012b) stated that the scope of work for SWMU 22 would include draining, cleaning, inspecting, demolition, and disposal of the Main API separator for permanent closure. The scope of work also included collection of samples of waste materials for disposal characterization and confirmation soil samples to evaluate for potential releases. However, NRC later determined that demolition of the Main API Separator could not safely be performed due to the depth of the separator and the nearby infrastructure. NMED approved the work plan to fill the subsurface concrete structure of the Main API Separator.

Two monitoring wells were installed in the vicinity of SWMU 22 and soil and groundwater samples were collected to provide additional delineation of potential impacts in this area. The soil sample analytical results from both the CAI and the ACAI were screened using the SSLs published by NMED in 2015 (NMED, 2015b). The following conclusions are based on the updated screening:

- Shallow soil samples collected from within and around SWMU 22 as part of the CAI and ACAI indicate that no impacts above Ind/Occ or CW SSLs are present in the shallow soils.

- Deeper soil samples collected from within and around SWMU 22 indicate the presence of hydrocarbon and arsenic impacts near the soil-groundwater interface. One soil sample collected during the installation of MW-138 (18 ft bgs) contained cobalt at a concentration above the CSSL; however, none of the remaining samples collected from this area contained similar concentrations of cobalt.

Groundwater sample data indicate the presence of dissolved phase impacts from historic releases in the area. However, no PSH is present in the immediate vicinity of SWMU 22.

Recommendations

The following is a summary of recommendations for the three SWMUs addressed in this revised ACAI report:

- NRC will continue to manage the potential exposure to impacted soil within SWMU 17, SWMU 20, and SWMU 22, as well as other SWMUs and AOCs, through the soil management program. The soil management program includes review of historical soil data, as available, and determination of appropriate mitigation practices during the excavation permitting process.

- Recovery of PSH from groundwater in the vicinity of SWMU 17 and SWMU 20 will continue to be performed utilizing the existing recovery trenches RW-2, RW-7, and RW-8.

- Groundwater monitoring will continue according to the facility wide groundwater monitoring program.

- Further evaluation of the concrete sump boxes within SWMU 17 is recommended and is underway. An interim measures work plan describing the plans to fill the sumps and perform additional soil investigation adjacent to the sumps was submitted in September 2015 (Arcadis, 2015c). NMED approved the work plan in November 2015 (NMED, 2015d). NRC will implement the recommended activities and submit a report documenting the results in 2016.

- Other than continued groundwater monitoring, no further action is recommended for the North Bundle Cleaning Pad (SWMU 20) or the Main API Separator (SWMU 22) at this time.

1. Introduction

1.1 Facility Background

The Navajo Refining Company, L.L.C. (NRC) owns and operates the Artesia Refinery (Refinery), located in Artesia, New Mexico (Figure 1). The facility has been in operation since the 1920's and processes crude oil into asphalt, fuel oil, gasoline, diesel, jet fuel and liquefied petroleum gas.

The Refinery is regulated under the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA). In October 2003, the Secretary of the New Mexico Environment Department (NMED) issued a Post-Closure Care Permit (Permit) to for the Refinery, which has U.S. Environmental Protection Agency (EPA) ID number NMD048918817 (NMED, 2003). A modified Permit was issued in December 2010 (NMED, 2010).

Among other action items, the Permit authorizes and requires NRC (the Permittee) to conduct site investigations at Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs) listed in the Permit. The purpose of each investigation is to evaluate for the presence, nature and extent of hazardous and regulated constituents pursuant to Section 20.4.1.500 of the New Mexico Administrative Code (NMAC). The Permit establishes the general and specific standards for the investigation activities.

The SWMUs and AOCs listed in the 2003 version of the Permit were divided into three groups for investigation, as shown in Table 1, to efficiently address the investigation needs at each SWMU or AOC. Additional SWMUs and AOCs were added to the Permit in 2010 and are included in Table 1 for completeness. Figure 2 depicts the locations of SWMUs and AOCs located within the boundary of the active Refinery.

1.2 Group 3 Unit Status

A Corrective Action Investigation (CAI) Workplan was initially submitted to NMED in 2009 and a revised CAI Workplan was submitted in July 2010 (Arcadis, 2010). NMED approved the CAI workplan in September 2010 (NMED, 2010) and the CAI was conducted in 2011. The findings from the 2011 investigations were presented in the *AOC Group 3 Corrective Action Investigation Report* (CAI Report) dated July 2011 (Arcadis, 2011). The CAI Report was approved by NMED, with modifications, in a letter dated December 28, 2011 (NMED, 2011). Requested modifications to the CAI

Report were made and submitted along with a comment response letter on March 12, 2012 (Arcadis, 2012a).

A brief summary of the current status of the five areas including in SWMU / AOC Group 3 is:

- Clarified Slurry Oil (CSO) Tanks (Group 3 AOC1, Permit SWMU 17): this area is in the northwest portion of the Refinery and includes Tanks 18, 58, 59, 61, 63, 65 and 75 as shown in Figure 2. These tanks currently store clarified slurry oil (CSO), a heavy oil product that is a bottom distillation fractionation stream of the Fluid Catalytic Cracker (FCC) unit. Also included in this area, south of Tank 63, is a "slurry slinger" building that historically decanted CSO so that the stream could be returned to the refining process. Liquids from the decanting (slinging) process were piped to above ground storage tanks while the residual liquids with entrained solids were placed into sumps located outside the building. The residual stream from the sumps was transferred via vacuum truck for further processing and oil recovery. An underground storage tank (UST) was located adjacent to the slurry slinger and was used to store spent parts washing fluid, which consisted of diesel and CSO.

- North Bundle Cleaning Pad (Group 3 AOC2, Permit SWMU 20): this area is located in the northern portion of the refinery immediately north of the Former Diesel Storage Tanks (Permit AOC 2) as shown in Figure 2. This SWMU includes the concrete pad where heat exchanger bundles are inspected, cleaned and repaired. The concrete pad is sloped to a collection sump, which is drained into the plant wastewater treatment system. This pad is actively in use.

- South Bundle Cleaning Pad (Group 3 AOC3, Permit SWMU 21): this area is located in the southern portion of the Refinery, just west of the Southeast Tank Farm Area (Permit AOC 3), as shown in Figure 2. This SWMU includes the concrete pad where heat exchanger bundles are inspected, cleaned and repaired. The concrete pad is sloped to a collection sump, which is drained into the plant wastewater treatment system. This pad is actively in use.

- Main American Petroleum Institute (API) Separator (Group 3 AOC4, Permit SWMU 22): the separator is located in the northern portion of the Refinery, within the wastewater treatment area and north of the active North Plant Process Area (Permit SWMU 25) and west of the closed Tetra Ethyl Lead Impoundment (TEL) (Permit SWMU 8), as shown in Figure 2. The primary structure is an in-ground concrete separator that is approximately 20 feet (ft) wide by 80 ft long.

SWMU 24, the current API separator, was built above ground and is located southwest of the Main API Separator. After the current API separator was installed and placed in service, the Main API Separator was drained and accumulated wastes were removed and disposed of off-site as hazardous waste. The Main API Separator was then pressure washed and sand-blasted to remove remaining waste material. Cleaning was considered complete when stains had been removed from the concrete.

After removal from service as an oil/water separator in 2004, the concrete Main API Separator was used to settle non-hazardous catalyst fines from the FCC unit. Water and catalyst were placed into the separator. The catalyst was allowed to settle to the bottom of the separator while water passed through the overflow and into the wastewater treatment system. The settled catalyst was periodically removed and characterized for proper off-site disposal. NRC ceased the use of the Main API Separator for settling catalyst fines in late 2011. In early 2012, the water was pumped off and placed into the wastewater treatment system. The remaining catalyst fines were removed from the structure.

- South Alkylation Unit (Group 3 AOC5, Permit SWMU 23): the unit is located in the southern portion of the refinery, within the boundaries of the South Plant Process Area (SWMU 26) and south of the Southwest Tank Farm (Permit AOC 4), as shown on Figure 2. The unit was de-inventoried, isolated and neutralized and then removed from service in the early 1990's but most of the equipment remains in place. There are numerous active units and processes in the area including the following: fractionation of liquefied petroleum gas (LPG), LPG product cooling and a cooling tower. Due to the proximity of surrounding units and active aboveground piping, there are no plans to further demolish this unit.

The CAI Workplan and CAI Report referred to each of the areas included in Group 3 by a different AOC number than that listed in the Permit. Both references are provided in parentheses in the description of the units above. However, throughout the rest of this report, the areas will be described according to the Permit definition.

1.3 Purpose of this Report

Based on the recommendations of the CAI report, the NMED required that an additional corrective action investigation (ACAI) be conducted including installation of an additional soil boring to delineate the extent of phase separated hydrocarbons (PSH) identified during the CAI, collection of PSH samples to compare historical PSH

composition with the current PSH, and excavation of the slurry slinger oil UST. The *AOC Group 3 Additional Corrective Action Investigation Workplan* (ACAI Workplan) was submitted to the NMED in April 2012 (Arcadis, 2012b) to comply with this requirement. The NMED issued approval, with modifications, of the ACAI Workplan on March 13, 2013 (NMED, 2013a) and NRC provided a response to comments letter and replacement pages for the ACAI Workplan on April 12, 2013 (Arcadis, 2013b).

The ACAI Workplan stated that the Main API Separator (SWMU 22) would be demolished and removed from the ground; however, upon further engineering review, it was determined that the removal of the below-ground concrete structure was not feasible. NRC discussed rescinding that portion of the ACAI Workplan with NMED prior to the NMED approval of that workplan. NMED requested additional evaluation of soil in the vicinity of the Main API Separator. A letter providing additional data evaluation for this SWMU was submitted to NMED in February 2013 (Arcadis, 2013a). In the approval with modifications letter regarding the ACAI Workplan (NMED, 2013), NMED suggested that additional investigation of SWMU 22 be deferred until access was more feasible.

The approved ACAI Workplan was implemented in 2013 and the ACAI Report was submitted to NMED in April 2014 (Arcadis, 2014). The ACAI report documented the investigation activities completed and the results of the soil, groundwater and PSH investigations at the Clarified Slurry Oil Tanks (SWMU 17) and the North Bundle Cleaning Pad (SWMU 20) conducted.

Among the recommendations stated in the ACAI Report, NRC committed to submittal of a workplan to install two additional monitoring wells within SWMU 22, per the NMED request. Preliminary utility clearance was performed and a letter workplan for the installation of the requested wells was submitted to NMED on November 13, 2014 (HollyFrontier, 2014b). NMED provided approval, with modifications, to the well installation workplan in December 2014 (NMED, 2014b). One of the modifications required by NMED was that instead of submitting an addendum to the ACAI Report following the well installation, NRC should submit a revised ACAI Report. The NMED requested that the revised ACAI Report be submitted no later than March 27, 2015. However, delays in well installation were encountered, as described in this report, and extensions to the submittal deadline were requested (HollyFrontier, 2015a and 2015b). NMED approved both extensions (NMED, 2015a and 2015c), extending the submittal date for the revised ACAI Report to December 31, 2015.

This revised ACAI Report summarizes the work performed under the approved ACAI Workplan and the installation of two additional monitoring wells within SWMU 22. Additionally, the previous evaluation of soil and groundwater data for the SWMUs included in this group has been updated to incorporate the most recent soil screening levels (SSLs) published by NMED (NMED, 2015b).

2. Background

2.1 Facility Background

NRC operates an active petroleum refinery located at 501 East Main Street in the city of Artesia, Eddy County, New Mexico. The facility has been in operation since the 1920's and processes crude oil into asphalt, fuel oil, gasoline, diesel, jet fuel, and liquefied petroleum gas.

As stated previously, NRC divided the SWMUs and AOCs included in the 2003 Permit into three groups to perform the required investigations, as shown in Table 1. In 2010, the Permit was modified to address changes at the North Colony Landfarm, and additional SWMUs and AOCs were added to the Permit. The locations of all the SWMUs and AOCs included in the 2003 and 2010 Permits are shown on Figure 2. Figure 3 provides information about the storage tanks within the Refinery, including tank size and contents. It should be noted that the tank contents provided in Figure 3 is based on current information and may differ from historic tank content information.

Corrective action investigations have been completed at all of the SWMUs and AOCs included in the 2003 Permit. The results of these investigations have confirmed the presence of hydrocarbon impacts in shallow soil and groundwater beneath the Refinery.

Sitewide groundwater monitoring is performed semiannually and the results of the monitoring program are reported to NMED annually. The most recent groundwater monitoring report was submitted in February 2015 (Arcadis, 2015a) and contains figures that depict the extent of dissolved phase groundwater impacts along with the extent of identified PSH on groundwater. Information from the sitewide groundwater monitoring program is discussed in this revised ACAI report; however, the laboratory data associated with that program is not included with this submittal.

2.2 Clarified Slurry Oil Tanks (SMWU 17) Background

The CSO tanks are located in the northwestern portion of the Refinery and include Tanks 18, 58, 59, 61, 63, 65 and 75, as shown in Figures 2 and 3. These tanks are actively in use for storage of CSO. There have been two documented releases associated with Tank 63, as follows:

- In May 2009, Tank 63 was being cleaned out and was gauged to determine if the liquid level was below a manway on the south side of the tank. Although the gauging information showed that the level was low enough to open the manway, approximately 38 barrels of CSO was released to the soil. A vacuum truck was used to recover the liquid and returned it to the refining process. Soil within the release area was excavated and disposed of off-site. To be conservative, the excavated soil was disposed of as hazardous waste (K170).[1] A C-141 release report was filed for this release.

- In May 2009, approximately 290 barrels of slurry oil was released from a frac tank that was being used to store material from Tank 63 during a tank cleaning project. A vacuum truck was used to remove the released oil and 230 barrels of the 290 barrels released was recovered. The spill occurred at the southeast side of Tank 834 in the adjacent diesel tank farm (AOC 1). Soil within the release area was excavated and disposed of off-site. To be conservative, the excavated soil was disposed of as hazardous waste (K170).[2] A C-141 release report was filed for this release.

There have been no other documented releases from tanks within SWMU 17.

There is an area located in the northeastern portion of SWMU 17 that contains a building that houses slurry slingers and ancillary piping and equipment outside the building. As described in Section 1, the slurry stream is a product of the FCC unit comprised of heavy oil with entrained catalyst solids. Slurry slingers were formerly used to mechanically separate the entrained catalyst solids from the slurry stream to yield decanted CSO, which was routed to above-ground storage tanks and further used in the refining process. The residual liquids/fines stream was routed to containment boxes (sumps) adjacent to the building. The residual stream from the sumps was routinely transferred via vacuum truck for further processing and oil recovery.[3] The slurry slingers are no longer used, but remain in place within the building.

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[1]According to the US EPA, spills of clarified slurry oil are not included in the K170 listing, even if they contain particulates that would have otherwise settled out. 63 *Fed. Reg*. 42110, 42153-54 (Aug. 6, 1998).
[2]See footnote 1.
[3]In the proposed listing of K170, US EPA noted that oil recovered from CSO sediments/solids and returned to the refining process is RCRA-exempt pursuant to 40 CFR 261.4(a)(12). (60 *Fed. Reg*. 57747, 57766 (Nov. 20, 1995).

While in use, the slingers were very maintenance-intensive, requiring regular disassembly and cleaning. Select internal mechanical components were routinely removed from the slinger unit and cleaned in a trough located outside of the building under the west canopy. Diesel was used as a cleaning fluid, and the waste cleaning fluid, including residual slurry oil, was drained out of the trough and into a UST, also located west of the slurry slinger building, beneath a concrete slab. The contents of the recovered oil UST were routinely pumped to the slop oil system.

The contents of the recovered oil UST were removed when it was removed from service in 2003. At that time, the UST was believed to be in good condition, with no reported releases. Because the UST was underneath a concrete slab, no additional information was available regarding the condition of the tank at the time the CAI was completed. The UST was removed as part of the ACAI activities. The removal of the UST is described in further detail in Section 3 of this revised report.

Immediately northwest of the CSO tanks is the diesel tank farm (AOC 1) which includes two tanks used to store diesel, Tank 834 and Tank 838. Within the last five years, there have been no reported releases from Tank 838 and three releases reported from a sump associated with Tank 834, as follows:

- April 23, 2007: 8 barrels of combined diesel and water released from the Tank 834 sump and impacted soil was removed from the area. A C-141 release report was filed for this release.

- June 29, 2007: 20 barrels of diesel overflowed from the Tank 834 sump and impacted soil was removed from the area. A C-141 release report was filed for this release.

- December 17, 2009: Approximately 40 barrels of diesel overflowed from the Tank 834 sump due to an open drain valve on the south diesel salt filter. Impacted soil was excavated and disposed of off-site as non-hazardous waste. A C-141 release report was filed for this release.

The Tank 834 sump is located southwest of Tank 834, northwest of SWMU 17.

South of the CSO tanks, on the opposite side of Eagle Draw, is the former North API Separator area (SWMU 18). Both AOC 1 and SWMU 18 were investigated during the corrective action and additional corrective action investigations of SWMU / AOC Group 1 (Arcadis, 2006 and Arcadis, 2009b).

