SFPP, L.P., an operating partnership of
Kinder Morgan Energy Partners, L.P.

STAGE 1 ABATEMENT PLAN

Three Saints Road Release Site
Anthony, New Mexico

November 8, 2019

Dezbah Jesus
New Mexico Environment Department
Ground Water Quality Bureau
121 Tijeras Ave. NE, Suite 1000
Albuquerque, New Mexico 87102-3400

Arcadis U.S., Inc.
1140 North Town Center Drive
Suite 320
Phoenix
Arizona 85008
Tel 602 438 0883
Fax 602 438 0102
www.arcadis.com

Subject:
Stage 1 Abatement Plan
Three Saints Road Release, Anthony, New Mexico

ENVIRONMENT

Dear Ms. Jesus:

Date:
November 8, 2019

Contact:
Bob Forsberg

Phone:
480.535.7399

Email:
bob.forsberg@arcadis.com

Our ref:
30036536

On behalf of Santa Fe Pacific Pipeline (SFPP), L.P., an operating partnership of Kinder Morgan Energy Partners, L.P. (Kinder Morgan), Arcadis U.S., Inc., (Arcadis) has prepared the attached *Stage 1 Abatement Plan* for the Three Saints Road Release Site ("the Site"), in response to the New Mexico Environment Department (NMED) *Stage 1 Abatement Plan Required, Santa Fe Pacific Pipeline Spill, 3 Saints Road, Anthony, New Mexico,* letter, dated September 4, 2019. This Stage 1 Abatement Plan was prepared following New Mexico Administrative Code (NMAC) 20.6.2.4106. Because substantial investigation and remediation of the source zone has already been performed at the site under NMAC 20.6.2.1203 much of the information required for a final site investigation report is available. In particular, it is proposed that the data and information in this document and supporting site investigation reports be considered sufficient to fulfill the requirements of a final site investigation report for the source zone because adequate definition of source zone conditions and data necessary to select and design an effective source zone abatement option are provided. Approval of this document as the final site investigation report for the source zone is requested, so that a Stage 2 abatement plan proposal can be submitted for selection and design of a source zone abatement option.

Please contact Scott Martin, Director, EHS / Remediation for Kinder Morgan, at (714) 560-4775 if you have questions or require additional information.

Sincerely,

Arcadis U.S., Inc.

Robert Forsberg, R.G. (Arizona)
Principal Geologist

Jon Spitzinger, P.E. (New Mexico)
Principal Civil Engineer

Attachment

Copies:
Justin Ball, NMED
Gary Esslinger, EBID
Scott Martin, Kinder Morgan

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121 Tijeras Ave. NE, Suite 1000
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Robert Forsberg, R.G. (Arizona)
Principal Geologist

Jon Spitzinger, P.E. (New Mexico)
Principal Civil Engineer

Prepared by:

410 N. 44th Street
Suite 1000
Phoenix
Arizona 85008
Tel 602 438 0883
Fax 602 438 0102
Arcadis U.S., Inc.

Our Ref.:

30036536

Date:

November 8, 2019

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ACRONYMS AND ABBREVIATIONS

Arcadis	Arcadis U.S., Inc.
ASTM	American Society for Testing and Materials
bbls	barrels
bgs	feet below groundwater surface
CAR	Corrective Action Report
COC	chain of custody.
CSM	conceptual site model
ºC	degrees Celsius
EBID	Elephant Butte Irrigation District
EPA	United States Environmental Protection Agency
ft	feet
Kinder Morgan	Kinder Morgan Energy Partners, L.P.
LNAPL	light non-aqueous phase liquid
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NTU	Nephelometric Turbidity Units
PAHs	polyaromatic hydrocarbons
PID	photoionization detector
ppmv	parts per million volume
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
SFPP	Santa Fe Pacific Pipeline, L.P.
Site	3 Saints Road Release Site
Test America	Test America Laboratories, Inc.
TGI	technical guidance instructions
USCS	Unified Soil Classification System
UVOST®	Ultraviolet Optical Screening Tool
VOCs	volatile organic compounds
Work Plan	Groundwater Monitor Well Work Plan

1 INTRODUCTION

On behalf of Santa Fe Pacific Pipeline (SFPP), L.P., an operating partnership of Kinder Morgan Energy Partners, L.P. (Kinder Morgan), Arcadis U.S., Inc. (Arcadis) prepared this *Stage 1 Abatement Plan* for the Three Saints Road Release Site ("the Site"), in response to the New Mexico Environment Department (NMED) letter dated September 4, 2019.