North of the CSO tanks, across a drainage ditch that enters Eagle Draw is SWMU 6, the North Colony Landfarm (NCL). Tank 815 is located on the eastern half of the NCL and contains diesel. In October 2012, there was a release of 12 barrels of diesel from Tank 815 through a sample port that had been left open. Soil samples were collected within the area of the release. Stained soil was removed to a depth of approximately 6 inches and was disposed of off-site at an approved hazardous waste disposal facility. A release report was submitted to NMED on December 28, 2012 (Arcadis, 2012c). Soil borings are collected and analyzed every five years from beneath the NCL as per the Permit. In April 2015, there was a release of greater than 25 barrels of water and diesel from the Tank 815 water draw sump. A C-141 release report was filed on April 21, 2015. Shallow impacted soil was excavated from the release area and was disposed of off-site as hazardous waste since the excavated soil was from within the NCL. A final C-141 release report will be submitted providing documentation of the release and remediation activities.

The Carbon Black Oil (CBO) loading rack (AOC 20) and one portion of the railcar loading and offloading racks (AOC 30) are located west of the CSO tanks. No investigation of these two AOCs has been performed to-date. Although some releases have been reported for the CBO loading rack, CBO is a very heavy thick material that does not typically infiltrate through the soil. Therefore it is unlikely that releases from the CBO rack would impact soil and groundwater within SWMU 17.

In September 2010, an underground pipeline break was discovered east from the CSO tanks in the vicinity of MW-94. The line was excavated and a pinhole leak was discovered and repaired. The pipeline was conveying JP8, a jet fuel, and the volume of JP8 released from the line was unknown. A C-141 release report was filed for this incident.

2.3 North Bundle Cleaning Pad (SMWU 20) Background

The north bundle cleaning pad (SWMU 20) is located in the northern portion of the Refinery, as shown in Figure 2. This SWMU includes the concrete pad where heat exchanger bundles are inspected, cleaned and repaired. The concrete pad is sloped to a collection sump, which is drained into the plant wastewater treatment system. This pad is actively in use.

Immediately south of the north bundle cleaning pad is the former diesel tank storage area (AOC 2), which is now occupied by the FCC unit. The former North API Separator (SWMU 18) is located to the west of the north bundle cleaning pad. Both of

these adjacent areas were investigated during the initial and additional corrective action investigations of SWMU / AOC Group 1 (Arcadis, 2006 and Arcadis, 2009b).

The North Plant Process Area (SWMU 25) is located south of the north bundle cleaning pad and to either side of the former diesel tank storage area (AOC 2). This area includes active process units and piping. No investigation activities have been performed specifically for SWMU 25.

2.4 Main API Separator (SWMU 22) Background

The Main API Separator (SWMU 22) is located in the northern portion of the Refinery, within the wastewater treatment area. The primary structure is an in-ground concrete separator that is approximately 20 ft wide by 80 ft long. The Main API Separator was placed into service in 1987.

The current API separator (SWMU 24) was built above ground and is located southwest of the Main API Separator. After the current API separator was installed and placed in service, the Main API Separator was drained and accumulated wastes were removed and disposed of off-site as hazardous waste. The Main API Separator was then pressure washed and sand-blasted to remove remaining waste material. Cleaning was considered complete when stains had been removed from the concrete.

After removal from service as an oil/water separator in 2004, the concrete Main API Separator was used to settle catalyst fines. Water and catalyst were placed into the separator. The catalyst was allowed to settle to the bottom of the separator while water passed through the overflow and into the wastewater treatment system. The settled catalyst was periodically removed and characterized for proper off-site disposal. NRC ceased the use of the Main API Separator for settling catalyst fines in late 2011. In early 2012, the water was pumped off and placed into the wastewater treatment system. The remaining catalyst fines were removed from the structure.

Tank 806 which is a dissolved-air flotation unit (AOC 11) is located north of the main API separator. There have been no releases reported from this area.

Tanks 801 and 836 are aggressive biological treatment tanks (AOC 9) located to the northeast of the main API separator. On January 10, 2010, approximately 1,360 barrels of wastewater was released from Tank 836 due to freezing conditions. The wastewater was contained and removed using a vacuum truck and placed back into

the wastewater treatment system. Details of the release were provided to NMED in a response letter dated March 12, 2012 (Arcadis, 2012a).

The Talon Tanks and ancillary equipment area (AOC 14) are located southeast of the main API separator. No known releases have been reported for these tanks or the ancillary equipment.

2.5 AOC Group 3 Previous Investigations

The corrective action investigation for the five SWMU / AOC Group 3 areas was conducted in January 2011 in accordance with the NMED-approved SWMU / AOC Group 3 Corrective Action Investigation Workplan dated August 2010 (Arcadis, 2010). These investigations involved installation of soil borings, conversion of the soil borings to temporary monitoring wells, and collection of soil samples and groundwater samples from each of the AOC Group 3 SWMUs.

The findings of the January 2011 investigations were presented in the *SWMU / AOC Group 3 Corrective Action Investigation Report* dated July 2011 (Arcadis, 2011). The CAI report included summary data tables, figures indicating sampling locations, figures presenting summary of soil and groundwater exceedances and a detailed discussion of the findings for each area of investigation.

Soil sample results from the CAI were screened using the December 2009 NMED Soil Screening Levels (NMED, 2009), which were current at the time the CAI report was written. The results of that screening were summarized in Table 5 and Figure 8 of the CAI report.

For the ACAI report (Arcadis, 2014), the soil data screening was updated using the SSLs from Table A-1 from *Risk Assessment Guidance for Site Investigations and Remediation* (NMED, 2012a), as corrected on the NMED website (NMED, 2012b), which was the most current version of the guidance document at that time. Soil data was screened according to the following hierarchy:

- The lower value of the Industrial/Occupational (Ind/Occ) Exposure or Construction Worker (CW) Exposure SSLs were used to screen shallow soil samples collected from 0 to 1 or 0 to 2 ft bgs;

- CW SSLs were used to screen soil samples from greater than 1 ft bgs to 10 ft bgs; and

- Dilution Attenuation Factor (DAF) 20 SSLs were used to screen soil samples from greater than 10 ft bgs,

  OR

- If no SSL value exists, the EPA Industrial Soil Regional Screening Level (RSL) from the EPA website was used to screen soil up to 10 ft bgs.

Total petroleum hydrocarbon (TPH) Diesel Range Organics (DRO) and Oil Range Organics (ORO) were compared to the screening level values for "unknown oil" in soil under an industrial setting, obtained from Table 6-2 of the *Risk Assessment Guidance for Site Investigations and Remediation* (NMED, 2012a).

The data screening evaluation did not include residential screening levels for soil and thus, is not intended to allow for future unrestricted land use. NRC does not currently intend to close the SWMUs included in this investigation without land use controls. In the future, if NRC wishes to close any of these areas without controls, it is understood that residential SSLs will be applicable.

NMED issued an updated versions of the *Risk Assessment Guidance for Site Investigations and Remediation* in December 2014 and July 2015 (NMED, 2014c and 2015b). The numeric values for the SSLs did not change between the 2014 and 2015 versions of the guidance document; however, there were changes in some of the SSLs between the 2012 and 2014 versions of the guidance document. Therefore, this revised ACAI has been updated to include the most recent SSLs. To simplify the screening, the following hierarchy was used to define critical soil screening levels (CSSLs) in this revised report:

- The lower value of the Ind/Occ or CW SSLs were used to screen shallow soil samples (0 to 10 ft bgs). If no NMED Ind/Occ or CW SSL is published for a specific compound, the EPA Industrial RSL was used, if available, to screen shallow soil samples (0 to 10 ft bgs).

- DAF 20 SSLs were used to screen soil samples from greater than 10 ft bgs. If no NMED DAF 20 SSL is available for a specific compound, the EPA Tap Water RSL was used to calculate a DAF 20 SSL, referred to as an RSL-based DAF.

- TPH DRO and ORO samples from all depth intervals were compared to the screening level values for "unknown oil" obtained from Table 6-2 of the guidance document (NMED, 2015b).

Groundwater results presented in the CAI report were screened against a critical groundwater screening level (CGWSL) current at that time. The CGWSL values have been updated and were determined as follows:

- New Mexico Water Quality Standards (WQS) found in NMAC 20.6.2.3103.

- EPA's Federal Maximum Contaminant Levels (MCL).

- If no value for the WQS or MCL was available, then Tap Water value from Table A-1 of the *Risk Assessment Guidance for Site Investigations and Remediation* (NMED, 2012a), if available.

TPH DRO and ORO were compared to the screening level values for "unknown oil" concentrations in groundwater, obtained from Table 6-2 of the *Risk Assessment Guidance for Site Investigations and Remediation* (NMED, 2012a).

This revised report uses the same hierarchy for determining the CGWSL; however, the most recent Table A-1 of the NMED guidance document (NMED, 2014c and 2015b) was used as the source of Tap Water values, where necessary.

In addition, NRC completed an evaluation of to determine concentrations of constituents of concern (COCs) in unimpacted or "background" groundwater (Arcadis, 2015b). As reported in the background groundwater evaluation report (Arcadis, 2015b), the upper tolerance limit (UTL) for several inorganic COCs were determined to be greater than the WQS or MCL values. For those compounds with no WQS, MCL, or tap water value and for those compounds where the background UTL exceeds the WQS or MCL, the background concentration was used to update the screening of the CAI data.

The updated screening of soil and groundwater CAI data is discussed in the following subsections.

2.5.1 Clarified Slurry Oil Tanks (SWMU 17)

As discussed in the CAI report, soil borings and temporary wells were installed at five locations in and around the CSO tanks. Figure 4 shows the historical sample locations in and around the CSO tanks. The following subsections provide a summary of the updated analytical screening and conclusions made in the CAI report.

2.5.1.1 Soil Analytical Results

Shallow Soil

Shallow soil samples were collected from five locations in and around SWMU 17 as part of the CAI. The laboratory reports for the soil samples were submitted in the CAI report (Arcadis, 2011). Analytical results from samples collected from the 0 to 1 ft bgs interval at each of the five locations are summarized in Table 2 and screened against the CSSLs. Table 2 presents the results for COCs for which at least one result was reported above the corresponding detection limit.

None of the COCs were reported at concentrations above the respective CSSLs. Figure 5 depicts the distribution of TPH (GRO, DRO, and ORO) in the shallow soil samples collected from borings associated with SWMU 17. TPH is considered a "screening" COC as an overall indicator of potential impacts from hydrocarbons.

These results of the updated screening of the shallow soil samples indicate that there is no current exceedance of the CSSL for non-residential exposures and that there have been no recent or on-going releases at the surface in the area of SWMU 17.

Deep Soil

Deep soil samples were collected from five locations in and around SWMU 17 as part of the CAI. The laboratory reports for the soil samples were submitted in the CAI report. Analytical results from 16 soil samples collected from the five borings at depths greater than 10 ft bgs are summarized in Table 3 and screened against the DAF 20 SSLs. If no DAF 20 SSL has been published by the NMED, but a Tap Water RSL has been published by the EPA, then the Tap Water RSL was used to calculate an RSL-based DAF 20 SSL. Table 3 presents analytical results for TPH, metals, and those VOCs and SVOCs for which at least one result was reported above the detection limit.

Figure 6 depicts the results of the updated screening of the deep soil samples from SWMU 17. The results of the updated screening indicate the following:

- The reported concentration of TPH DRO exceeds the CSSL in only 1 of the 16 samples, the sample collected from 12.5 to 15 ft bgs from location SWMU17-BH03.

- The reported concentration of arsenic exceeds the CSSL in all of the 16 samples collected from SWMU17.

- The reported concentration of 1,2,4-trimethylbenzene exceeds the CSSL in 5 of the 16 samples. CSSL exceedances were present in sample intervals ranging from 10 to 22.5 ft bgs within three of the five boring locations. None of the reported concentrations of 1,2,4-trimethylbenzene in samples collected from SWMU17-BH04 and SWMU17-BH05 exceed the CSSL.

- The reported concentration of benzene exceeds the SSL in 6 of the 16 samples. CSSL exceedances were present in sample intervals ranging from 10 to 22.5 ft bgs within four of the five boring locations. None of the reported concentrations of benzene in samples collected from SWMU17-BH05 exceeded the SSL.

- The reported concentration of ethylbenzene exceeds the CSSL in 7 of the 16 samples. The CSSL exceedances were in sample intervals ranging from 10 to 22.5 ft bgs within four of the five boring locations, and in the 26 to 28 ft bgs interval from location SWMU17-BH04. None of the reported concentrations of ethylbenzene in samples collected from SWMU17-BH05 exceeded the CSSL.

- The reported concentration of naphthalene, analyzed by method 8260 Volatile Organic Compounds (VOCs), exceeds the CSSL in 9 of the 16 samples. The CSSL exceedances were in sample intervals ranging from 10 to 22.5 ft bgs within all five of the boring locations, and in the 26 to 28 ft bgs interval from location SWMU17-BH04.

- The reported concentration of total xylenes exceeds the CSSL in 2 of the 16 samples. The CSSL exceedances were in sample intervals ranging from 12.5 to 15 ft bgs at locations SWMU17-BH01 and SWMU17-BH03. The concentration of m,p-xylene exceeded the CSSL in the 12.5 to 15 ft bgs sample from SWMU-BH01 while the concentration of o-xylene exceeded the CSSL in the 12.5 to 15 ft bgs sample from SWMU-BH03.

- The 6 samples that contained reported concentrations of TPH DRO greater than 1,000 milligrams per kilogram (mg/kg) were analyzed for semivolatile organic compounds (SVOCs). The reported concentration 2-methylnaphthalene exceeds the CSSL in 4 of the 6 samples. The CSSL exceedances were in sample intervals ranging from 10 to 15 ft bgs. No exceedances of 2-methylnaphthalene were reported in the sample collected from 20 to 22.5 ft bgs at location SWMU17-BH01 or in the sample from location SWMU17-BH05.

- The reported concentration of naphthalene, analyzed by method 8270 SVOCs, exceeds the CSSL in all 6 of the samples analyzed by this method. The CSSL exceedances were in sample intervals ranging from 10 to 22.5 ft bgs within all five of the boring locations.

The hydrocarbon detections in the deeper soil samples are related to the dissolved phase organic plume which underlies the CSO tanks and large parts of the facility. The depth to groundwater in the area of the CSO tanks was observed to range from approximately 10 to 14 ft bgs. Soil samples collected from depths of 10 ft or greater were likely collected from the saturated zone or from the capillary fringe. Thus, the hydrocarbons detected in the soil samples collected from depths of 10 ft or greater are related to the affected groundwater in the dissolved phase organic plume and are not necessarily indicative of releases within the CSO tank containment.

2.5.1.2 Groundwater Analytical Results

As described in Section 6.2.2 of the CAI Report (Arcadis, 2011), groundwater samples were collected from the four temporary wells installed in this area where PSH was not observed. Table 4 provides a summary of the water level measurements recorded during the 2011 CAI for the temporary wells. Water level measurements collected as part of the sitewide groundwater monitoring program from nearby wells during March 2011 are provided in Table 4 for comparison, along with subsequent water level measurements. Figure 7 depicts the potentiometric surface within the northwestern portion of the Refinery, as measured during the first semiannual event of 2011 shortly after the temporary wells were installed.

Table 5 provides a summary of groundwater analytical results for samples collected in 2011 from the SWMU 17 temporary wells as part of the CAI. Analytical results from samples collected from wells in the immediate vicinity of SWMU 17 as part of the sitewide groundwater monitoring program during March 2011 and during subsequent events are also provided in Table 5 for comparison. The complete analytical results for

the samples collected from the temporary wells were provided in the CAI report and the complete analytical results for the sitewide groundwater monitoring program are provided in the annual groundwater monitoring reports. Analytical reports for the first semiannual groundwater monitoring event of 2015 are provided in Appendix A of this report.

The analytical results provided in Table 5 include the results for all three of the TPH ranges, as well as the total metals and VOCs where at least one sample contained a reported concentration above the CGWSL. The results of the updated screening indicate the following:

- TPH GRO, TPH DRO, and TPH ORO were reported in the groundwater samples collected from the four temporary wells. Reported DRO concentrations exceed the CGWSL in all of the samples collected from the temporary wells and in samples collected from wells in the vicinity of SWMU 17. Reported concentrations of ORO exceed the CGWSL in sampled collected from two of the four temporary wells (SWMU17-BH02 and SWMU17-BH03) as in samples collected from wells in the vicinity of SWMU-17.

- Three metal compounds were reported at concentrations exceeding the CGWSLs, as follows:

    - Arsenic concentrations were reported in the groundwater samples collected from temporary wells SWMU17-BH03 and SWMU17-BH05 at concentrations above the CGWSL. Arsenic concentrations were reported at concentrations above the CGWSL in 2013 and 2014 in samples collected from monitoring well NCL-31. All other arsenic concentrations were reported below the CGWSL in monitoring wells in the vicinity of SWMU 17.

    - Iron concentrations were reported above the CGWSL in the groundwater samples collected from MW-95 in April 2013 and from NCL-31 in April 2014. The reported concentrations of iron were below the CGWSL in the temporary well samples and in all other samples collected from monitoring wells located in the vicinity of SWMU 17.

    - Manganese concentrations were reported above the CGWSL in all of the samples collected from NCL-31. Manganese concentrations in all samples collected from the temporary wells and all other monitoring wells in the vicinity of SWMU-17 are below the CGWSL.

- VOCs were reported in groundwater samples collected from all four of the temporary wells and in many of the wells in the vicinity of SWMU 17, as follows:

    - 1,2,4-Trimethylbenzne was reported at concentrations above the CGWSL in the sample collected from SWMU17-BH03, but were reported below the CGWSL in the samples collected from the other three temporary wells. 1,2,4-Trimethylbenzene has also been reported at concentrations above the CGWSL in samples collected from MW-67, MW-91, MW-96, and MW-108.
    - 1,2-Dichloroethane was reported at a concentration above the CGWSL in one sample collected in April 2014 from MW-108, but was reported at concentration below the CGWSL in the samples collected from the temporary wells and from all other wells in the vicinity of SWMU 17.
    - Benzene was reported at concentrations above the CGWSL in the samples collected from SWMU 17-BH02, SWMU17-BH03, and SWMU17-BH04. Benzene was also reported at concentrations above the CGWSL in all of the samples collected from MW-67, MW-91, and MW-108 between 2011 and 2015. Benzene was reported at concentrations above the CGWSL in the sample collected from MW-95 in April 2012 and in the sample collected from MW-96 in April 2014, but was below the CGWSL in all other samples collected from these two wells between 2011 and 2015. Benzene has not been detected in samples collected from NCL-31.
    - Carbon tetrachloride was reported at concentrations above the CGWSL in samples collected from MW-108 and NCL-31 in April 2014. All other samples contained no detectable concentrations of this COC.
    - Ethylbenzene was reported at concentrations above the CGWSL in samples collected in 2011 from MW-91; however, all other concentrations were below the CGWSL in MW-91. None of the reported concentrations of ethylbenzene in samples collected from the temporary wells or the other monitoring wells in the vicinity of SWMU-17 were above the CGWSL.
    - Methyl-tert-butyl ether (MTBE) was reported at concentrations above the CGWSL in samples collected from SWMU 17-BH02 and SWMU17-BH04. MTBE was reported at concentrations above the CGWSL in MW-67 and MW-96 between 2011 and 2015. None of the reported concentrations in the remaining wells in the vicinity of SWMU-17 were above the CGWSL.
    - Naphthalene was reported at concentrations above the CGWSL in samples collected from SWMU 17-BH02 and SWMU17-BH03. Naphthalene concentrations in samples collected from MW-91 between 2011 and 2015 exceed the CGWSL and one sample collected from MW-

96 in April 2014 was above the CGWSL. Naphthalene concentrations in the majority of the samples collected from wells in the vicinity of SWMU17 have been either not detectable or reported at concentrations below the CGWSL.

- Toluene was reported at concentrations above the CGWSL in samples collected in November 2014 and April 2015 from MW-91. The reported concentrations of toluene in samples collected from the temporary well and from other wells in the vicinity of SWMU 17 were below the CGWSL.
- Total xylenes were reported at concentrations below the CGWSL in the samples collected from the four temporary wells. The total xylenes concentration reported in samples collected from MW-91 in April 2011, September 2011, and April 2015 were above the CGWSL. The concentrations of total xylenes have been either below the CGWSL or the detection limit in samples collected from other wells in the vicinity of SWMU 17.

Figure 8 depicts the results of the updated groundwater screening and PSH measurements in the vicinity of SWMU 17.

2.5.1.3 PSH Results

Three feet of PSH was observed in the temporary monitoring well SWMU17-BH01 installed near the northeast corner of SWMU 17. As described in Section 7.1.1 of the CAI Report (Arcadis, 2011), a PSH sample was collected from this well and submitted for PIANO hydrocarbon characterization analysis. The analysis indicated that the PSH in SWMU17-BH01 appears to be a blend of hydrocarbon ranges, including kerosene, gasoline and diesel ranges.

The extent of PSH in the northeastern portion of SWMU 17 is delineated by existing monitoring wells (MW-67, MW-91, MW-94, MW-95, MW-108, and NCL-31) and recovery wells (RW-7 and RW-8) in the area, as shown in Figure 8 of this report. The PSH observations in this portion of the Refinery are related to the known northwest plant area PSH plume due to historic releases of petroleum hydrocarbons, as described in Section 2.2 of this report.

The recovery wells RW-7R and RW-8R are part of the system installed in this area to recover PSH. As shown in Figure 8, the PSH thickness in wells in the vicinity of SWMU 17 has been decreasing significantly since 2011.

2.5.2 North Bundle Cleaning Pad (SWMU 20)

As discussed in the July 2011 report, soil borings were installed at four locations around the north bundle cleaning pad and temporary monitoring wells were installed in each boring. Figure 9 of this report shows the historical sampling locations in and around the North Bundle Cleaning Pad. The following subsections provide a summary of the updated analytical screening and conclusions made in the CAI report.

2.5.2.1 Soil Analytical Results

Shallow Soil

Shallow soil samples were collected from four locations in and around SWMU 20 as part of the CAI. The laboratory reports for the soil samples were submitted in the CAI report (Arcadis, 2011). Analytical results from samples collected from the 0 to 1 foot ft bgs interval at each of the five locations are summarized in Table 6 and screened against the lower of the Ind/Occ or CW SSLs. Table 6 presents the results for COCs for which at least one result was reported above the corresponding detection limit.

Figure 10 depicts the results of the updated shallow soil screening for SWMU 20. The COCs shown in Figure 10 include TPH GRO, TPH DRO, and TPH ORO since TPH DRO is the only COC with a result above the CSSL.

One sample, collected from the 7.5 to 10 ft bgs interval from location SWMU20-BH02, contained reported concentrations of TPH DRO above the CSSL. However, reported concentrations for all other COCs in samples collected from the 0 to 1 ft bgs interval were below the CSSL. These findings indicate that there have been no recent or on-going releases at the surface in the area of the North Bundle Cleaning Pad (SWMU 20).

Deep Soil

Deep soil samples were collected from four locations in and around SWMU 20 as part of the CAI. The laboratory reports for the soil samples were submitted in the CAI report (Arcadis, 2011). Deep soil samples were also collected from a fifth location associated with SWMU 20 as part of the ACAI, and are discussed in Section 6 of this revised ACAI report. Analytical results from deep soil samples collected at depths greater than 10 ft bgs from borings associated with SWMU 20 are summarized in Table 7 and screened against the DAF 20 SSL. Those compounds with at least one

reported concentration are shown in Table 7. If no DAF 20 SSL has been published by the NMED, but a Tap Water RSL has been published by the EPA, then the Tap Water RSL was used to calculate and RSL-based DAF 20 SSL.

Figure 11 depicts the results of the updated screening of the deep soil samples from SWMU 20. The COCs shown in Figure 11 include TPH GRO, TPH DRO, TPH ORO and other COCs that had at least one result above the CSSL.

The results of the updated screening indicate the following:

- None of the reported concentrations of TPH exceed the CSSL in CAI samples.
- The reported concentration of arsenic exceeds the CSSL in all of the 11 CAI samples collected from SWMU 20.
- The reported concentrations of the following VOCs exceed the CSSL in the deep samples collected from SWMU 20 as part of the CAI:
    - 1,2,4-trimethylbenzene
    - 1,3,5-trimethylbenzene
    - Benzene
    - Ethylbenzene
    - Isopropylbenzene
    - m,p-Xylene
    - Naphthalene (by Method 8260)
    - N-propylbenzene
    - o-Xylene
    - Toluene
    - Xylenes (total)

It should be noted that none of the reported concentrations of VOC compounds exceeded the CSSLs in deep samples collected from SWMU20-BH02.

- The reported concentrations of the following SVOCs exceed the CSSL in the deep samples collected from SWMU 20 as part of the CAI:
  - 2-methylnaphthalene
  - Naphthalene (by Method 8270)

The depth to groundwater in the area of the North Bundle Cleaning Pad was observed to range from approximately 12 to 19 ft bgs. Soil samples collected from depths of 10 ft or greater were likely collected from the saturated zone or from the overlying capillary fringe. The hydrocarbons detected in the soil samples collected from depths of 5 ft or greater are related to the affected groundwater in the identified dissolved phase organic plume and are not indicative of recent releases from the North Bundle Cleaning Pad.

2.5.2.2 Groundwater Analytical Results

As described in Section 2.5.2.1 above, Table 4 provides a summary of water level measurements from the 2011 CAI as well as subsequent water level measurements from wells near SWMU 20. Figure 7 depicts the potentiometric surface within the northwestern portion of the Refinery, as measured during the first semiannual event of 2011 shortly after the temporary wells were installed.

As described in Section 6.2.2 of the CAI Report (Arcadis, 2011), temporary well SWMU20-BH04 did not yield sufficient water for laboratory analyses and SWMU20-BH01 contained PSH. Therefore, groundwater samples were collected from two of the four temporary wells installed as part of the CAI for laboratory analyses.

Tables 8 and 9 provide a summary of groundwater analytical results for samples collected in 2011 from the SWMU 17 temporary wells as part of the CAI. Table 8 contains the analytical results for TPH, metals, VOCs, and general chemistry parameters while Table 9 contains the analytical results for SVOCs. The results presented in Tables 8 and 9 include the previous results obtained during the CAI as well as results obtained during the ACAI. Analytical results from samples collected from wells in the immediate vicinity of SWMU 20 as part of the sitewide groundwater monitoring program during March 2011 and during subsequent events are also

provided in Tables 8 for comparison. The sitewide groundwater monitoring program does not include analysis of SVOCs, thus no SVOC results are included in Table 9 from nearby monitoring wells. The complete analytical results for the samples collected from the temporary wells were provided in the CAI report and the complete analytical results for the sitewide groundwater monitoring program are provided in the annual groundwater monitoring reports. Analytical reports for the samples collected during the ACAI and during the first semiannual groundwater monitoring event of 2015 are provided in Appendix A of this report.

The analytical results provided in Table 8 include the results for all three of the TPH ranges, as well as the total metals and VOCs where at least one sample contained a reported concentration above the CGWSL. The analytical results provided in Table 9 include SVOCs with at least one result reported above the respective detection limits. The results of the updated screening of the CAI data are discussed below, while the results of the screening of the ACAI data is discussed later in this report.

- TPH GRO, TPH DRO, and TPH ORO were reported in the groundwater samples collected from the temporary wells. Reported DRO concentrations exceed the CGWSL in all of the samples collected from the temporary wells and in samples collected from wells in the vicinity of SWMU 20. Reported concentrations of ORO exceed the CGWSL in sampled collected from the temporary wells as in samples collected from wells in the vicinity of SWMU 20.

- Five metal compounds were reported at concentrations exceeding the CGWSLs, as follows:

    - Arsenic concentrations were reported in the groundwater samples collected from temporary wells SWMU20-BH03 at concentrations above the CGWSL. Arsenic was also reported at concentrations above the CGWSL in the samples collected from SWMU20-BH05 (as part of the ACAI). Arsenic has been reported at concentrations above the CGWSL in samples collected from monitoring wells MW-23, MW-43, and MW-62 for some sampling events.

    - Barium was reported at a concentration above the CGWSL in the sample collected from SWMU20-BH03. Barium concentrations have also been reported above the CGWSL in samples collected from MW-23, MW-43, and MW-62.

- Iron was not analyzed in samples collected from the temporary wells installed as part of the CAI or the ACAI; however, iron has been reported at concentrations above the CGWSL in samples collected from MW-93 and MW-95.

- Lead was not present at concentrations above the CGWSL in samples collected from the temporary wells. One sample collected from MW-23 in April 2011 was above the CGWSL.

- Selenium was not present at concentrations above the CGWSL in samples collected from the temporary wells. Samples collected from MW-23, MW-43, MW-61, and MW-93 contained selenium at concentrations above the CGWSL in April 2015.

- VOCs were reported in groundwater samples collected from the CAI temporary wells and in some of the monitoring wells in the vicinity of SWMU 20, as follows:

  - 1,2,4-trimethylbenzene was present at concentrations above the CGWSL in samples collected from the temporary wells and from samples collected from monitoring wells near SWMU 20, with the exception of MW-25.

  - 1,2-Dichloropropane was present at a concentration above the CGWSL in the sample collected from SWMU-BH02 but was not detected in samples collected from the remaining temporary wells. This compound was detected at a concentration above the CGWSL in the sample collected from MW-43 in September 2011 but has not been detected at concentrations above the CGWSL in the remaining samples collected from that well or in samples collected from other monitoring wells in the vicinity of SWMU 20.

  - 1,3,5-trimethylbenzene was reported at concentrations above the CGWSL in the sample collected from SWMU20-BH03 and in one of the samples collected from MW-61 (April 2015).

  - Benzene was reported at concentrations above the CGWSL in the samples collected from the CAI temporary wells and in all of samples collected from the monitoring wells in the vicinity of SWMU 20, with the exception of MW-95. Only one of the samples collected from MW-95 (April 2012) contained benzene at a concentration above the CGWSL.

- Chloroform was not detected in any of the temporary wells nor in most of the monitoring wells in the vicinity of SWMU 20; however, chloroform was reported at concentrations above the CGWSL in samples collected from MW-61 from 2011 through April 2013. Subsequent samples from MW-61 contained chloroform either below the CGWSL or the detection limit.

- Ethylbenzene was reported at concentrations above the CGWSL in the samples collected from the CAI temporary wells. Ethylbenzene was also reported at concentrations above the CGWSL in one samples collected from MW-62 (November 2014) and in two samples collected from MW-91 (April and September 2011).

- Napthalene, as reported by Method 8260, was reported at concentrations above the CGWSL in samples collected from the CAI temporary wells. Napthalene was also reported at concentrations above the CGWSL in samples collected from MW-23, MW-61, MW-62, MW-91 and MW-93.

- Tetrachloroethene was not detected in samples collected from the CAI temporary wells at concentrations above the CGWSL, although the detection limit for the sample collected from SWMU20-BH03 was above the CGWSL. Tetrachloroethene has not be reported at concentrations above the CGWSL in samples collected from monitoring wells in the vicinity of SWMU 20 with the exception of MW-91 and MW-93.

- Toluene was reported at concentrations below the CGWSL in the samples collected from the CAI temporary wells. Toluene has not been reported at concentrations above the CGWSL in the samples collected from monitoring wells in the vicinity of SWMU 20 with the exception of two samples collected from MW-91 (November 2014 and April 2015).

- Xylenes were reported at concentrations above the CGWSL in samples collected from the CAI temporary wells. Xylenes have been reported at concentrations above the CGWSL in the samples collected from monitoring wells in the vicinity of SWMU 20 sporadically, with concentrations reported above the CGWSL in samples collected from MW-23 (November 2014 and April 2015), MW-61 (November 2014 and April 2015), MW-62 (October 2013 and April 2014), and MW-91 (April and September 2011 and April 2015).

- SVOCs were analyzed in the groundwater sample collected from the CAI temporary well SWMU20-BH03, based on the TPH DRO concentration. The following SVOCs were reported at concentrations above the respective CGWSLs: 2-methylnaphthalene, benzo(a)anthracene, naphthalene, and PAHs. PAHs are defined by the WQCC as naphthalene plus monomethylnaphthalenes.

Based on the presence of organic compounds and the depth intervals of hydrocarbon impacts in the soil, potential historic releases are likely to have contributed to these impacts. Residual hydrocarbon impacts may remain in the vadose zone as shown in the depth intervals of hydrocarbon impact.

All known historic releases associated with this area have been identified in this report; however, due to the age of the Refinery, it is not possible to determine what additional, undocumented historic releases may have contributed to the contamination in this area. Further discussion of the groundwater impacts identified in this area is provided in Section 6 of this revised ACAI report.

Figure 12 depicts the results of the updated groundwater screening and PSH measurements in the vicinity of SWMU 20.

Discussion of the analytical results of the additional sampling performed as part of the ACAI is provided in Section 6 of this report.

2.5.2.3 PSH Results

Approximately 0.04 ft of PSH was observed in the temporary monitoring well SWMU20-BH01 installed on the west side of the North Bundle Cleaning Pad. As described in Section 7.1.1 of the CAI Report (Arcadis, 2011), PIANO analysis of the PSH in SWMU20-BH01 indicated that the PSH at this location appears to be a blend of gasoline and diesel.

The PSH observed in SWMU20-BH01 may be related to a PSH plume which underlies the area to the west. PSH is observed in the nearby monitoring wells/recovery wells, RW-2 and MW-97, located west of the north bundle cleaning pad. Figure 12 depicts the PSH thickness recorded in the vicinity of SWMU 20.

2.5.3 Main API Separator (SWMU 22)

As discussed in the CAI report (Arcadis, 2011), soil borings were installed at two locations east of the main API separator. One temporary monitoring well was installed in the easternmost boring. Figure 13 of this revised report shows the historical sampling locations in and around the Main API Separator. Figure 13 also shows the locations of MW-137 and MW-138, which were installed as part of the ACAI and are discuss in more detail later in this revised report.

The following subsections provide a summary of the updated analytical screening of samples collected as part of the CAI and conclusions made in the CAI report.

2.5.3.1 Soil Analytical Results

Shallow Soil

Shallow soil samples were collected from two locations in and around SWMU 22 as part of the CAI. The laboratory reports for the soil samples were submitted in the CAI report (Arcadis, 2011). Analytical results from samples collected from the 0 to 1 foot ft bgs interval at each of the five locations are summarized in Table 10 and screened against the lower of the Ind/Occ or CW SSLs. Table 10 also presents the shallow soil sample results collected during the installation of MW-137 and MW-138, discussed later in this report. Table 10 contains the results for TPH (GRO, DRO, ORO), metals, and cyanide, as well as those VOCs and SVOCs for which at least one result was reported above the corresponding detection limit.

Figure 14 depicts the results of the updated shallow soil screening for SWMU 22. The COCs shown in Figure 14 include TPH GRO, TPH DRO, and TPH ORO as gross indicators of potential hydrocarbon impacts.

None of the shallow soil samples contained concentrations of COCs above the respective CSSLs.