The purpose of this Stage 1 Abatement Plan is to describe activities proposed to further define site conditions and provide the necessary data to select and design an effective abatement option. This document presents the current understanding of the of the source zone and distribution of residual light non-aqueous phase liquid (LNAPL) in the portion of the Anthony Drain impacted by the pipeline release. Specifically, this Stage 1 Abatement Plan includes

- evaluation of subsurface data from site investigation and remedial efforts and
- identification of data gaps proposed to be filled to support selection and implementation of abatement options.

This Stage 1 Abatement Plan was prepared following New Mexico Administrative Code (NMAC) 20.6.2.4106.

Further, substantial investigation and remediation of the source zone has already been performed at the site under NMAC 20.6.2.1203, so much of the information required for a final site investigation report is available. In particular, it is proposed that the data and information in this document and supporting site investigation reports be considered sufficient to fulfill the requirements of a final site investigation report for the source zone because adequate definition of source zone conditions and data necessary to select and design an effective source zone abatement option is provided. Supporting site investigation reports include:

- *Revised Corrective Action Report, 3 Saints Street Release Site, Anthony, New Mexico*, dated February 19, 2019.
- *Grab Groundwater Summary Report, 3 Saints Street Release Site, Anthony, New Mexico*, dated April 11, 2019.
- *UVOST® Investigation Summary Report, 3 Saints Street Release Site, Anthony, New Mexico*, dated May 3, 2019.

2 BACKGROUND

2.1 Site Location and Adjacent Land Uses

The Three Saints Road Release Site is located adjacent to 4220 Three Saints Road in Anthony, New Mexico, 88021. A site vicinity map is shown on Figure 1. Adjacent and nearby land use include community ditches, canals, drains, privately owned farmland and single-family home residences north and south; Three Saints Road, privately owned farmland and community ditches to the west; and privately-owned farmland, unpaved access road and community ditches to the east.

2.2 Site History

On December 13, 2018 at 11:41 pm Mountain Standard Time, an SFPP 12- inch pipeline automatically shut down in response to a loss of pressure which was ultimately determined to be the result of a rupture in the vicinity of 4220 Three Saints Road, New Mexico, 88021. The location and nature of the discharge was identified at 12:51 am on December 14, 2018 and subsequently reported to the NMED at 0309 am. SFPP estimates that approximately 10,910 barrels of gasoline was discharged.

Immediate actions taken to mitigate impacts from the release included: isolating the ruptured section of the pipeline; mobilization of emergency response personnel and oil spill response organizations (OSROs); isolation and control of the release vicinity; evacuation of nearby residents and excavation and repair of the pipeline. The immediate response activities were conducted between December 14 and December 23, 2018. After completion of immediate response activities, direct-push drilling equipped with a laser-induced fluorescence sensor (Ultraviolet Optical Screening Tool or UVOST®) was conducted to delineate the horizontal and vertical extent of petroleum hydrocarbon Light Non-Aqueous Phase Liquid (LNAPL) in the subsurface. Discrete soil samples were also collected for laboratory analysis from select boring locations. Direct push and grab groundwater sampling were then conducted at 63 locations to assess groundwater impacts. Corrective actions included product recovery and excavation of LNAPL impacted soil. A detailed review of previous investigations and remedial actions are included in Section 3 and 4.

3 INVESTIGATIONS

Initial investigation activities along the east and west banks of the Anthony Drain were conducted in phases from December 27, 2018 through February 17, 2019, using a direct-push drilling rig equipped with a laser-induced fluorescence sensor (UVOST®]). Soil samples were submitted for laboratory analysis of VOCs by EPA Method 8260B and TPH following EPA Method 8015.

Direct push soil sampling was performed at the Site from December 27 through 30, 2018. Soil samples were collected approximately 10 to 12 feet below ground surface (bgs) at four locations (i.e., SB-1 through SB-3 and SB-19) along the western (i.e., SB-1 through SB-3) and eastern bank (i.e., SB-19) of the Anthony Drain. Soil samples collected from SB-22 were collected at a depth of two to three feet bgs in Anthony Drain using a hand auger. Soil samples were submitted for laboratory analysis of VOCs by EPA Method 8260B and TPH following EPA Method 8015. Volatile organic compounds were not detected at concentrations exceeding DAF 1 Risk-based Soil Screening Levels (SSL), for borings SB-1 and SB-2, located beyond the LNAPL impacts. Dissolved phase gasoline constituents were detected inside the LNAPL extent (determined by UVOST® as described below) for borings SB-3, SB-19 and SB-22 at concentrations exceeding a DAF 1 Risk-based SSL. Soil analytical results are included in Tables 1 and 2. Soil boring locations and the approximate extent of LNAPL (determined by UVOST® as described below) are presented on Figure 2. Analytical results, soil boring locations and the approximate extent of LNAPL from the direct push soil sampling are reported in the *Revised Corrective Action Report, 3 Saints Street Release Site, Anthony, New Mexico* (Revised CAR), dated February 19, 2019.