Deep Soil

Deep soil samples were collected from only one boring in and around SWMU 22 as part of the CAI. The laboratory reports for the soil samples were submitted in the CAI report (Arcadis, 2011). Deep soil samples were also collected during the installation of

MW-137 and MW-138 as part of the ACAI, and the analytical results are discussed in Section 6 of this revised ACAI report.

Analytical results from deep soil samples collected at depths greater than 10 ft bgs from boring SWMU22-BH02 are summarized in Table 11 and screened against the DAF 20 SSL. Those compounds with at least one reported concentration are shown in Table 11. If no DAF 20 SSL has been published by the NMED, but a Tap Water RSL has been published by the EPA, then the Tap Water RSL was used to calculate and RSL-based DAF 20 SSL. Deep soil samples collected during installation of MW-137 and MW-138 are also shown in Table 11 and are discussed further in Section 6 of this revised report.

Figure 15 depicts the results of the updated screening of the deep soil samples from SWMU22-BH02 installed during the CAI, along with the deep soil samples collected as part of the ACAI. The COCs shown in Figure 15 include TPH GRO, TPH DRO, TPH ORO and any other COCs that had at least one result above the CSSL.

The results of the updated screening indicate the following:

- The reported concentration of TPH DRO exceeds the CSSL in the sample collected from 10 to 12.5 ft bgs but does not exceed the CSSL in the sample collected from 17.5 to 20 ft bgs.

- The reported concentration of arsenic exceeds the CSSL in both of the deep soil samples collected from SWMU22-BH02.

- The reported concentrations of the following VOCs exceed the CSSL in the sample collected from 10 to 12.5 ft bgs:

    - 1,2,4-trimethylbenzene
    - 1,3,5-trimethylbenzene
    - Benzene
    - Ethylbenzene
    - Isopropylbenzene

- m,p-Xylene
- o-Xylene
- Toluene
- Xylenes (total)

The reported concentrations of 1,2,4-trimethylbenzene, benzene, and ethylbenzene were above the CSSL in the sample collected from 17.5 to 20 ft bgs at the same location; however, the other VOCs were below the CSSL.

- The sample collected from 10 to 12.5 ft bgs was analyzed for SVOCs based on the TPH DRO concentration. The only SVOC that had a reported concentration above the CSSL this sample was naphthalene.

As stated in the CAI report, based on the depth intervals of hydrocarbon impacts in the soil, potential historic releases are likely to have contributed to these impacts. Residual hydrocarbon impacts may remain in shallow low permeability clay zone.

2.5.3.2 Groundwater Analytical Results

As described in Section 2.5.2.1 above, Table 4 provides a summary of water level measurements from the 2011 CAI as well as subsequent water level measurements from wells near SWMU 22. Figure 7 depicts the potentiometric surface within the northwestern portion of the Refinery, as measured during the first semiannual event of 2011 shortly after the temporary wells were installed.

Tables 12 and 13 provide a summary of groundwater analytical results for the groundwater sample collected from SWMU22-BH02 in 2011 as part of the CAI. Table 12 contains the analytical results for TPH, metals, cyanide, and VOCs while Table 13 contains the analytical results for SVOCs. The results presented in Tables 12 and 13 include the previous results obtained during the CAI as well as results obtained during the ACAI. Analytical results from samples collected from wells in the immediate vicinity of SWMU 22 as part of the sitewide groundwater monitoring program during March 2011 and during subsequent events are also provided in Table 12 for comparison. The sitewide groundwater monitoring program does not include analysis of SVOCs, thus no SVOC results are included in Table 13 from nearby monitoring wells. The complete analytical results for the samples collected from the temporary wells were provided in

the CAI report and the complete analytical results for the sitewide groundwater monitoring program are provided in the annual groundwater monitoring reports. Analytical reports for the samples collected during the ACAI and during the first semiannual groundwater monitoring event of 2015 are provided in Appendix A of this report.

The analytical results provided in Table 12 include the results for all three of the TPH ranges and for cyanide, as well as the total metals and VOCs where at least one sample contained a reported concentration above the respective CGWSL. The analytical results provided in Table 9 include SVOCs with at least one result reported above the respective detection limits. The results of the updated screening of the CAI data are discussed below, while the results of the screening of the ACAI data is discussed later in this report.

- TPH GRO, TPH DRO, and TPH ORO were reported in the groundwater sample collected from the temporary well SWMU22-BH02. Reported DRO and ORO concentrations exceed the CGWSL in that sample, as well as in all of the samples collected from monitoring wells in the vicinity of SWMU 22.

- Five metal compounds were reported at concentrations exceeding the CGWSLs, as follows:

    - Arsenic was reported in the groundwater sample collected from temporary well SWMU22-BH02 above the CGWSL. Arsenic concentrations in the samples collected from monitoring wells in the vicinity of SWMU 22 fluctuate with many of the concentrations above the CGWSL.

    - Barium was reported at a concentration below the CGWSL in the sample collected from SWMU22-BH02. Barium concentrations have been reported above the CGWSL in all samples collected from MW-23 and in one sample collected from MW-43 (September 2011).

    - Iron was not analyzed in the sample collected from the temporary well installed as part of the CAI; however, iron has been periodically reported at concentrations above the CGWSL in samples collected from TEL-4.

    - Lead was reported at a concentration below the CGWSL in the sample collected from SWMU22-BH02. One sample collected from MW-23 in April 2011 was above the CGWSL.

- Selenium was not present at concentrations above the CGWSL in the sample collected from SWMU22-BH02. Samples collected from MW-23 and MW-43 contained selenium at concentrations above the CGWSL in April 2015.

- VOCs were reported in the groundwater sample collected from SWMU22-BH02 and in some of the monitoring wells in the vicinity of SWMU 20, as follows:

  - 1,2,4-trimethylbenzene was present at concentrations above the CGWSL in samples collected from the temporary well and from samples collected from monitoring wells near SWMU 22.

  - 1,2-dichloropropane not detected in the sample collected from SWMU22-BH02 but was not detected at a concentration above the CGWSL in the sample collected from MW-43 in September 2011. This compound but has not been detected at concentrations above the CGWSL in the remaining samples collected from that well or in samples collected from other monitoring wells in the vicinity of SWMU 22.

  - Benzene was reported at concentrations above the CGWSL in the samples collected from SWMU22-BH02 and in all of samples collected from the monitoring wells in the vicinity of SWMU 22.

  - Ethylbenzene was reported at concentrations above the CGWSL in the sample collected from SWMU22-BH02. Ethylbenzene was also reported at concentrations above the CGWSL in one samples collected from MW-23 (April 2011) and in the samples collected from MW-137 and MW-138 (August 2015).

  - Napthalene, as reported by Method 8260, was reported at concentrations above the CGWSL in the samples collected from SWMU22-BH02 and MW-23. Napthalene was also reported at concentrations above the CGWSL in samples collected from MW-137 and MW-138 (August 2015).

  - Xylenes were reported at concentrations above the CGWSL in the sample collected from SWMU22-BH02. Xylenes have also been reported at concentrations above the CGWSL in the samples collected from MW-23 in November 2014 and April 2015 as well as in the samples collected from MW-137 in August 2015.

- Cyanide was not detected in the sample collected from SWMU22-BH02 and has not been reported at concentrations above the CGWSL in samples collected from the nearby monitoring wells.

- SVOCs were analyzed in the groundwater sample collected from SWMU22-BH02, based on the TPH DRO concentration. The following SVOCs were reported at concentrations above the respective CGWSLs: 2-methylnaphthalene, naphthalene, and PAHs. PAHs are defined by the WQCC as naphthalene plus monomethylnaphthalenes.

Based on the presence of organic compounds and the depth intervals of hydrocarbon impacts in the soil, potential historic releases are likely to have contributed to the observed groundwater impacts.

All known historic releases associated with this area have been identified in this report; however, due to the age of the Refinery, it is not possible to determine what additional, undocumented historic releases may have contributed to the contamination in this area. Further discussion of the groundwater impacts identified in this area is provided in Section 6 of this revised ACAI report.

Figure 16 depicts the results of the updated groundwater screening in the vicinity of SWMU 22.

Discussion of the analytical results of the additional sampling performed as part of the ACAI is provided in Section 6 of this report.

2.5.3.3 PSH Results

No PSH has been observed in the temporary well installed as part of the CAI or in any of the monitoring wells in the vicinity of SWMU 22. Thus, no previous PSH investigation has occurred for this area.

3. Scope of Services

The approved ACAI Workplan (Arcadis, 2012b) provided a detailed description of activities to be conducted at the Clarified Slurry Oil Tanks (SWMU 17) and the North Bundle Cleaning Pad (SWMU 20). As discussed in Section 1.3 of this revised report, recommendations were made in the original ACAI report to install two additional monitoring wells near the Main API Separator (SWMU 22). Preliminary utility clearance was performed and a letter workplan was for the installation of the requested wells was submitted to NMED on November 13, 2014 (HollyFrontier, 2014b). NMED provided approval, with modifications, to the well installation workplan in December 2014 (NMED, 2014b). One of the modifications required by NMED was that instead of submitting an addendum to the ACAI Report following the well installation, NRC should submit a revised ACAI Report.

This section provides a summary of activities performed during the ACAI, as well as the installation of the two monitoring wells near SWMU 22, and describes the procedures used. In addition to the investigation activities, this section describes the removal of the UST at the former slurry slinger building within SWMU 20 and the filling of the remaining portion of the separator in SWMU 22.

3.1 Health and Safety Considerations

The majority of the sampling activities were conducted in Level D personal protective equipment (PPE). Members of the field team were required to undergo facility-specific safety orientation prior to beginning work on the refinery site.

Soil and groundwater investigation activities were performed in historic process areas of the refinery, where the locations of underground piping is likely and actual soil boring locations may not be well documented. As a result, all of the locations for all soil borings are cleared prior to drilling. Clearing procedures include marking the desired boring location, then marking approximate locations of known underground utilities in the vicinity. Planned boring locations are then adjusted to be located a minimum of 18 to 24 inches from known underground utilities. NRC personnel approve each boring location prior to the start of any subsurface penetrations.

For all soil borings and wells, the upper 5 ft of soil were cleared and investigated using a hand auger. This provided confirmation that each location was clear of subsurface utilities so that drilling could continue.

All personnel working in the active refinery are required to wear personal hydrogen sulfide (H_2S) monitors due to the potential for the presence of this gas. Installation of the two monitoring wells near SWMU 22 began in November 2014. The shallow soil samples were collected and subsurface clearance completed for both locations on November 16, 2014. The drilling was completed, as described below, at location MW-137 and the well materials were installed. However, during development of the well, hydrogen sulfide (H_2S) was encountered in the breathing zone at concentrations high enough to sound the personal alarms. Work was halted and the well casing was sealed.

Installation of MW-138 was performed in August 2015 by a drilling crew equipped with supplied air respirators. H_2S was again encountered during well construction and development activities. However, H_2S was not elevated during sample collection activities.

3.2 Activities Performed

The activities performed in each area as part of the ACAI are described in the following subsections.

3.2.1 Clarified Slurry Oil Tanks (SWMU 17)

The approved ACAI Workplan included the following scope of services for delineation of potential impacts in the CSO tanks:

- Collection of PSH samples from five existing recovery wells or monitoring wells (RW-7, RW-8, MW-94, MW-67, and NCL-34) in the area of SWMU17. Submit the PSH samples for PIANO analyses and compare the results to the results of the PIANO analysis of the PSH sample collected from SWMU17-BH01 during the AOC Group 3 CAI.

- Excavation, removal and permanent closure of the slurry slinger recovered oil UST located between Tanks 63 and 65. The UST will be assessed, cleaned, and inspected during excavation and removal for permanent closure. Confirmation soil samples will be collected from the excavation to evaluate for potential releases.

PSH samples were collected from RW-7, MW-94, and RW-8 and were analyzed for PIANO, simulated distillation, and specific gravity. However, inadequate volume of PSH was available in MW-67 and NCL-34 to perform the planned analyses. The results of the analyses are discussed in Section 6 of this report.

A recovered oil UST was identified at the former slurry slinger building, located in the northeastern corner of SWMU 17. The limited history available for the tank indicated that the tank was emptied, cleaned, and removed from service in 2003. As part of the ACAI, additional information on the tank was obtained, including the dimensions of the tank and the location of piping connected to the tank. Figure 17 provides a plan view of the locations of the UST and adjacent sumps in relation to the former slurry slinger building.

In 2013, the tank was inspected and found to have minimal amounts of clear liquid, suspected to be rainwater because of the open top below the manway grate. A sample of the liquid contents of the tank was collected and analyzed to characterize the liquid. As discussed in Section 6, the liquid did not contain detectable concentrations of semivolatile compounds expected to be present in recovered oils from CSO solids separation.

The concrete slab over the tank was inspected and was found to be in good shape, with minimal staining. The dimensions of the tank were measured and the locations of piping between the tank and the former slurry slingers were documented. As shown in Figure 17, the UST was determined to be 38 inches in diameter, 6 feet long, with a 2-foot by 2-foot manway. A metal grate was located on top of the manway and two 2-inch diameter pipes drained residual oil not recovered as decanted CSO from the slurry slingers inside the building to the grated opening in the manway and spent washing fluids (diesel and CSO).

The concrete directly over the tank was removed broken up using jackhammers. The tank was then excavated and was staged at the North Bundle Cleaning Pad where the exterior of the tank was scraped, then steam cleaned. As the tank was excavated, two additional pipes were observed, attached near the top of the manway: a flanged pipe attached to the western side of the manway and a welded pipe attached to the eastern side of the manway. These pipes were disconnected prior to completion of the excavation and each pipe was plugged.

On February 13, 2014, the tank was inspected by a NRC tank inspector and a copy of the inspection report is provided in Appendix B. Although some general corrosion and pitting was observed, there were no signs of cracks, seams or other damage. There was no sign that leakage could have occurred from the UST.

In addition to the recovered oil UST, there were three sumps located along the southern side of the former slurry slinger building. These sumps consisted of concrete boxes that were installed in the early 1980s, according to refinery records. A fabricated steel box was placed into each of the concrete boxes in 1992 to facilitate removal of the residual stream from the slurry slinger. The residual stream consisted of liquids and solids from the slurry slingers, which were removed from service in 2003. The contents of the steel boxes were removed in October 2013 during cleaning of Tanks 65 and 75. Samples of the liquid material within the steel boxes were collected for characterization. Samples of the liquid material within the concrete boxes, outside of the steel boxes, were also collected for characterization. The results of the samples are discussed in Section 6 of this report.

The steel boxes were cleaned out using diesel as a cutting fluid to reduce the viscosity of the oily material in the sumps. The material was then removed and passed through a three-phase separation process in the same fashion as the material removed from Tanks 65 and 75. The oil phase was returned to the refinery process stream. The water phase was sent to the refinery process wastewater treatment system. The solid phase was placed into hazardous waste containers along with the solid phase from Tanks 65 and 75. The solids from the sumps and Tanks 65 and 75 were shipped off-site for hazardous waste disposal as K170 waste. Following removal of the majority of the material from the sumps, the steel boxes were then pressure-washed in place to remove the remaining oily residue. The wash water was passed through the same three-phase separation process.

Once the interior of the steel boxes were clean, the boxes were removed and staged on plastic south of the former slurry slinger building. The boxes were transported to the North Bundle Cleaning Pad, where the exterior of the steel boxes were then pressure washed. The wash water was collected and processed as described above.

Following removal of the steel boxes, the concrete boxes cleaned were inspected. The solids present in the concrete boxes consisted of sand, trash and debris blown into the gap between the steel and the concrete. The material was shoveled out of the concrete boxes and was managed as K170 hazardous waste as a conservative measure. The concrete boxes were pressure washed and the wash water was

processed through the refinery process wastewater treatment system. The concrete boxes remain in place.

A photographic log of the cleaning and removal of the UST and sumps is provided in Appendix B.

3.2.2 North Bundle Cleaning Pad (SWMU 20)

The approved ACAI Workplan included the following scope of services for delineation of potential impacts in the North Bundle Cleaning Pad:

- Collection of PSH samples from two existing monitoring or recovery wells (MW-97 and RW-2). Submit the PSH samples for PIANO analyses and compare the results to the results of the PIANO analysis of the PSH sample collected from SWMU20-BH01 during the AOC Group 3 CAI.

- Collection of soil samples from one boring north of SWMU20 for delineation of hydrocarbon and/or PSH;

- Conversion of soil boring to a temporary well;

- Collection of groundwater samples from the temporary well, if less than 0.1 foot (ft) of PSH is present on the groundwater;

- Collection of PSH samples from the temporary well if more than 0.1 ft of PSH is present on the groundwater; and

- Plugging and abandonment of the temporary wells.

One PSH sample was collected from MW-97 (southwest of SWMU20-BH-01). There was an inadequate volume of PSH present to collect adequate sample for analysis. Wells within the vicinity (MW-96, MW-61, MW-62, and MW-23) had no measurable PSH. The sample from MW-97 was analyzed for PIANO, simulated distillation and specific gravity.

One soil boring was placed in the location shown on Figure 9 and soil samples were collected. For consistency with the approved CAI borings, the additional boring was named SWMU20-BH05. The soil boring was converted into a temporary well and a groundwater sample was collected from the temporary well.

3.2.3 Main API Separator

The approved well installation workplan (HollyFrontier, 2014b) included the following scope of services for well installation near the Main API Separator:

- Installation of two monitoring wells (MW-137 and MW-138)
- Collection of soil samples from both locations;
- Collection of groundwater samples from each of the two monitoring wells, if less than 0.03 foot (ft) of PSH is present on the groundwater; and
- Collection of PSH samples from each well if more than 0.1 ft of PSH is present on the groundwater.

The two planned monitoring wells (MW-137 and MW-138) were placed in the locations shown on Figure 13. Soil and groundwater samples were collected from both locations, as described in Section 3.3 of this revised ACAI report.

The approved well installation workplan (HollyFrontier, 2014b) also included a description of the planned closure in place of the remaining subsurface portion of the Main API Separator. In the approval letter (NMED, 2014b), NMED stated that the filling of the Main API Separator is considered to be corrective action, not closure, since the separator is considered a SWMU, not a regulated unit.

Following receipt of approval from NMED for the filling of the separator, standing liquids were pumped out of the below grade concrete structure of the Main API Separator. These liquids were primarily from precipitation, although it is possible that some of the liquids were from groundwater seepage into the separator. The liquids were disposed of in the current wastewater treatment system, upstream of the current oil/water separator. The concrete structure was then pressure-washed to remove any staining and the liquid generated during the pressure-washing activities were also processed through the current wastewater treatment system. The below-grade structure was filled with lean cement to approximately 8 inches below the top of the side walls of the former separator. An 8-inch thick, steel-reinforced, concrete slab was poured on top of the fill material and graded to match the surrounding walls. A joint sealing compound was placed between the slab and the walls of the separator.

The approval letter (NMED, 2014b) requested a description of the activities performed and photo documentation. Appendix C provides photo documentation of the condition of the Main API Separator immediately after it was cleaned but prior to filling with lean cement, and after the installation of the cover slab.

3.3 Sample Collection Methods

Methods and procedures for sample collection within each area are described in the following subsections.

3.3.1 Soil Sample Collection and Analysis

3.3.1.1 North Bundle Cleaning Pad (SWMU 20)

Soil boring/temporary well SWMU20-BH05 was installed by first clearing the location to a depth of 5 ft bgs using a hand auger, then completed using a hollow stem auger rig for the remainder of the boring and to install the temporary well. During installation, split spoons were continuously advanced into the boring ahead of the auger and the recovered soils from were observed and continuously logged. The boring/temporary well installation occurred on May 7, 2013 by National EWP of Peralta, New Mexico.

Soil cores collected from the borings for observation and logging were field screened with a photoionization detector (PID) and field observations were made of staining and/or odor. Field screening observations were noted on the boring log along with the lithologic properties of the soil. The soil boring and temporary well completion log for this investigation is provided in Appendix D.

According to the requirements of the ACAI Workplan, soil samples were planned to be collected from the following intervals:

- 0 to 1 feet – this sample was to be collected during subsurface clearing
- 1 foot to groundwater – one sample was to be collected from the interval with the highest observed impact from field screening methods (photo-ionization detector readings and/or visual impacts)

- Capillary zone –one sample was to be collected from the soil within the capillary zone immediately above the groundwater

- Bottom of boring

Samples were collected from the following intervals: 1 ft bgs (shallow soil), 11 ft bgs (highest PID reading), 13 ft bgs, 15 ft bgs (capillary zone), and 19 ft bgs (bottom of boring). A field duplicate sample was collected from the 19 ft bgs interval.

Each soil sample was collected as a discrete, non-composited sample. Soil samples were placed directly into laboratory-provided sample jars, labelled and placed in an iced container prior to shipment to the laboratory. All six soil samples were submitted for laboratory analysis, as follows:

- TPH by Method 8015: GRO, DRO, and ORO

- VOCs by Method 8260

- Resource Conservation and Recovery Act (RCRA) Metals by Methods 6010 and 7470

- SVOCs by Method 8270

Analytical reports for the soil samples are provided in Appendix A in electronic format.

3.3.1.2 Main API Separator

On November 16, 2014, the upper 5 feet of soil at the selected locations for monitoring wells MW-137 and MW-138 was investigated using a hand auger. Additional subsurface clearance was then performed prior using a hydro-vac to remove soil from an area slightly larger in diameter than the hollow-stem auger. Once the locations were cleared, well MW-137 was installed, on November 19, 2014. During development of MW-137, following installation of the well screen, sandpack and grout seal, elevated levels of H_2S were detected. Work was stopped and the well casing was sealed.

Installation of monitoring well MW-138 was performed on August 10 and 11, 2015. As described in Section 3.1, the work was performed using supplied air due to the presence of H_2S.

Soils collected from the borings for both wells were field screened with a PID and field observations were made of staining and/or odor. Field screening observations were noted on the boring log along with the lithologic properties of the soil. The soil boring and well completion logs for both wells are provided in Appendix D.

Soil samples were collected according to Section 5.2 of the approved ACAI workplan (Arcadis, 2012b). However, during installation of monitoring well MW-137, the PID malfunctioned and could not be used for field screening. Therefore, soil samples were collected based on field observations only. Samples were collected from 0 to 1 ft bgs (shallow soil), 5 to 6 ft bgs, 9 to 10 ft bgs, 17.5 ft bgs (capillary zone), and 29 to 30 ft bgs (bottom of boring). Soil samples were collected during the installation of MW-138 from 0 to 1 ft bgs (shallow soil), 12 ft bgs (capillary zone), 18 ft bgs (highest PID reading), and 24 ft bgs (bottom of boring).

Each soil sample was collected as a discrete, non-composited sample. Soil samples were placed directly into laboratory-provided sample jars, labelled and placed in an iced container prior to shipment to the laboratory. All of the soil samples were analyzed for the following parameters:

- Total petroleum hydrocarbons (TPH) by method 8015 modified:
    - Gasoline range organics (GRO);
    - Diesel range organics (DRO); and
    - Motor oil range organics (ORO).
- Volatile organic compounds (VOCs) by method 8260
- Semivolatile organic compounds (SVOCs) by method 8270
- Total metals Skinner list (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, cyanide, lead, mercury, nickel, selenium, silver, vanadium, zinc).

Analytical reports for the soil samples are provided in Appendix A.

3.3.2 Groundwater Sample Collection and Analysis

3.3.2.1 North Bundle Cleaning Pad (SWMU 20)

A temporary well was installed in the soil boring SWMU20-BH05, consisting of a 10 foot section of 2 inch Polyvinyl Chloride (PVC) well screen with 0.010 inch slots installed from 9 to 19 ft bgs. Solid 2 inch PVC piping was attached to the screen interval and extended above the surface. A 20/40 sand pack was placed in the annular space to a minimum of two ft above the screen, and an approximate two-foot bentonite seal was placed on top of the sand pack. The screen interval for the temporary well is shown on the well completion log contained in Appendix D.

The temporary well was developed by pumping using a peristaltic pump until the water ran clear and approximately three well casing volumes had been removed. Once the well development was complete, a multi-parameter meter was attached and field parameters were recorded, including pH, conductivity, dissolved oxygen, temperature and oxidation-reduction potential (ORP). Purging continued until the readings for at least three parameters had stabilized. The specified limits for pH and dissolved oxygen are plus or minus 0.2 units, specific conductance is plus or minus 0.02 units and oxidation-reduction potential is plus or minus 20 units.

A groundwater sample was collected from the temporary well installed in soil boring SWMU20-BH05 on May 13, 2013. The well was gauged prior to sampling to determine the depth to groundwater, the total depth of the well, and whether PSH was present. Samples were collected using low flow/low stress procedures. During the purging process, water quality parameters were recorded using a multi-parameter meter and a flow-through cell. Once the purge parameters had stabilized, the flow through cell was disconnected from the pump system and the groundwater sample was collected. Gauging measurements and purge parameters were documented on field sampling form.

The groundwater sample collected from the temporary well was submitted to ALS Environmental in Houston, Texas for analysis of the parameters indicated below:

- TPH by Method 8015: GRO, DRO, and ORO
- VOCs by Method 8260:

- RCRA Metals by Method 6010 and 7471
- SVOCs by Method 8270

Analytical reports for the groundwater samples are provided in Appendix A.

Following completion of sample collection, the temporary well PVC casing was removed from the boring and the borehole was sealed with bentonite chips, which were then hydrated.

3.3.2.2 Main API Separator (SWMU 22)

Monitoring wells MW-137 and MW-138 were installed in soil borings that extend a minimum of five feet below the observed depth of groundwater. The monitoring wells were constructed of 2-inch poly-vinyl chlorinated (PVC) casing with 0.010-inch slotted well screen. A solid 2-inch diameter PVC casing was attached to the screen interval and extended to the ground surface. Clean sand was placed in the annular space to approximately 2 feet above the well screen top as filter pack, then a bentonite seal was placed to near the ground surface. At each location, the PVC casing was cut off slightly below the ground surface and a steel manhole was installed around the casing, set into a 4-foot by 4-foot concrete pad.

A field geologist recorded all pertinent information, including the depth of the boring, the well screen interval, the type of filter sand used, the filter pack interval, the top of the bentonite seal, and the depth of groundwater during drilling and upon completion of each well. The location and top of casing was measured by a licensed surveyor in relation to the same benchmark used to survey the remaining monitoring wells associated with the refinery.

Both wells were developed by pumping to remove fine-grained materials. Water quality parameters were monitored throughout the development process and development was considered complete when the parameters stabilized. Groundwater samples were collected following completion of purging by directing the flow directly into laboratory provided containers. Samples were properly labeled and delivered to ESC Lab Sciences in Mount Juliet, Tennessee for analysis of the parameters indicated below:

- TPH by Method 8015: GRO, DRO, and ORO
- VOCs by Method 8260:
- Skinner List Metals by Method 6020 and 7470
- SVOCs by Method 8270
- Total dissolved solids (TDS) by Method 2540
- Nitrate-Nitrite by Method 353.2
- Cyanide by Method 9012
- Chloride, Fluoride, and Sulfate by Method 9056

Analytical reports for the groundwater samples are provided in Appendix A.

3.3.3 PSH Sample Collection and Analysis

As described in Section 3.2, PSH samples were collected from three wells located near SWMU 17 and one PSH sample was collected from a well near SWMU 20, as follows:

- Clarified Slurry Oil Tanks (SWMU 17)
  - RW-7 on April 24, 2013
  - RW-8 on April 24, 2013
  - MW-94 on April 24, 2013
- North Bundle Cleaning Pad (SWMU 20)
  - MW-97 on April 24, 2013

A dedicated bailer and rope was used to collect the PSH samples from each well. The bailer was slowly lowered into the PSH and slowly removed from the well casing. An attempt was made to collect only PSH but if both water and PSH were present the

liquids were allowed to separate. A bottom emptying device was used to decant (drain), to the extent practical, the groundwater out of the bailer into a bucket. The PSH was then decanted into the appropriate sample container. The excess liquids were placed into a bucket and disposed of in the Refinery process sewer system, upstream of the oil/water separator.

The PSH samples were submitted to ALS Laboratory and subsequently subcontracted to SPL in Houston, Texas for fingerprint analyses to evaluate the type of hydrocarbons present. The following analyses were run on the PSH samples collected:

- Paraffins, Isoparaffins, Aromatics, Naphthenics and Olefins (PIANO) analysis
- Simulated distillation
- Specific gravity

The PIANO analytical method used to evaluate the PSH sample was a gas chromatograph / mass spectrometer (GC/MS) method that provided information on the distribution of petroleum hydrocarbons on the C4 to C12 carbon range for gasoline constituents. The simulated distillation analysis provided information of the C8 to C40 carbon range to assess the presence of crude oil, the presence of other refined petroleum products and the degree of weathering of the PSH.

Analytical reports for the PSH samples are provided in Appendix A.

3.3.4 Confirmation Sample Collection and Analysis

Soil samples were collected from the soil excavated during the UST removal within SWMU 17 and from the side walls and bottom of the excavation. The soil samples from the excavation side walls and bottom were collected as grab samples. The soil sample from the excavated soil was collected as a composite sample, which was generated by placing small amounts of soil from various locations within the soil stockpile directly into the sample container. The results of the soil samples associated with the UST removal are discussed in Section 6 of this report.

Once the three steel sump boxes associated with the slurry slinger building were visually clean, rinsate samples were collected by pouring distilled water over the surface of the steel and collecting the rinsate. Samples were collected from the interior

and exterior of each box and from each box lid. The results of the rinsate samples are discussed in more detail in Section 6 of this report.

3.4 Quality Control Samples and Review

Field duplicates, field blanks, equipment rinsate blanks and trip blanks were planned to be obtained at a minimum at the following rates for soil and groundwater samples submitted to the laboratory for analysis:

- Field Duplicates – 10%
- Equipment Rinsate Blanks – 5% for soil samples (minimum of one per day)
- Trip Blanks – one per shipping container with samples intended for VOC analyses

Field duplicate samples were collected from randomly selected locations at the recommended rate. Trip blanks were included in each shipping container that contained samples intended for VOC analyses. Equipment blanks were collected at the rate of one sample for every 20 soil samples; however, an equipment blank was not collected on every day.

3.5 Survey Data

A licensed surveyor was utilized to obtain coordinates and land surface elevations for the boring/wells installed as part of this investigation. Horizontal locations were measured to the nearest 0.1 foot while elevation data was measured to the nearest 0.01 foot. The top of casing elevation for the monitoring wells was determined by measuring the length of the stickup and incorporating that information with the land surface elevation at that location. Survey data is provided on the boring and well completion logs (Appendix D).

3.6 Investigation Derived Waste

Investigation Derived Waste (IDW) solids included drill cuttings, disposable equipment, personal protective equipment (gloves) and other refuse generated during the course of the investigation. IDW soils were collected and placed into three drums the drums were labeled for later disposal. Other solid IDW was placed into the plant trash bins for later disposal.

Analytical data from the soil samples from the soil boring SWMU20-BH02 was reviewed to make a determination of the appropriate waste characterization of the IDW. The soil was determined to be non-hazardous; thus, the three drums of soil were combined with other non-hazardous solids and disposed of off-site at a non-hazardous waste disposal facility. A copy of the manifest is provided in Appendix E.

Analytical data from the soil samples collected during installation of MW-137 and MW-138 was reviewed to make a determination of the appropriate waste characterization of the IDW. The soil was determined to be non-hazardous; thus, the four drums of soil generated during installation of these two wells were combined with other non-hazardous solids and disposed of off-site at a non-hazardous waste disposal facility.

IDW water was generated from decontamination of reusable equipment and from development, purging and sampling of the temporary well. The IDW water was collected and disposed of in the refinery wastewater treatment system, upstream of the oil/water separator.

Material removed during cleaning of the slurry slinger recovered oil UST and effluent sumps was passed through a three-phase separation process as described above. The solids were containerized with the solids removed from Tanks 65 and 75 (similar wastes) during the tank cleaning project. All personal protective gear that came into contact with the material removed during the cleaning of the UST and sumps was also containerized and labeled as hazardous waste. The materials were shipped off site to Rineco for disposal and copies of the manifests are provided in Appendix E.

4. Field Investigation Results

This section provides a summary of the results of field investigation activities.

4.1 Surface Conditions

4.1.1 Area Land Uses

The area north, south and east of the facility is sparsely populated and used primarily for agricultural and ranching purposes. The primary business and residential areas of the City of Artesia are located to west, southwest and northwest of the Refinery. There are a few commercial businesses south of the Refinery along Highway 82, including an oil field pipe company located at the southeast corner of the plant. Much of the property for a half mile north to East Richey Avenue and east toward Bolton Road is owned by NRC. Much of the area east and northeast to Haldeman Road is a cultivated pecan orchard or used for other agricultural and ranching purposes.

The active Refinery and some of the surrounding property owned by NRC is fenced and guarded with only a few controlled entry points. The agricultural fields directly east and northeast of the Refinery that are owned by NRC are not fenced.

4.1.2 Topography

The Refinery facility is located on the east side of the city of Artesia in the broad Pecos River Valley of eastern New Mexico. The topography of the site and surrounding areas is shown in Figure 1. The average elevation of the city is 3,380 ft above mean sea level. The plain, on which Artesia is located, slopes eastward at about 30 ft per mile.

4.1.3 4.1.3 Surface Water Drainage Features

Surface drainage in the area is dominated by small ephemeral creeks and arroyos that flow eastward to the Pecos River, located three miles east of the city.

Natural surface drainage at the facility is to the north and east. The major drainage in the immediate area of the refinery is Eagle Creek (or Eagle Draw), an ephemeral watercourse normally flowing only following rain events, that runs southwest to northeast through the process area of the refinery and then eastward to the Pecos River. Upstream of the refinery, Eagle Draw functions as a major stormwater

conveyance for the community. It also drains outlying areas west of the city and is periodically scoured by intense rain events.

The elevation of Eagle Draw is 3,360 ft at its entrance to the Refinery and decreases to approximately 3,305 ft at its confluence with the Pecos River. A large portion of the Refinery is within the 100-year floodplain of Eagle Draw. However, Eagle Draw has been channelized from west of Artesia to the Pecos River to help control and minimize flood events. In the vicinity of the refinery, the Eagle Draw channel has been lined with concrete to provide further protection during flood events. A check dam was also constructed west of Artesia along Eagle Draw. At this time, most of the city and the Refinery have been effectively removed from the floodplain.

Stormwater that falls within process areas is directed to the Refinery wastewater treatment system through a series of sumps and underground piping. Stormwater that falls within the Refinery but outside of process areas is directed to stormwater retention areas and is not allowed to enter Eagle Draw or any of the surface water drainage ditches that drain stormwater from the city.