The UVOST® was deployed by the direct push rig at 291 boring locations to identify and delineate the horizontal and vertical extent of petroleum hydrocarbon LNAPL in the subsurface, above and below the groundwater table. Based on data collected during the UVOST® investigation, LNAPL extends up to 140 ft outside the original configuration of the Anthony Drain. The pre-excavation extent and bottom elevation

of LNAPL is shown on Figure 3 as the combination of the color and grayscale flooded contours. Color flooded contours show the extent of LNAPL not removed by excavation, and grayscale flooded contours show the extent of the LNAPL footprint removed by excavation with the hachured cells indicating where LNAPL impacted soil may remain below the bottom of the excavation (See Section 4). The UVOST® investigation provided guidance in determining the extent of excavation phase activities. Details of direct push drilling activities and the pre-excavation extent of LNAPL are presented in the *UVOST® Investigation Summary Report*, *3 Saints Street Release Site, Anthony, New Mexico,* dated May 3, 2019.

Direct push and grab groundwater sampling were performed at the Site from February 18 through March 7, 2019. Groundwater samples were collected at 56 locations using direct push drilling technology and a Geoprobe® Screen Point Groundwater Sampler; and seven grab water samples were collected from approximately 6 inches below the surface of groundwater accumulated in the excavation, through use of a pole, peristaltic pump and tubing. Laboratory analysis of grab groundwater samples collected from within the LNAPL extent reported concentrations of VOCs above their respective screening levels. Groundwater analytical results from outside and inside the ditch are included in Tables 3 through 5. Grab groundwater sample locations are presented on Figures 3 through 5. An additional groundwater sample was collected for general chemistry analyses in an effort to establish background geochemical concentrations (Table 6). Outside the delineated LNAPL zone, no dissolved phase gasoline constituents were detected at concentrations exceeding an NMED Groundwater Standard or NMED Tapwater Screening Level. Dibenz(a,h)anthracene, which is not a gasoline constituent, was observed in GW-44 at a concentration above the NMED Tap Water Screening Level of 0.0343 µg/L. Field activities and analytical results are summarized in the *Grab Groundwater Summary Report, 3 Saints Road Release Site, Anthony, New Mexico*, dated April 11, 2019.

4 REMEDIAL ACTIONS

Corrective actions completed to date include LNAPL recovery and excavation of petroleum hydrocarbon contaminated and overburden soil. Petroleum LNAPL recovered during initial release response and excavation activities was captured by vac trucks from the drain. The recovered LNAPL was temporarily stored in tanks staged at both the release site as well as the Jobe Rail Yard located at 117 Harding Road, Anthony, New Mexico. Approximately 217,410 gallons (5,176 bbls) of LNAPL was subsequently transported back to SFPP's El Paso Breakout Station in El Paso, Texas. An additional approximately 41,523 gallons (989 bbls) was transported to Intergulf Corporation's Hwy 225 facility in LaPorte, Texas for re-processing. Approximately 23,988 gallons (571 bbls) of LNAPL was recovered via skimming from exposed surface/groundwater during the excavation activities and transported to Intergulf for re-processing.

Excavation of LNAPL impacted soil was conducted at the Site from January 15 through June 26, 2019. Excavated soil was handled and maintained according to the established Revised Waste Management Plan (Arcadis, 2019c). LNAPL contaminated soil was excavated from the subsurface and along the sides and bottom of the Anthony Drain. Non-impacted overburden was removed and screened using a photoionization detector as described in the Excavation Phase Work Plan (Arcadis 2019a). Non-impacted overburden was stockpiled for tested for reuse applicability. The excavation advanced by removing soils from 25 by 25 feet grid cells along the length of the Anthony Drain to remove petroleum hydrocarbon mass delineated by the LNAPL fluorescence response (UVOST®) data. LNAPL impacted soil was excavated

based on converging data using three methodologies: laser-induced fluorescence response of LNAPL; field screening of soil via photoionization detector; and laboratory analytical results. Approximately 38,600 cubic yards of petroleum impacted soil was excavated and transported to Rhino Environmental Services in Chaparral, New Mexico for recycling via land farming. A summary of investigation derived waste handling and management is summarized in an October 25, 2019 submittal to the NMED Hazardous Waste Bureau on October 25, 2019 (Arcadis, 2019h). A comprehensive summary of excavation activities is presented under separate cover in the *Excavation Completion Report*, *3 Saints Street Release Site, Anthony, New Mexico,* dated November 8, 2019.