Stormwater that enters each of the two SWMUs addressed in this ACAI Report is captured and is managed as part of the overall Refinery process wastewater management system.

4.2 Exploratory Drilling Investigations

The methods used to complete the drilling activities for the ACAI and subsequent installation of monitoring wells near SWMU 22 were described in Section 3. Locations of the samples collected as part of this investigation are depicted on Figures 4, 9, and 13.

Lithologic observations were recorded on the boring/well completion log contained in Appendix D. These observations are incorporated into the subsurface conditions description provided in Section 4.3.

4.3 Subsurface Conditions

Based on previous and current soil borings in the refinery, permeable near-surface sediments to depths of 25 to 35 ft generally consist of thin discontinuous zones of clayey sands and gravels bounded by thicker zones of fine grained silts, clays and indurated caliche.

Layers of sandstone and clay were encountered in all of the borings installed in and around the areas investigated for this ACAI. Saturated soil was encountered in soil borings installed in these areas at depths of between 17 to 30 ft bgs.

Soil boring and monitor well completion logs for the CAI were contained in Appendix A of the CAI report (Arcadis, 2010). The soil boring and well completion logs for SWMU20-BH05, MW-137, and MW-138 are included in Appendix D of this revised ACAI report.

4.4 Temporary Well Abandonment

Temporary well material was removed from SWMU20-BH05 following completion of sampling. The borehole was then abandoned by filling the boring with bentonite chips and hydrating the chips.

4.5 Groundwater Conditions

The principal aquifers in the Artesia area are within the San Andres Formation and the valley fill alluvium. In the vicinity of the refinery process area is a near-surface water-bearing zone, apparently limited in vertical extent that is shallow with respect to the surface yet exhibits artesian properties at some monitoring wells. Lithologic logs from monitor wells installed previously in the refinery process area document a near-surface saturated zone overlying the main valley fill alluvium and containing water of variable quality in fractured caliche and sand and gravel lenses at depths of 15 to 30 ft. This water is under artesian pressure for at least some or most of the year with static water levels 3 to 5 ft above the saturated zones. The general direction of groundwater flow in the near-surface saturated zone is to the east.

Water levels and PSH depths, if present, were measured in the temporary well installed for this ACAI and in nearby monitoring wells. The depth to water from the established measuring point, the northern side of the well casing, was measured using a battery-powered water level indicator or oil/water interface probe, if PSH was suspected to be present.

The water level and PSH, if present, measurements recorded during the CAI and the ACAI for SWMU 17, SWMU 20, and SWMU 22 are shown on Table 4. Table 4 also provides water level and PSH thicknesses in the nearby wells, as measured during semiannual monitoring events from 2011 through the first event of 2015.

Figure 7 presents the shallow potentiometric surface calculated using data obtained shortly after the CAI was completed. Figure 18 presents the shallow potentiometric surface calculated using data from the second semiannual groundwater monitoring event of 2014. The data presented in Figure 18 is the most recent data submitted to NMED, in the 2014 annual groundwater report (Arcadis, 2015a).

In March 2011 (Figure 7), the potentiometric surface was very flat beneath in the northern portion of the refinery, with the flow direction toward the northeast beneath SWMU 17 and SWMU 20. The gradient was steeper to the east beneath SWMU 22 with a flow direction more clearly to the east.

In November 2014 (Figure 18), the flow direction beneath SWMU 17 was more easterly, and the flow direction beneath SWMU 22 remains easterly, with a relatively flat gradient. However, a groundwater sink was observed around RW-1 and RW-2, south of SWMU 17 and west of SWMU 20. This hydraulic sink reflects the pumping of groundwater from these two recovery wells.

5. Regulatory Criteria

This section presents the sources of screening levels used to evaluate investigation analytical results.

5.1 New Mexico Soil Screening Levels

NRC has followed guidance provided by NMED to develop CSSLs to evaluate which potential COCs require additional evaluation, risk assessment or cleanup. The primary source of soil screening levels is the NMED risk-based soil screening guidance document *Risk Assessment Guidance for Site Investigations and Remediation* (NMED, 2012a; NMED, 2014c; NMED, 2015b). As discussed in Section 2.5 of this revised ACAI report, the CSSLs have been updated to the most recent version of the guidance documents.

The AOCs investigated for this ACAI are all located within the active refinery. Access to these areas is limited to personnel approved to enter the refinery, which includes employees and contractors who have met the safety and security requirements for entry into the refinery. The purpose of this investigation is to determine whether there is a current risk of exposure. Thus, the screening levels were selected based on exposure pathways including soil to groundwater leaching as well as direct exposure to industrial and construction workers. The CSSLs were used according to the following hierarchy:

- The lower value of the Ind/Occ or CW SSLs were used to screen shallow soil samples (0 to 10 ft bgs). If no NMED Ind/Occ or CW SSL is published for a specific compound, the EPA Industrial RSL was used, if available, to screen shallow soil samples (0 to 10 ft bgs).

- DAF 20 SSLs were used to screen soil samples from greater than 10 ft bgs. If no NMED DAF 20 SSL is available for a specific compound, the EPA Tap Water RSL was used to calculate a DAF 20 SSL, referred to as an RSL-based DAF.

- TPH DRO and ORO samples from all depth intervals were compared to the screening level values for “unknown oil” obtained from Table 6-2 of the guidance document (NMED, 2015b).

The data screening evaluation did not include residential SSLs and thus, is not intended to allow for future unrestricted land use. NRC does not currently intend to close the AOCs included in this investigation without land use controls. In the future, if NRC wishes to close any of these areas without controls, it is understood that residential SSLs will be applicable.

5.2 New Mexico Groundwater Standards

NRC has followed guidance provided by NMED to develop a CGWSL to determine which potential COCs require additional evaluation, risk assessment or cleanup. The CGWSL was determined as follows:

- New Mexico Water Quality Standards (WQS) found in NMAC 20.6.2.3103.
- EPA's Federal Maximum Contaminant Levels (MCL).
- If no value for the WQS or MCL was available, then Tap Water value from Table A-1 of the *Risk Assessment Guidance for Site Investigations and Remediation* (NMED, 2012a), if available.

TPH DRO and ORO were compared to the screening level values for "unknown oil" obtained from Table 6-2 of the NMED guidance document (NMED, 2012a). This older version of the guidance document was used for the TPH screening value in groundwater because the groundwater screening level was removed from subsequent versions of the guidance document.

6. Sampling Results (Site Contamination)

This section presents the sampling results of the ACAI of the Clarified Slurry Oil Tanks (SWMU 17) and the North Bundle Cleaning Pad (SWMU 20). A summary of the updated screening results of the CAI data was provided in Section 2.5 of this ACAI report.

6.1 Soil Sampling Results

The scope of services performed for the ACAI was described in Section 3, along with the intervals sampled, dates and methods of sample collection, and laboratory analyses performed. This section presents the results for laboratory analysis of the soil sampling.

6.1.1 Soil Sampling Field Screening Results

Field screening observations, including measurements of organic vapors with a PID, visual observations, and olfactory observations were recorded on the soil boring log, which is provided in Appendix D.

6.1.2 Soil Sample Chemical Analytical Results

6.1.2.1 Clarified Slurry Oil Tanks (SWMU 17)

Soil Borings

No additional soil borings were installed within this SWMU as part of the ACAI. The updated screening of the CAI soil sample results was discussed in Section 2.5.1.1 of this revised ACAI report.

Soil Samples from UST Removal

Soil was removed from around and above the slurry slinger UST in order to excavate the tank. As described in Section 3, a composite sample was collected from the stockpile for waste characterization. Table 14 provides a summary of the analytical results for the waste characterization. An electronic copy of the analytical report is provided in Appendix A. A letter was submitted to NMED on February 12, 2014 (HollyFrontier, 2014a) requesting concurrence that the soil removed from around the

UST would not be considered a hazardous waste. NMED provided concurrence in a letter dated February 24, 2014 (NMED, 2014a).

UST Excavation Confirmation Soil Samples

Soil confirmation samples were collected from the side walls and floor of the excavation, following removal of the UST. These samples were analyzed for TPH DRO, TPH ORO, metals, and SVOCs based on the historical contents of the UST. Table 15 provides a summary of the analytical results for the soil confirmation samples. An electronic copy of the analytical report is provided in Appendix A. As shown in Table 15, the reported concentrations of TPH DRO exceed the SSL in samples collected from the floor of the excavation and in samples collected from the east and west walls of the excavation. None of the reported concentrations of VOC and SVOC compounds or metals exceed the SSLs.

6.1.2.2 North Bundle Cleaning Pad (SWMU 20)

Only one soil boring was installed as part of the ACAI. This boring, SMWU20-BH05, was installed north of the North Bundle Cleaning Pad, identified on Figure 9.

An electronic copy of the analytical data reports is provided in Appendix A and the analytical results for the soil sampling are summarized in Tables 6 and 7, as described in Section 2.5.2.1 of this revised ACAI report.

The analytical data were reviewed to determine whether quality assurance and quality control procedures were adequate for the purpose of this investigation. Appendix A contains the data validation checklists and comments regarding any exceptions reported. Qualifiers resulting from the data validation review are included in Tables 6 and 7.

Tables 6 and 7 list the soil sampling results from both the CAI and ACAI for samples collected in and around the North Bundle Cleaning Pad (SWMU 20) during installation of soil borings/temporary wells. A total of 23 soil samples were submitted for laboratory analyses between the two events, including field duplicates. Figures 10 and 11 depict the results of the soil sample screening.

Section 2.5.2.1 provided a summary of the updated screening of the CAI data. The following is a summary of the analytical results from both the CAI and ACAI compared to the relevant CSSL for each compound:

- TPH GRO, TPH DRO and TPH ORO were analyzed in all 23 samples. TPH screening results were as follows:
    - TPH GRO was detected in 17 of the 23 samples, with concentrations ranging from 0.021 to 4,100 mg/kg. There is not a specific SSL for GRO; thus, there were no exceedances of an SSL for this compound.
    - TPH DRO was detected in 22 of the 23 samples, with concentrations ranging from 0.99 to 6,500 mg/kg. Only one sample contained DRO at a concentration above the CSSL of 3,800 mg/kg.
    - TPH ORO was detected in all of the 23 samples analyzed for ORO, with concentrations ranging from 0.75 to 660 mg/kg, all below the SSL of 3,800 mg/kg.
- The full list of VOC compounds was analyzed in all of the 23 samples, although the list of compounds differed slightly for the samples collected from SWMU20-BH05. The VOC compounds were detected at concentrations above the relevant CSSLs, as follows:
    - 1,2,3-Trimethylbenzene was included in the VOC analyte list for samples collected from SWMU20-BH05 although it was not reported in samples collected from the borings SWM20-BH01 through SWMU20-BH04. This compound was detected in 4 of the 6 samples at concentrations ranging from 0.029 to 1.2 mg/kg. The reported concentration in the shallow soil sample did not exceed the CSSL, while only 1 of the 5 deep soil samples contained a concentration above the CSSL.
    - 1,2,4-Trimethylbenzene was reported in the 17 samples collected from locations SWMU20-BH01 through SWMU20-BH04, and was detected in 7 of the 11 samples, with concentrations ranging from 0.0016 J to 22 mg/kg. None of the reported concentrations exceeded the CSSL in the 6 shallow soil samples while 8 of the 16 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone. However, no exceedances were observed in samples collected from location SWMU20-BH02.

- 1,3,5-Trimethylbenzene was detected in 14 of the 23 samples, with concentrations ranging from 0.0016 J to 68 mg/kg. None of the reported concentrations exceeded the CSSL in the 7 shallow soil samples while 5 of the 16 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone. However, no exceedances were observed in samples collected from locations SWMU20-BH01 or SWMU20-BH02.

- Benzene was detected in 19 of the 23 samples, with concentrations ranging from 0.00055 J to 56 mg/kg. None of the reported concentrations exceeded the CSSL in the 7 shallow soil samples while 13 of the 16 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone. However, no exceedances were observed in samples collected from location SWMU20-BH02.

- Ethylbenzene was detected in 20 of the 23 samples, with concentrations ranging from 0.0016 to 2,200 mg/kg. None of the reported concentrations exceeded the CSSL in the 7 shallow soil samples while 11 of the 16 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone. However, no exceedances were observed in samples collected from location SWMU20-BH02.

- Isopropylbenzene (cumene) was detected in 16 of the 23 samples, with concentrations ranging from 0.0026 to 26 mg/kg. None of the reported concentrations exceeded the CSSL in the 7 shallow soil samples while 3 of the 16 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone. However, no exceedances were observed in samples collected from locations SWMU20-BH02 or SWMU20-BH05.

- Naphthalene, as measured by the VOC analytical method, was detected in 17 of the 23 samples, with concentrations ranging from 0.00094 to 34 mg/kg. None of the reported concentrations exceeded the CSSL in the 7 shallow soil samples while 13 of the 16 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone. However, no exceedances were observed in samples collected from location SWMU20-BH02.

- N-propylbenzene was detected in 15 of the 23 samples, with concentrations ranging from 0.0061 to 74 mg/kg. None of the reported concentrations exceeded the CSSL in the 7 shallow soil samples while 4 of the 16 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone. However, no exceedances were observed in samples collected from locations SWMU20-BH01, SWMU20-BH02, or SWMU20-BH05.

- Toluene was detected in 18 of the 23 samples, with concentrations ranging from 0.00078 to 2,700 mg/kg. None of the reported concentrations exceeded the CSSL in the 7 shallow soil samples while 3 of the 16 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone. However, no exceedances were observed in samples collected from locations SWMU20-BH01, SWMU20-BH02, or SWMU20-BH05.

- Total xylenes were detected in 19 of the 23 samples, with concentrations ranging from 0.0022 to 5,500 mg/kg. None of the reported concentrations exceeded the CSSL in the 7 shallow soil samples while 7 of the 16 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone. However, no exceedances were observed in samples collected from locations SWMU20-BH01 or SWMU20-BH02.

- SVOC compounds were analyzed in 13 of the 23 samples collected during both investigations; however, the same list of compounds was not reported for all samples. The SVOC compounds were detected at concentrations above the relevant CSSLs, as follows:

  - 2-methylnaphthalene was detected in 12 of the 13 samples, with concentrations ranging from 0.26 to 17 mg/kg. None of the reported concentrations exceeded the CSSL in the 3 shallow soil samples while 6 of the 10 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone. No detectable 2-methylnaphthalene was reported in the deep sample analyzed for SVOCs from location SWMU20-BH01.

- Naphthalene was detected in 12 of the 13 samples, with concentrations ranging from 0.25 to 11 mg/kg. None of the reported concentrations exceeded the CSSL in the 3 shallow soil samples while all 10 of the deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone.

- RCRA 8 metals were analyzed in all 23 samples. All of the RCRA 8 metals were detected as follows:

  - Arsenic was detected in all 23 samples at concentrations ranging from 1.49 to 17.2 mg/kg. None of the reported concentrations exceeded the CSSL in the 7 shallow soil samples while all 16 of the deep soil samples exceeded the CSSL.

  - Barium was detected in all 23 samples at concentrations ranging from 13 to 387 mg/kg, all below the CSSLs.

  - Cadmium was detected in all 23 samples at concentrations ranging from 0.0833 to 0.56 mg/kg, all below the CSSLs

  - Cadmium was detected in all 23 samples at concentrations ranging from 3.04 to 132 mg/kg, all below the CSSLs for total chromium.

  - Lead was detected in all 23 samples at concentrations ranging from 2.14 to 81.6 mg/kg, all below the CSSLs.

  - Mercury was detected in all 23 samples at concentrations ranging from 0.00114 to 0.222 mg/kg, all below the CSSLs.

  - Selenium was detected in 17 of the 23 samples at concentrations ranging from 0.259 to 26.7 mg/kg, all below the CSSLs.

  - Silver was detected in 2 of the 23 samples at concentrations ranging from 0.108 to 23.5 mg/kg, all below the CSSLs.

Figures 11 and 12 provide a graphical depiction of the soil sample analytical results for the COCs with at least one reported concentration above the relevant CSSLs.

6.1.2.3 Main API Separator (SWMU 22)

As described in Section 3 of this revised report, two monitoring wells were installed according to the approved monitoring well workplan (NMED, 2014a). The locations of MW-137 and MW-138 are show in Figure 13

An electronic copy of the analytical data reports is provided in Appendix A and the analytical results for the soil sampling are summarized in Tables 10 and 11, as described in Section 2.5.3.1 of this revised ACAI report.

Tables 10 and 11 list the soil sampling results from both the CAI and ACAI for samples collected in and around the Main API Separator (SWMU 22) during installation of soil borings and monitoring wells. A total of 15 soil samples were submitted for laboratory analyses between the two events, including field duplicates. Figures 14 and 15 depict the results of the soil sample screening.

Section 2.5.3.1 provided a summary of the updated screening of the CAI data. The following is a summary of the analytical results from both the CAI and ACAI compared to the relevant CSSL for each compound:

- TPH GRO, TPH DRO and TPH ORO were analyzed in all 15 samples. TPH screening results were as follows:
    - TPH GRO was detected in 8 of the 15 samples, with concentrations ranging from 0.0221 to 2,380 mg/kg. There is not a specific SSL for GRO; thus, there were no exceedances of an SSL for this compound.
    - TPH DRO was detected in 14 of the 15 samples, with concentrations ranging from 2.4 to 28,200 mg/kg. Two samples contained DRO at a concentration above the CSSL of 3,800 mg/kg, both from a depth of 10 to 12.5 ft bgs.
    - TPH ORO was detected in 9 of the 15 samples analyzed for ORO, with concentrations ranging from 2.8 to 610 mg/kg, all below the SSL of 3,800 mg/kg.
- The full list of VOC compounds was analyzed in all of the 15 samples. The VOC compounds were detected at concentrations above the relevant CSSLs, as follows:

- 1,2,4-Trimethylbenzene was detected in 7 of the 15 samples, with concentrations ranging from 0.00831 to 104 mg/kg. None of the reported concentrations exceeded the CSSL in the 6 shallow soil samples while 5 of the 9 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone, but were not detected in the samples collected from the bottom of the borings for monitoring wells MW-137 and MW-138.

- 1,2-Dichloropropane was not detected in any of the 6 shallow soil samples, but was detected in 1 of the deep samples (MW-137, 17.5 ft bgs) at a concentration of 1.16 mg/kg, above the CSSL.

- 1,3,5-Trimethylbenzene was detected in 8 of the 15 samples, with concentrations ranging from 0.00855 to 26.7 mg/kg. None of the reported concentrations exceeded the CSSL in the 6 shallow soil samples while 2 of the 9 deep soil samples contained concentrations above the CSSL. The two exceedances were present in samples collected within the capillary zone.

- Benzene was not detected in any of the shallow soil samples, but was detected in 6 of the 9 deep samples, with concentrations ranging from 0.149 to 14.2 mg/kg, all above the CSSL. The exceedances were present in samples collected at or below the capillary zone, but benzene was not detected in the samples collected from the bottom of the borings for monitoring wells MW-137 and MW-138.

- Chloroform was not detected in any of the 6 shallow soil samples, but was detected in 1 of the deep samples (MW-137, duplicate 17.5 ft bgs) at a concentration of 0.206 mg/kg, above the CSSL.

- Ethylbenzene was detected in 8 of the 15 samples, with concentrations ranging from 0.00053 to 111 mg/kg. None of the reported concentrations exceeded the CSSL in the 6 shallow soil samples while 2 of the 9 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone, but ethylbenzene was not detected in the samples collected from the bottom of the borings for monitoring wells MW-137 and MW-138.

- Isopropylbenzene (cumene) was detected in 8 of the 15 samples, with concentrations ranging from 0.0025 to 22.6 mg/kg. None of the reported concentrations exceeded the CSSL in the 7 shallow soil samples while 3 of the 16 deep soil samples contained concentrations above the CSSL. The two exceedances were present in samples collected within the capillary zone.

- Naphthalene, as measured by the VOC analytical method, was detected in 5 of the 15 samples, with concentrations ranging from 1.91 to 20.2 mg/kg. None of the reported concentrations exceeded the CSSL in the 6 shallow soil samples while 4 of the 9 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone, but ethylbenzene was not detected in the samples collected from the bottom of the borings for monitoring wells MW-137 and MW-138.

- N-propylbenzene was detected in 4 of the 15 samples, with concentrations ranging from 0.516 to 43 mg/kg. None of the reported concentrations exceeded the CSSL in the 6 shallow soil samples while 1 of the 9 deep soil samples (MW-138, 12 ft bgs) contained a reported concentration above the CSSL.

- Toluene was detected in 6 of the 15 samples, with concentrations ranging from 0.00058 to 26 mg/kg. None of the reported concentrations exceeded the CSSL in the 6 shallow soil samples while 2 of the 9 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone, but toluene was not detected in the samples collected from the bottom of the borings for monitoring wells MW-137 and MW-138.

- Total xylenes were detected in 8 of the 15 samples, with concentrations ranging from 0.0025 to 60.1 mg/kg. None of the reported concentrations exceeded the CSSL in the 6 shallow soil samples while 2 of the 9 deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone, but toluene was not detected in the samples collected from the bottom of the borings for monitoring wells MW-137 and MW-138.

- SVOC compounds were analyzed in 12 of the 15 samples collected during both investigations; however, the same list of compounds was not reported for all samples. The SVOC compounds were detected at concentrations above the relevant CSSLs, as follows:

    - 1,1-Biphenyl was detected in 5 of the 12 samples, with concentrations ranging from 0.0991 to 10.9 mg/kg. None of the reported concentrations exceeded the CSSL in the 4 shallow soil samples while the reported concentrations in 3 of the 8 of the deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone, but 1,1-biphenyl was not detected in the samples collected from the bottom of the borings for monitoring wells MW-137 and MW-138.

    - 1-Methylnaphthalene was detected in 7 of the 12 samples, with concentrations ranging from 0.582 to 42 mg/kg. None of the reported concentrations exceeded the CSSL in the 4 shallow soil samples while the reported concentrations in 4 of the 8 of the deep soil samples contained concentrations above the CSSL. The exceedances were present in samples collected at or below the capillary zone, but 1-methylnaphthalene was not detected in the samples collected from the bottom of the borings for monitoring wells MW-137 and MW-138.

    - 2-Methylnaphthalene was detected in 7 of the 12 samples, with concentrations ranging from 1.06 to 44 mg/kg. None of the reported concentrations exceeded the CSSL in the 4 shallow soil samples while the reported concentration in 1 of the 8 of the deep soil samples contained concentrations above the CSSL. The exceedance was present in the sample collected at the capillary zone in the boring for MW-138, but 2-methylnaphthalene was not detected in the samples collected from the bottom of the borings for monitoring wells MW-137 and MW-138.

    - Isophorone was detected in 6 of the 12 samples, with concentrations ranging from 0.055 to 7.05 mg/kg. None of the reported concentrations exceeded the CSSL in the 4 shallow soil samples while the reported concentration in 1 of the 8 of the deep soil samples contained concentrations above the CSSL. The exceedance was present in the sample collected at the capillary zone in the boring for MW-138, but isophorone was not detected in the samples collected from the bottom of the borings for monitoring wells MW-137 and MW-138.

- Naphthalene was detected in 6 of the 12 samples, with concentrations ranging from 1.06 to 44 mg/kg. None of the reported concentrations exceeded the CSSL in the 4 shallow soil samples while the reported concentration in 5 of the 8 of the deep soil samples contained concentrations above the CSSL. The exceedances were present in the samples collected at or below the capillary zone, but naphthalene was not detected in the samples collected from the bottom of the borings for monitoring wells MW-137 and MW-138.

- RCRA 8 metals were analyzed in soil samples collected during the CAI while Skinner list metals were analyzed in soil samples collected during the ACAI. The only metals with reported concentrations above the CSSLs were arsenic and cobalt, as follows:

  - Arsenic was detected in all 15 samples at concentrations ranging from 0.809 to 7.79 mg/kg. None of the reported concentrations exceeded the CSSL in the 6 shallow soil samples while all 9 of the deep soil samples exceeded the CSSL.

  - Cobalt was detected in 11 of the 15 samples at concentrations ranging from 1.33 to 6.06 mg/kg. None of the reported concentrations exceeded the CSSL in the shallow soil samples, and the only sample that contained a reported concentration above the CSSL in the deep samples was the sample collected from MW-138 at a depth of 18 ft bgs.

Figures 14 and 15 provide a graphical depiction of the soil sample analytical results for the COCs with at least one reported concentration above the relevant SSLs.

6.2 Groundwater Sampling Results

The scope of services performed for the ACAI was described in Section 3, along with the boring and well locations, dates and methods of sample collection, and laboratory analyses performed. This section presents the results for laboratory analysis of the groundwater sampling.

6.2.1 Groundwater General Chemistry Results

General chemistry parameters were measured during purging of the temporary well SWMU20-BH05 prior to sample collection, including pH, temperature, specific conductance, dissolved oxygen, and oxygen-reduction potential (ORP). The purge

parameters were recorded on the sample collection field form, which is provided in Appendix F.

The general chemistry parameters listed above are also measured during purging of the monitoring wells prior to sample collection as part of the facility-wide groundwater monitoring program. The purge parameters for each sampling event are presented in the annual groundwater monitoring reports. The purge parameters recorded during the initial sampling of MW-137 and MW-138 in August 2015 are provided in the field forms in Appendix F of this revised ACAI report.

6.2.2 Groundwater Sample Chemical Analytical Results

Analytical results for the groundwater sampling conducted as part of the CAI and the ACAI are summarized in Tables 5, 8, 9, 12, and 13, as discussed in Section 2.5 of this revised ACAI report.

An electronic copy of the analytical data reports for groundwater samples collected as part of this ACAI is provided in Appendix A. The analytical reports for samples collected as part of the CAI in 2011 were provided to NMED in the CAI report (Arcadis, 2011). Analytical reports for the semiannual monitoring events were submitted to NMED in the respective annual groundwater monitoring reports. The analytical reports for samples collected as part of the first semiannual groundwater monitoring event of 2015, which are included in the data tables for this report, are also provided in Appendix A.

The analytical data were reviewed to determine whether quality assurance and quality control procedures were adequate for the purpose of this investigation. Appendix A contains the data validation checklists and comments regarding any exceptions reported. Qualifiers resulting from the data validation review are included in the appropriate data tables.

6.2.2.1 Clarified Slurry Oil Tanks (SWMU 17)

No dissolved phase groundwater samples were collected from SWMU 17 as part of the ACAI. Updated screening of the CAI groundwater sample results were discussed in Section 2.5 of this revised ACAI report.

6.2.2.2 North Bundle Cleaning Pad (SWMU 20)

Groundwater samples were collected from two temporary wells (SWMU20-BH02 and SWMU20-BH03) around the North Bundle Cleaning Pad during the CAI in 2011. Additional groundwater samples were collected as part of the semiannual groundwater monitoring program from monitoring wells (MW-23, MW-43, MW-61, MW-62, MW-91, MW-93, and MW-95) as part of the facility-wide semiannual monitoring program between 2011 and 2015. Samples were collected at the frequency required for the facility-wide monitoring program from these wells when less than 0.03 ft of PSH was present. Groundwater samples were collected from one temporary well (SWMU20-BH05) in May 2013 for the ACAI.

A total of 63 groundwater samples were collected from the temporary wells and the nearby monitoring wells between January 2011 and April 2015. The following COCs had at least one reported result above the respective CGWSL, as shown in Tables 8 and 9:

- TPH GRO was detected 62 of the 63 groundwater samples, with concentrations ranging from 0.0526 to 51.6 mg/L. There is not a specific SSL for GRO; thus, there were no exceedances for this compound.

- TPH DRO was detected in all 63 samples, with concentrations ranging from 0.57 to 37 mg/L, all above the CGWSL for “unknown oil” of 0.2 mg/L.

- TPH ORO was detected in all 10 of the samples analyzed for this range, with concentrations ranging from 0.44 to 4.4 mg/L, all above the CGWSL for “unknown oil” of 0.2 mg/L.

- RCRA 8 metals were analyzed in the samples collected from the temporary wells as part of the CAI and ACAI. Various metals are analyzed for the facility-wide groundwater monitoring program. Table 8 presents the results of those metals with detected concentrations above the CGWSL in at least one sample, as follows:

    - Arsenic was detected in 37 of the 63 samples at concentrations ranging from 0.00127 to 0.0341 mg/L. The reported concentrations in 17 of the samples were above the CGWSL, including the samples collected from SWMU20-BH03 and SWMU20-BH05. Arsenic concentrations periodically exceed the CGWSL in samples collected from MW-23 and MW-43, and the sample

collected from MW-62 in April 2015 contained arsenic at a concentration above the CGWSL.

- Barium was detected in 62 of the 63 samples at concentrations ranging from 0.0243 to 11.8 mg/L. The reported concentrations in 11 of the samples were above the CGWSL, including the sample collected from SWMU20-BH03. Barium concentrations periodically exceed the CGWSL in samples collected from MW-23, MW-43, and MW-62.

- Iron was not analyzed in the samples collected from the temporary wells; however, iron was detected in 17 of the 58 samples collected from the nearby monitoring wells at concentrations ranging from 0.036 to 3.2 mg/L. The reported concentrations in 3 of the samples were above the CGWSL, including samples collected from MW-93 (November 2014 and April 2015) and MW-95 (April 2013).

- Lead was detected in 16 of the 63 samples at concentrations ranging from 0.00048 to 0.0292 mg/L. The reported concentrations of lead were all below the CGWSL, with the exception of the sample collected from MW-23 in April 2015.

- Selenium was detected in 21 of the 63 samples at concentrations ranging from 0.00038 to 0.17 mg/L. The reported concentrations of selenium in samples collected from the temporary wells were below the CGWSL. The reported concentrations in samples collected from nearby monitoring wells exceeded the CGWSL in 4 of the samples collected from MW-23, MW-43, MW-61, and MW-93 in April 2015.

- The full list of VOC compounds was analyzed in all 63 samples. Table 8 provides a summary of the VOC compounds that were reported at concentrations above the CGWSLs in at least one sample from SWMU 20, as follows:

  - 1,2,4-Trimethylbenzene was detected in 52 of the 63 samples at concentrations ranging from 0.012 to 0.71 mg/L. The reported concentration in 51 of the samples was above the CGWSL. The exceedances were observed in samples collected from the temporary wells and in nearby monitoring wells, with the exception of MW-95.

- 1,2-Dichloropropane was detected in 4 of the 63 samples at concentrations ranging from 0.0032 to 0.0094 mg/L. The reported concentration in 2 of the samples was above the CGWSL. The exceedances were observed in the sample collected from SMWU20-BH02 and in one sample collected from MW-43 in September 2011.

- 1,3,5-Trimethylbenzene was detected in 37 of the 63 samples at concentrations ranging from 0.0015 to 0.23 mg/L. The reported concentration in 2 of the samples was above the CGWSL. The exceedances were observed in the sample collected from SMWU20-BH03 and in the sample collected from MW-61 in April 2015.

- Benzene was detected in 60 of the 63 samples at concentrations ranging from 0.0015 to 21 mg/L. The reported concentrations in samples collected from the temporary wells and in nearby monitoring wells all exceed the CGWSL, with the exception of MW-95. The sample collected from MW-95 in April 2012 contained a reported concentration of benzene above the CGWSL; however, all others have been below the CGWSL or the reporting limit.

- Chloroform was detected in 7 of the 63 samples at concentrations ranging from 0.059 to 0.28 mg/L. No detectable concentrations were present in samples collected from the temporary wells. All of the detected concentrations were in samples collected from MW-61, with 5 of the 7 reported concentrations above the CGWSL.

- Ethylbenzene was detected in 58 of the 63 samples at concentrations ranging from 0.0091 to 1.9 mg/L. The reported concentrations in 8 of the samples were above the CGWSL, including the samples collected from the temporary wells and the samples collected from MW-23 in April 2011, the samples collected from MW-62 in November 2014, and the samples collected from MW-91 in April and September 2011.

- Naphthalene, as measured by the VOC method, was detected in 52 of the 63 samples at concentrations ranging from 0.005 to 0.42 mg/L. The reported concentrations in 42 of the samples were above the CGWSL. No reported concentrations exceeded the CGWSL in samples collected from MW-43 and MW-95.

- Tetrachloroethene was detected in 16 of the 63 samples, at concentrations ranging from 0.00087 to 1.91 mg/L. The reported concentrations in 15 of the samples were above the CGWSL, including samples collected from MW-91 and MW-93.

- Toluene was detected in 42 of the 63 samples at concentrations ranging from 0.0056 to 1.9 mg/L. The reported concentrations in 2 of the samples (MW-91, November 2014 and April 2015) were above the CGWSL, while all other reported concentrations were below the CGWSL.

- Total xylenes were detected in 54 of the 63 samples at concentrations ranging from 0.035 to 2.8 mg/L. The reported concentrations in 13 samples were above the CGWSL, including the samples collected from the temporary wells. No reported concentrations of total xylenes exceed the CGWSL in samples collected from MW-43, MW-93, and MW-95.

- SVOCs were analyzed in 3 samples collected from temporary wells SWMU20-BH03 and SWMU20-BH05 based on the TPH DRO concentrations. The analyte list for the SVOCs were not the same due to the difference in time of sample collection. Table 9 provides a summary of the SVOC compounds that were detected in at least one sample. The SVOCs that contained at least one concentration above the respective CGWSLs in at least one sample from SWMU 20, included the following:

  - 2-Methylnaphthalene was detected in all 3 samples at concentrations ranging from 100 to 130 micrograms per liter (ug/L), all above the CGWSL.

  - Benzo(a)anthracene was detected in 2 of the 3 samples at concentrations of 0.54 ug/L and 0.23 ug/L, both above the CGWSL.

  - Dibenzofuran was detected in the 2 samples collected from SWMU20-BH05 at concentrations of 5 and 13 ug/L, but was not analyzed for the sample collected from SWMU20-BH03. The reported concentration of the normal sample collected from SWMU20-BH05 was above the CGWSL.

  - Naphthalene, as measured by the SVOC method, was detected in all 3 samples at concentrations ranging from 50 to 220 ug/L, all above the CGWSL.

- PAHs, calculated as the sum of naphthalene and 2-methylnaphthalene, were present in all 3 samples, at concentrations ranging from 180 to 340 ug/L, all above the CGWSL.

Figure 12 provides a graphical depiction of the groundwater sample analytical results for the COCs with at least one reported concentration above the relevant CGWSLs.

6.2.2.3 Main API Separator (SWMU 22)

Groundwater samples were collected from one temporary well (SWMU22-BH02) near the Main API Separator during the CAI in 2011. Additional groundwater samples were collected as part of the semiannual groundwater monitoring program from monitoring wells (MW-23, MW-43, and TEL-4) as part of the facility-wide semiannual monitoring program between 2011 and 2015. Samples were collected at the frequency required for the facility-wide monitoring program from these wells when less than 0.03 ft of PSH was present. Groundwater samples were collected from monitoring wells MW-137 and MW-138 in August 2015 for the revised ACAI.