An impermeable LNAPL barrier (a.k.a., hanging curtain), was installed along the western excavation bank, on the northern and southern sides of the SFPP pipeline corridor, and, temporarily, on the southern bank of the Kilgore Lateral crossing, where excavation limits could not be advanced to remove all LNAPL impacted soil. This hanging curtain will prevent migration of the remaining LNAPL back into the excavated area. Final design details for restoration/reconstruction of the Anthony Drain remain a work in progress in collaboration with Elephant Butte Irrigation District.

5 SITE CONCEPTUAL MODEL

5.1 Regional Geology

According to Hawley and Kennedy (2004), the Three Saints Road Release Site is located within the Mesilla Basin in the Mexican Highland section of the Basin and Range physiographic province and it is one of the larger structural depressions of the southern Rio Grande rift tectonic province. The distinctive geomorphic characteristic of this part of the Basin and Range province is the large extent of basin-floor areas relative to the flanking piedmont slopes and mountain uplifts. Most ranges are narrow and low lying (less than 8,000 [ft] elevation) in comparison with highlands of the northern and central Rio Grande.

The Mesilla Basin is bounded on the east by the Organ-Franklin-Juarez mountain chain and on the west by the East Potrillo Mountains and Aden and Sleeping Lady Hills. The Robledo and Doña Ana Mountains form the western and eastern boundaries in the northern section of the basin, respectively.

According to Hawley and Kennedy (2004), the Mesilla Basin extends southward about 60 miles from the upper end of the Mesilla Valley, at the mouth of Selden Canyon, to a poorly defined groundwater divide located about 15 miles south of the International Boundary and southwest of Sierra Juárez. Basin width varies from about 5 miles at its northern end to about 25 miles in its central part. The extensive, undissected plain west of the Mesilla Valley is locally designated the West Mesa or “La Mesa”.

5.2 Regional Hydrogeology

The Three Saints Road release occurred within the Mesilla Valley subsection of the Mesilla Basin in southern New Mexico. The Mesilla Basin is bounded on the east by the Organ-Franklin-Juarez mountain chain and on the west by fault-block and volcanic uplands, which extend northward from the East Potrillo Mountains (Hawley and Kennedy 2004). The Mesilla Valley segment is located within the eastern part of the Mesilla Basin.

According to Land (2016), the Rio Grande alluvial aquifer underlies the Mesilla Valley floor between Leasburg Dam to the north and the El Paso narrows to the south. This hydrostratigraphic unit comprises river-channel and overbank facies ranging in texture from sand and gravel to silt and clay. Fluvial deposits associated with the Rio Grande are up to approximately 100 ft thick in places and may be up to five miles wide. Beneath the alluvial aquifer is poorly consolidated sands and gravels of the Tertiary-Quaternary Santa Fe Group, which forms the principal basin-fill aquifer in the Mesilla Basin. The Santa Fe Group basin-fill aquifer has a saturated thickness of up to 3,000 ft, and has been subdivided into upper, middle, and lower Santa Fe hydrostratigraphic units.

Groundwater within the Mesilla Valley fill is generally unconfined and typically moves southerly down the valley. However, local-flow direction is influenced by nearby hydraulic conditions, such as the river, drains, canals, well pumpage, and heavily irrigated fields (Hawley and Kennedy 2004). The water table is approximately 10 to 25 ft below the land surface in much of the valley-floor area. Recharge to the valley-fill aquifer occurs primarily as vertical flow from the surface water system (river, canals, laterals, and drains) and irrigated cropland fields except in times of extreme drought. The inner-valley aquifer zone is the major source of recharge to underlying and laterally adjacent basin fill of the Santa Fe Group (Teeple 2017).

5.3 Site-Specific Geology

The Site lies within the floodplain of the Rio Grande River; subsurface lithologic information supports the interpretation that Site soils were deposited by flood events of the Rio Grande River. Beds of sand or gravel and beds of sand and silt mixtures with laterally discontinuous lenses of clayey soil are present. Interpretation of the geology is based on lithologic observations during site investigation and excavation phase activities. Lithologies encountered during direct push drilling and soil sampling consisted of silt, sand and gravel to total depth of the investigation (approximately 25 ft bgs). Native soil (tan sandy silt) have been encountered during excavation of petroleum impacted soil and clean overburden. These generally fine-grained soil types are consistent with fluvial floodplain deposits of the Mesilla Basin.

5.4 Site-Specific Hydrogeology

Groundwater flow is generally south toward the Rio Grande River based on the regional groundwater flow patterns for this area of the Mesilla Valley. According to aquifer tests, maximum values of transmissivity in the central Mesilla Basin range from 10,900 to 40,000 square feet per day (Hawley and Kennedy 2004). Hamilton and Maddock (1993) report that the Rio Grande flood plain alluvium can be considered an unconfined aquifer. Lowering of the water table in an unconfined aquifer leads to the release of water stored in interstitial openings by gravity drainage. Storativity in unconfined aquifers typically ranges from 0.1 to 0.3 (Lohman 1972).