A total of 35 groundwater samples were collected from the temporary well and the nearby monitoring wells between January 2011 and April 2015. The following COCs had at least one reported result above the respective CGWSL, as shown in Tables 12 and 13:

- TPH GRO was detected all 35 samples with concentrations ranging from 1.4 to 39 mg/L. There is not a specific SSL for GRO; thus, there were no exceedances for this compound.

- TPH DRO was detected in all 35 samples with concentrations ranging from 1.2 to 20 mg/L, all above the CGWSL for “unknown oil” of 0.2 mg/L.

- TPH ORO was detected in all 8 of the samples analyzed for this range, with concentrations ranging from 0.6 to 1.76 mg/L, all above the CGWSL for “unknown oil” of 0.2 mg/L.

- RCRA 8 metals were analyzed in the sample collected from the temporary well as part of the CAI and ACAI. Various metals are analyzed for the facility-wide groundwater monitoring program. The Skinner list of metals was analyzed in samples collected from MW-137 and MW-138 in August 2015. Table 12 presents

the results of those metals with detected concentrations above the CGWSL in at least one sample, as follows:

- Arsenic was detected in 29 of the 35 samples at concentrations ranging from 0.006 to 0.029 mg/L. The reported concentrations in 19 of the samples were above the CGWSL, including the sample collected from SWMU22-BH02. Arsenic concentrations periodically exceed the CGWSL in samples collected from MW-23, MW-43, and TEL-4. Arsenic exceeded the CGWSL in the sample collected from MW-138 and in the normal sample collected from MW-137, but not the field duplicate sample collected from that same well.

- Barium was detected in all 35 samples at concentrations ranging from 0.0144 to 11.8 mg/L. The reported concentrations in 8 of the samples were above the CGWSL, including samples collected from MW-23 from April 2011 through April 2014 and in the sample collected from MW-23 in September 2011. Barium did not exceed the CGWSL in samples collected from SWMU22-BH02, MW-137, or MW-138.

- Chromium was detected in 13 of the 35 samples at concentrations ranging from 0.0013 to 0.6 mg/L. The reported concentrations in 9 of the samples collected from TEL-4 were above the CGWSL; however, none of the samples collected from SWMU22-BH02, MW-137, or MW-138 contained detectable concentrations of chromium.

- Iron was not analyzed in the sample collected from the temporary well; however, iron was detected in 11 of the 31 samples collected from the nearby monitoring wells at concentrations ranging from 0.059 to 2.4 mg/L. The reported concentrations in 3 of the samples collected from TEL-4 were above the CGWSL.

- Lead was detected in 12 of the 35 samples at concentrations ranging from 0.000551 to 0.0292 mg/L. The reported concentrations of lead were all below the CGWSL, with the exception of the sample collected from MW-23 in April 2015.

- Selenium was detected in 11 of the 35 samples at concentrations ranging from 0.00042 to 0.12 mg/L. The reported concentrations of selenium in samples collected from the temporary well, as well as MW-137 and MW-138, were below the CGWSL. The reported concentrations in samples collected from

nearby monitoring wells exceeded the CGWSL in the samples collected from MW-23 and MW-43 in April 2015.

- Cyanide was analyzed in the samples collected from SWMU22-BH02, MW-137, and MW-138 and is analyzed in samples collected from MW-43 as part of the facility-wide groundwater monitoring program. Cyanide was not detected in the samples collected from the temporary well or from MW-137 and MW-138. Cyanide was detected in 3 of the samples collected from MW-43 between April 2011 and April 2015 at concentrations ranging from 0.0025 to 0.0705 mg/L, all below the CGWSL.

- The full list of VOC compounds was analyzed in all 35 samples. Table 12 provides a summary of the VOC compounds that were reported at concentrations above the CGWSLs in at least one sample from SWMU 22, as follows:

  - 1,2,4-Trimethylbenzene was detected in 31 of the 35 samples at concentrations ranging from 0.012 to 0.47 mg/L. The reported concentration in 30 of the samples was above the CGWSL. The exceedances were observed in samples collected from the temporary wells and in nearby monitoring wells.

  - 1,2-Dichloropropane was detected in 3 of the 35 samples at concentrations ranging from 0.0032 to 0.0054 mg/L. The reported concentration in 1 sample was above the CGWSL. The exceedance was observed in the sample collected from MW-43 in September 2011.

  - Benzene was detected in all 35 samples at concentrations ranging from 0.0078 to 17 mg/L, all above the CGWSL

  - Ethylbenzene was detected in 27 of the 35 samples at concentrations ranging from 0.0035 to 2.2 mg/L. The reported concentrations in 5 of the samples were above the CGWSL, including the samples collected from the temporary well and the samples collected from MW-137 and MW-138 in August 2015. The reported concentration of ethylbenzene in the sample collected from MW-23 in April 2011 was above the CGWSL, but the subsequent samples collected from this well contained ethylbenzene concentrations below the CGWSL.

- MTBE was detected in 26 of the 35 samples, at concentrations ranging from 0.0077 to 0.2 mg/L. The reported concentrations in 3 samples, collected from TEL-4 in April and September 2011 and April 2012, were above the CGWSL. The subsequent samples collected from TEL-4 and from the temporary well and other wells near SWMU 22 contained MTBE at concentrations below the CGWSL or detection limits.

- Naphthalene, as measured by the VOC method, was detected in 26 of the 35 samples at concentrations ranging from 0.0035 to 0.305 mg/L. The reported concentrations in 13 of the samples were above the CGWSL including the samples collected from the temporary well, MW-23, MW-137, and MW-138. No reported concentrations exceeded the CGWSL in samples collected from MW-43 and TEL-4.

- Toluene was detected in 18 of the 35 samples at concentrations ranging from 0.0046 to 1.58 mg/L. The reported concentrations in the 2 samples (normal and duplicate) collected from MW-137 were above the CGWSL, while all other reported concentrations were below the CGWSL.

- Total xylenes were detected in 31 of the 35 samples at concentrations ranging from 0.019 to 1.4 mg/L. The reported concentrations in 5 samples were above the CGWSL, including samples collected from the temporary well, MW-23 (November 2014 and April 2015), MW-137, and MW-138. No reported concentrations of total xylenes exceed the CGWSL in samples collected from MW-43, MW-138, and TEL-4.

- SVOCs were analyzed in 4 samples collected from the temporary well SWMU22-BH02, MW-137, and MW-138 based on the TPH DRO concentrations. The analyte list for the SVOCs were not the same due to the difference in time of sample collection. Table 13 provides a summary of the SVOC compounds that were detected in at least one sample at a concentration above the CGWSL, which included the following:

  - 1-Methylnaphthalene was detected in the 3 samples collected from MW-137 and MW-138 at concentrations ranging from 42 to 71.8 ug/L, but was not analyzed for the sample collected from SWMU22-BH02. All of the reported concentrations were above the CGWSL.

- 2-Methylnaphthalene was detected in all 4 samples at concentrations ranging from 39 to 73.3 ug/L, all above the CGWSL.

- Dibenzofuran was detected in the 3 samples collected from MW-137 and MW-138 at concentrations ranging from 3.79 to 13.6 ug/L, but was not analyzed for the sample collected from SWMU22-BH02. The reported concentration of the duplicate sample collected from MW-137 was above the CGWSL, while the reported concentration of the other 2 samples was below the CGWSL.

- Naphthalene, as measured by the SVOC method, was detected in all 4 samples at concentrations ranging from 79.7 to 199 ug/L, all above the CGWSL.

- PAHs, calculated as the sum of naphthalene, 1-methylnaphthalene (if analyzed), and 2-methylnaphthalene were present in all 4 samples, at concentrations ranging from 160.7 to 344.1 ug/L, all above the CGWSL.

Figure 16 provides a graphical depiction of the groundwater sample analytical results for the COCs with at least one reported concentration above the relevant CGWSLs.

6.2.3 PSH Analytical Results

As previously discussed, PSH was encountered during the CAI and the ACAI included collection of additional PSH samples for further evaluation of the nature and extent of PSH within the vicinity of SWMU 17 and SWMU 20.

As shown in Table 4, PSH was present in two of the temporary wells installed as part of the ACAI. A review of the PSH data was performed to evaluate the nature of the PSH within each of the samples and to compare the PSH between the two SWMUs. A detailed evaluation memo is provided as Appendix G.

6.2.3.1 Clarified Slurry Oil Tanks (SWMU 17)

As described in Appendix G, the PSH present in the wells in the vicinity of SWMU 17 appears to primarily be a jet fuel or kerosene material. As discussed in Section 2.2, there was a release of JP8 (jet fuel) from an underground pipeline just east of SWMU 17 in 2010. The PSH evaluation noted that the PSH present in MW-94 appeared to be the least weathered while the PSH present in RW-7 and RW-8 appeared to be more weathered. The weathering is consistent with an undocumented historical release in

the vicinity of RW-7 and RW-8 along with the more recent release near MW-94. The PSH evaluation concluded that the PSH present in SWMU17-BH01 is similar to the PSH present in MW-94, RW-7, and RW-8. However, the PSH from SWMU17-BH01 also appears to be less weathered than the PSH collected from RW-7 and RW-8. Thus, all of the PSH in this area appears to be similar in nature, although the PSH present in MW-94 and SWMU17-BH01 appears to be from a more recent release (less weathered).

6.2.3.2 North Bundle Cleaning Pad (SWMU 20)

As described in Appendix G, the PSH present in SWMU20-BH01 appears to be a mixture of gasoline and diesel range hydrocarbons while the PSH present in MW-97 appears to be more of a gasoline range hydrocarbon. The PSH near SWMU 20 appears to be distinctly different than that near SWMU 17. It is possible that the PSH present in SWMU20-BH01 is more weathered than the PSH present in MW-97, or the PSH may be from different releases. The lack of PSH in the temporary wells and wells surrounding SWMU20-BH01 provides horizontal delineation of the PSH in the immediate vicinity of the North Bundle Cleaning Pad.

6.3 UST Contents and Metal Sump Rinsate Sampling Results

As described in Section 3.3.4, a sample of the liquid contents of the recovered oil UST was collected and analyzed to characterize the contents. Table 16 provides a summary of the analytical results for this sample and the laboratory report is provided in Appendix A. None of the compounds expected to be present in recovered oil from CSO separation were detected in the sample. This sample confirms the reports that the UST was sufficiently pressure washed when it was removed from service. After the contents were removed and the tank was excavated, the exterior of the UST was scraped clean of dirt. The dirt was collected and staged with the dirt excavated during the removal of the UST. The UST was then steam cleaned and inspected. No rinsate samples were collected from the interior of the UST as the contents of the tank were clean and there was no evidence of releases from the tank.

After the contents of the metal effluent sump boxes were removed, and the boxes were pressure-washed, rinsate samples were collected from both the inside and outside of the boxes and the lids in order to determine if the cleaning process was complete. Table 17 provides a summary of the rinsate sample analytical results and the laboratory report is provided in Appendix A. There were detectable concentrations of DRO, ORO, barium, lead, benz(a)anthracene, benzo(a)pyrene, and

benzo(b)fluoranthene in all six of the rinsate samples. There were detectable concentrations of chromium and dibenzo(a,h)anthracene in two of the six samples (eastern sump lid and western sump lid). There were detectable concentrations of benzo(k)fluoranthene in five of the six samples (all but the western sump).

The rinsate sample analytical results were compared to the characteristically hazardous waste limits and to the treatment standards for K170 waste, to provide a conservative evaluation of potential impacts. The reported concentrations were several orders of magnitude below the comparison standards. Thus, the metal boxes are considered clean enough to be handled as scrap metal and recycled.

7. Conclusions

The ACAI of AOC Group 3 has been completed according to the approved ACAI workplan and the approved workplan for installation of additional wells at SWMU 22. The following sections present a summary of the investigation and analytical results for each area investigated.

7.1 Clarified Slurry Oil Tanks (SWMU 17)

Shallow soil samples collected from within and around SWMU 17 as part of the CAI and ACAI indicate that no impacts above Ind/Occ or CW SSLs are present in the shallow soils.

Soil and groundwater samples collected from within and around SWMU 17 indicate the presence of hydrocarbon and arsenic impacts near the soil-groundwater interface.

Groundwater sample data indicate the presence of both PSH and dissolved phase impacts from historic releases in the area.

PSH in wells in the vicinity of SWMU 17 appears to be similar to jet fuel and is believed to be present from historical and recent releases of JP8 from an underground pipeline in the area. PSH in the vicinity of SWMU 17 does not appear to be associated with the CSO tanks.

The recovered oil UST associated with the former slurry slinger operation has been excavated and does not appear to have been a source of hydrocarbon impacts to soil or groundwater. Confirmation samples from the excavation indicate the presence of elevated hydrocarbons in the area, which may be associated with historical releases from the nearby diesel tanks.

The former effluent sumps located along the south side of the former slurry slinger building have been cleaned and the metal sump boxes have been removed. Rinsate samples from the steel boxes indicate that the boxes were adequately cleaned.

7.2 North Bundle Cleaning Pad (SWMU 20)

One shallow soil sample (7.5 to 10 ft bgs) collected from the northeastern corner of SWMU 20 contained TPH DRO above the SSL. The shallower soil sample (0 to 1 ft bgs) from this same location did not contain any COCs above the Ind/Occ or CW

SSLs. The remaining shallow soil samples indicate that no impacts above Ind/Occ or CW SSLs are present in the shallow soils.

Soil and groundwater samples collected from within and around SWMU 20 as part of the CAI and ACAI indicate the presence of hydrocarbon-related COCs and elevated arsenic concentrations near the soil-groundwater interface.

Groundwater sample data indicate the presence of both PSH and dissolved phase impacts from historic releases in the area.

PSH in wells in the vicinity of SWMU 20 appears to be gasoline and diesel range hydrocarbons. The lack of PSH in wells surrounding SWMU20-BH01 indicates the PSH is horizontally delineated in the immediate area of SWMU 20.

7.3 Main API Separator (SWMU 22)

Shallow soil samples collected from within and around SWMU 22 as part of the CAI and ACAI indicate that no impacts above Ind/Occ or CW SSLs are present in the shallow soils.

Soil and groundwater samples collected from within and around SWMU 22 indicate the presence of hydrocarbon and arsenic impacts near the soil-groundwater interface. One soil sample collected during the installation of MW-138 (18 ft bgs) contained cobalt at a concentration above the CSSL; however, none of the remaining samples collected from this area contained similar concentrations of cobalt.

Groundwater sample data indicate the presence of dissolved phase impacts from historic releases in the area. However, no PSH is present in the immediate vicinity of SWMU 22.

8. Recommendations

The ACAI for AOC Group 3 has resulted in confirmation and further delineation of impacts to soil and groundwater within each of the areas investigated. The following sections provide recommendations for further action, if appropriate.

8.1 Clarified Slurry Oil Tanks (SWMU 17)

Surface soil impacts in the area are limited in extent and are below the exposure levels for refinery workers.

Deeper soil impacts are present and are most likely associated with impacted groundwater in the area due to historical releases from the nearby diesel tanks and underground piping. Potential exposure to the deeper soil impacts is managed through the NRC soil management procedures, which includes review of historical soil data, as available, and determination of appropriate mitigation practices during the excavation permitting process.

Recovery of PSH from groundwater will continue to be performed utilizing the existing recovery trenches RW-7 and RW-8. Groundwater monitoring will continue according to the facility wide groundwater monitoring program.

The recovered oil UST associated with the former slurry slinger operation has been removed from the ground and the tank has been shown to be clean. It is recommended that the tank be handled as scrap metal and recycled. The metal sump boxes have been removed and cleaned, and may also be handled as scrap metal and recycled.

An interim measures work plan describing the plans to fill the sumps and perform additional soil investigation adjacent to the sumps was submitted in September 2015 (Arcadis, 2015c). NMED approved the work plan in November 2015 (NMED, 2015d). NRC will implement the recommended activities and submit a report documenting the results in 2016.

8.2 North Bundle Cleaning Pad (SWMU 20)

Surface soil impacts in the area are limited in extent and are below the exposure levels for refinery workers.

Deeper soil impacts are present and are most likely associated with impacted groundwater in the area due to historical releases from the process areas and piping. Potential exposure to the deeper soil impacts is managed through the NRC soil management procedures, which includes review of historical soil data, as available, and determination of appropriate mitigation practices during the excavation permitting process.

Recovery of PSH from groundwater will continue to be performed utilizing the existing recovery trench RW-2. Groundwater monitoring will continue according to the facility wide groundwater monitoring program.

No further action is recommended for the North Bundle Cleaning Pad at this time.

8.3 Main API Separator (SWMU 22)

Surface soil impacts in the area are limited in extent and are below the exposure levels for refinery workers.

Deeper soil impacts are present and are most likely associated with impacted groundwater in the area due to historical releases. Potential exposure to the deeper soil impacts is managed through the NRC soil management procedures, which includes review of historical soil data, as available, and determination of appropriate mitigation practices during the excavation permitting process.

Groundwater monitoring will continue according to the facility wide groundwater monitoring program.

The subsurface structure of the former Main API Separator has been filled and capped, removing the potential for migration of contaminants from this structure into the subsurface or from the groundwater into the structure.

No further action is recommended for the Main API Separator at this time.

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