Direct push groundwater sampling found the hydrostatic water level between approximately 11 and 12 feet below ground surface or about 3,795 feet to 3,797 feet above mean sea level (ft-msl) assuming a surface elevation between 3,807 feet and 3,808 feet above mean sea level. Monitoring of groundwater elevation in the excavation has found the hydrostatic water level to range from 3,794 feet to 3,797.5 ft-msl. About one quarter mile north of the site, groundwater elevations observed in EBID piezometer MES_23R have varied between about 3,793.7 feet and 3,798 ft-msl over the past nine months. Water levels at that same piezometer have varied between about 3,791.6 feet and 3,800.5 ft-msl over the past ten years.

Site specific hydraulic properties and interpretation of subsurface conditions are based upon logs generated during Hydraulic Profiling Tool (HPT) investigation, including electrical conductivity (EC) and estimated hydraulic conductivity (estimated K) logs. The EC of the soil was logged simultaneously with HPT data. Electrical conductivity of the soil is a function of the ionic content of the soil and therefore indicates relative grain size. Clays and silts have relatively high ion concentrations and therefore relatively high electrical conductivity; sands and gravels have relatively low ion concentrations and therefore relatively low electrical conductivity. Electrical conductivity logs generated by the HPT indicate the subsurface is composed of clean sands and/or gravels from approximately 8 to 11 feet bgs, and a silt and sand mixture from approximately 11 ft bgs to total depth of the investigation (approximately 25 ft bgs). Discontinuous lenses of finer grained soil were observed at approximately 16 ft bgs in soil borings SB-1 and SB-2. A detailed summary of direct push drilling and copies of HPT logs are presented in the Revised CAR (Arcadis 2019b).

Estimated hydraulic conductivity (K) logs (Arcadis 2019f) indicate subsurface soils is fairly uniform across the area of investigation. Relatively high hydraulic conductivity soils appear to be laterally continuous, whereas relatively low hydraulic conductivity soils do not appear to be laterally contiguous across the area of investigation. Estimated K logs and EC logs indicate the subsurface is composed primarily of sands and silts. Discontinuous, lower hydraulic conductivity lenses were observed at approximately 16 ft bgs in SB-1 and SB-2, consistent with EC logs across this interval at these locations. Estimated hydraulic conductivity in the saturated zone generally ranges from 50 to 100 ft/day, with some layers of lower and higher hydraulic conductivity. These results are consistent with other estimates of hydraulic conductivity of the shallow soils in the vicinity of the Site. Further, there does not appear to be a pattern of low hydraulic conductivity at any specific depth indicating no larger-scale laterally continuous low permeability layer in the top 25 ft of soil at the Site.

5.5 Surface Water Hydrology

A hydraulic connection is observed between the Rio Grande River and the surface water and shallow groundwater systems of the irrigated Mesilla Valley (Nickerson and Myers 1993). Surface water supply is derived from the Rio Grande River, a few large tributary arroyo systems, a network of irrigation canals and laterals, and groundwater drainage ditches that discharge to the Rio Grande. Seasonal trends in the shallow water table generally correspond to groundwater pumping and surface water irrigation during the irrigation season. The Anthony Drain functions to drain excess groundwater from irrigated acreage. When groundwater is sufficiently high, water in the drain can flow to the Rio Grande, however, flow has not been observed in the drain since project inception in December 2018.

The portion of the Anthony Drain affected by the Three Saints Road Release is assumed to have only shallow, flowing water during months-long periods occurring several years apart when groundwater is high enough to induce flow in the drain; and is not considered relatively permanent waters. Based on water levels recorded at EBID piezometer MES_23R, the portion of the Anthony Drain did not have flowing water for more than 90% of the past 10 years. The Anthony Drain through and upstream of the site is designed for collection and diversion of groundwater and is not intended for collection and/or diversion of surface water. The top edge of the drain is higher than the surrounding ground surface which slopes away from the drain so little to no surface water runoff contributes to flow in the portion of the Anthony Drain in and

upstream of the site. The ephemeral surface water in the drain lacks the biological, hydrological, and physical characteristics commonly associated with intermittent or continuous conveyances of water.

5.6 Nature, Extent and Magnitude of Contamination

The contaminants of potential concern (COPCs) are gasoline-range petroleum hydrocarbons, specifically gasoline-range volatile organic compounds [VOCs] and gasoline-range semi volatile organic compounds [SVOCs]. The list of constituents currently included in the soil analytical program is presented in Appendix A. The extent of these COPCs has been characterized in soil, groundwater and LNAPL. During and following characterization activities, excavation of the gasoline source zone was conducted in all accessible areas, and this discussion reflects the post-excavation nature, extent and magnitude of contamination.

5.6.1 Soil

The estimated extent and deepest occurrence of LNAPL found during the investigation and remaining after excavation are shown on Figure 6. Soil screening data collected from east-side elevation grid cells (i.e., final elevation of E, F, G and H transects) confirm excavation successfully removed most source zone material in shallow soil on the east of excavation boundary. Photoionization detector concentrations were reported below the 500 parts per million volume (ppmv) screening level, for these transects with the exception of grid cells E43, F40, F43 and G42. Soil screening results collected along the east sidewall of the excavation reported concentrations between 0 and 6337 ppmv; for sidewall soil in grid cells C37-SW, D29-SW, D33-SW, E43-SW, F31-SW, F42/G42-SW and H43-SW. Soil screening results exceeding 500 ppmv suggests excavation of the extent of soil impacts in these grid cells is incomplete. Soil screening concentrations exceeding the 500 ppmv screening level, in the center of the excavation (i.e., final elevation of C and D transects) include C22, C23, C29, C30, C31, C33, C41, C43, D03, D04, D41, and D42. Soil screening data collected along the western edge (e.g., select grid cells along A and B transects), report VOC concentrations above 500 ppmv. Soil screening results exceeding 500 ppmv is one line of evidence that source mass remains. The vertical extent of contamination for grid cells along the A and B transects have not been defined. Source material currently remains on the north and western boundaries of excavation. A summary of soil screening and analytical results that guided excavation is presented in the Excavation Completion Report (Arcadis 2019i).

5.6.2 Groundwater

Based on review of groundwater quality data collected at the Site using direct push drilling technology, the lateral and vertical extent of groundwater impacts appears to have been characterized (Figures 3, 4, and 5), at the time of sample collection, by the extent of gasoline LNAPL defined by UVOST® investigation.

Within the pre-excavation extent of gasoline LNAPL, concentrations of benzene, toluene, ethylbenzene and total xylenes (BTEX), naphthalene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, n-hexane, 1-methylnaphthalene, and 2-methylnaphthalene above NMED Groundwater Standard or NMED Tapwater Screening Level were observed shallow groundwater samples and samples collected from open water within the excavation. Note that the laboratory reporting limit exceeded the screening level of 0.0343 micrograms per liter (µg/L) for dibenz(a,h)anthracene in all groundwater samples.

Outside of the interpreted pre-excavation extent of gasoline LNAPL, no VOCs or SVOCs were observed above NMED Groundwater Standards or NMED Tapwater Screening Levels, with one exception. Dibenz(a,h)anthracene, which is not a constituent of gasoline, was observed in GW-44 located approximately 50 ft east of the gasoline LNAPL extent. Outside of the interpreted pre-excavation extent of gasoline LNAPL, groundwater samples were collected from 0 to 3 ft below the water table and from 17 to 20 feet below the water table.

Based on these data, the extent of dissolved-phase gasoline constituents in groundwater at the time of sampling was confined to the source zone defined by the pre-excavation gasoline LNAPL extent.

1,4-dioxane was not detected at concentrations above laboratory reporting limits in groundwater samples collected at the Site. Note that the laboratory reporting limit (<10 µg/L) exceeded the screening level of 4.59 µg/L for sample GW-29.

The grab groundwater sample results are summarized in the Grab Groundwater Summary Report (Arcadis 2019d).

5.6.3 LNAPL

Discussion of the characterization and distribution of LNAPL is presented in the UVOST® Investigation Summary Report (Arcadis 2019f); and is summarized below.

LNAPL fluorescence response data using UVOST® was collected along the east and west banks of the Anthony Drain to delineate LNAPL impacts. The estimated extent and deepest occurrence of LNAPL found during the investigation and remaining after excavation are shown in plan view on Figure 7 and in cross-section on Figure 8. Prior to excavation, LNAPL extended up to 140 feet outside the original configuration of the Anthony Drain. Petroleum impacted soil was excavated based, in part, on the extent and interpolated top and bottom of the LNAPL zone estimated from UVOST® data. The extent of LNAPL removed by excavation is shown in plan view by the gray-scale flooded contours on Figure 7 and in cross-section on Figure 8. Details of soil excavation are outlined in the Excavation Completion Report (Arcadis 2019i).

Based on the UVOST® data collected, LNAPL is fully delineated at the Site. The extent and bottom elevation of LNAPL estimated to remain is shown on Figure 7. LNAPL remains along the western boundary of the drain where excavation was not feasible due to the presence of utilities (electrical, water, and natural gas). LNAPL also remains within the SFPP pipeline corridor and EBID's Kilgore Lateral crossing.

LNAPL source mass remaining after excavation may be present in two mobility states. Most remaining source mass is thought to be present as residual LNAPL. Residual LNAPL trapped in the soil and is immobile (Interstate Technology & Regulatory Council [ITRC] 2018). Within the overall footprint of residual LNAPL, there may be pockets of mobile LNAPL, which is LNAPL that can drain from the soil (for example into a well) but does not necessarily have the ability to spread (i.e., migrate) outside the stable LNAPL zone footprint (ITRC 2018). The overall footprint of the LNAPL zone is interpreted as stable with little to no potential for LNAPL to migrate based on the time since the original release, removal from the drain during the emergency response of about half the LNAPL released, and the excavation of roughly three quarters of the LNAPL source zone footprint. The potential for LNAPL to migrate is a function of the mobility of the

LNAPL (e.g., LNAPL transmissivity) and the LNAPL gradient balanced by the resistive forces of capillary tension on the LNAPL and natural source zone depletion (NSZD) (ITRC 2018).

5.6.4 Summary of Source Area Nature and Extent

Source mass is primarily present as residual LNAPL remaining in soils mainly to the west of the Anthony Drain near the water table and also around the SFPP pipeline corridor and the Kilgore Lateral where they cross the Anthony Drain. There is evidence of low concentrations of source zone material remaining below the maximum depth of some excavation cells. Dissolved-phase gasoline constituents have been observed only within the interpreted extent of LNAPL (Figure 6).

5.7 Contaminant Fate and Transport

The fate and transport of petroleum LNAPL is well described by ITRC (2018). The indented paragraphs below are excerpts from *Light Non-Aqueous Phase Liquid (LNAPL) Site Management: LCSM Evolution, Decision Process, and Remedial Technologies* Section 3.2 *Life Cycle and Anatomy of an LNAPL Body* (ITRC 2018) that describe the petroleum LNAPL fate and transport details relevant to this conceptual site model. Site-specific gasoline fate and transport characterization is provided in the un-indented text.

> When an LNAPL release occurs, the LNAPL will move vertically downward under the influence of gravity through the permeable pathways (e.g., unconsolidated soil, fractures, and macropores) and, if sufficient LNAPL volume and head is generated by the release, the LNAPL will eventually encounter the water table. During the downward movement of LNAPL through the soil, the presence of confining layers, subsurface heterogeneities, or other preferential pathways may result in irregular and complex lateral spreading and/or perching of LNAPL before the water table is encountered.

The LNAPL released to the Anthony Drain started out at the water table, so very little vertical migration occurred.

> Once at the water table, the LNAPL will spread laterally in a radial fashion as well as penetrate vertically downward into the saturated zone, displacing water to some depth proportional to the driving force of the vertical LNAPL column (or LNAPL head). The vertical penetration of LNAPL into the saturated zone will continue to occur as long as the downward force produced by the LNAPL head or pressure from the LNAPL release exceeds the counteracting forces produced by the resistance of the soil matrix and the buoyancy resulting from the density difference between LNAPL and groundwater. Once the release of LNAPL is terminated, the areal extent of the LNAPL body will continue to expand for a relatively short time, and eventually stop once the resistive forces in the soil balance the driving force of the diminishing LNAPL head. When the LNAPL body reaches this state, the LNAPL body has stabilized in extent, and will not typically expand further unless additional releases or significant subsurface hydraulic changes occur.

While the primary release point was at the pipeline, LNAPL quickly spread atop the surface/groundwater exposed along the length of the section of Anthony Drain where the pipeline crosses. Resulting LNAPL lateral migration at the water table was perpendicular to the edges and ends of the section of the drain. Rapid removal of LNAPL from the drain during the emergency response quickly reduced the LNAPL head driving LNAPL migration allowing the LNAPL extent to stabilize, likely within weeks of the release. The

UVOST® investigation that began two weeks after the release and four days after LNAPL removal from the drain was complete found no evidence of ongoing LNAPL migration.

> A typical LNAPL body consists of LNAPL partially filling the soil pore space in a highly variable and often discontinuous distribution. The volume of aquifer occupied by an LNAPL body is not comprised of a single fluid phase, but rather of multiple fluids and soil in proportions that will vary throughout. An LNAPL body is therefore a multiphase system where the pore space contains varying quantities of LNAPL, groundwater, and/or gases both above and below the static water table elevation. Generally speaking, the spatial extent occupied by an LNAPL body is predominantly comprised of water, followed by a lesser amount of LNAPL, with the smallest fraction of the pore space occupied by gas.
>
> As with any fluid, LNAPL will take the path of least resistance in the subsurface, with preferential pathways (both natural and man-made) often controlling the ultimate LNAPL body geometry. Similarly, LNAPL is typically the non-wetting or intermediate wetting phase and will preferentially occupy larger pore spaces in the subsurface or macropores such as fractures in clays or bedrock. As a result, LNAPL may be found in all directions from a release point (i.e., not just downgradient) in highly irregular distributions.

As shown by the interpreted extent of LNAPL (Figure 2), the LNAPL migration distance from the edge of the drain is highly variable. It is probable that the longest migration distances, for example directly north of the pipeline corridor and also about 300 feet north of the pipeline corridor, are along buried geologic features, such as paleochannels that ran downslope to the west toward the Rio Grande River.

> Once a release has terminated and the LNAPL body has initially stabilized, longer-term changes in the LNAPL body will be dominated by NSZD processes (including dissolution, volatilization, and biodegradation) and smearing due to water table fluctuations.
>
> The smearing of LNAPL due to water table fluctuations will redistribute the LNAPL mass so that it becomes progressively less mobile and recoverable over time. For example, in a rising and subsequent falling water table in an unconfined condition: the mobile fraction of the LNAPL will move up with the water table during the rise, but some portion of this mobile fraction will become trapped in the pore space when the water table drops. Therefore, the vertical LNAPL distribution changes and the mobile fraction that remains afterwards are smaller.
>
> NSZD processes progressively reduce LNAPL mass over time via direct biodegradation of LNAPL by microbes and by physical partitioning processes, into other phases (e.g., soil gas and groundwater), where biodegradation also occurs. This results in the depletion of constituents from the LNAPL and reduction in mass, and eventually, diminishing amounts of constituent dissolution and volatilization. NSZD processes therefore play an important role in risk mitigation and the long-term stability of LNAPL bodies.
>
> [F]luctuations in the water table that redistribute the mobile LNAPL fraction, together with biodegradation, dissolution, and volatilization that deplete LNAPL mass, decrease the fraction of mobile LNAPL over time until all LNAPL exists as residual.

During the period from the release in mid-December 2018 through early November 2019, water table fluctuations – due mainly to groundwater pumping and supply of surface water for irrigation – have caused the water table to drop about 3 ⅓ feet, then rise about 4 ⅓ feet, then drop about 1 ½ feet. As a result, the remaining LNAPL smear zone may be as much as about 3 ⅓ feet deeper and one foot shallower than

indicated by the UVOST® data. Over the past 10 years, the water table has fluctuated by 9 feet with annual fluctuation as much as about 6 feet. LNAPL mobility has likely been substantially reduced by smearing induced by water table fluctuations already encountered.

LNAPL NSZD encompasses a variety of processes that act to biologically degrade and physically redistribute LNAPL constituents to the aqueous or gaseous phases where they are also subsequently broken down biologically. NSZD occurs primarily through direct contact oil biodegradation, biodegradation of solubilized hydrocarbons at the oil/water interface, LNAPL volatilization and biodegradation in the vadose / smear zone, and less significantly through dissolution into groundwater and biodegradation in the saturated zone.

NSZD begins as soon as LNAPL is released to the subsurface, typically via volatilization and dissolution, and eventually most prominently through biodegradation as intrinsic microorganisms acclimate to the presence of the petroleum hydrocarbons and use it as a growth substrate.

Direct-contact biodegradation occurs in the immediate proximity to the LNAPL, within pores with oil where air-phase porosity is present (e.g., top of LNAPL body). By-product gases from this reaction are directly outgassed to the vadose zone and do not enter aqueous phase.

Biodegradation of LNAPL constituents occurs across the entire smear zone (from unsaturated, to partially, to fully saturated) by naturally-occurring microorganisms. Biodegradation occurs via a multitude of mechanisms in both aerobic and anaerobic conditions. Aerobic biodegradation occurs where ample oxygen (O_2) is present. In a relatively short time (i.e., several months depending upon geochemistry), the often finite supply of electron acceptors within the LNAPL smear zone such as O_2, nitrate (NO_3^-), ferric iron (Fe^{3+}), and sulfate (SO_4^{2-}) are consumed and conditions become increasingly more favorable to anaerobic biodegrading organisms that produce methane (CH_4). Gaseous by-products of biodegradation processes, carbon dioxide (CO_2) and CH_4, are observable in the vadose zone soil gas above the LNAPL source zone. As the CH_4 diffuses upward, it encounters O_2 diffusing downward from the atmosphere which enables intrinsic methanotrophs and other microorganisms to consume the CH_4 and create CO_2 and water vapor. Vapor phase hydrocarbons (i.e., volatile organic compounds [VOCs]) are also degraded aerobically and anaerobically in the vadose zone, depending on the local (pore scale) conditions.

NSZD rates at a given site are affected by a number of interrelated factors including temperature, soil moisture, soil gas permeability, groundwater geochemistry, and microbiology.

While no characterization of NSZD has been performed, NSZD is certainly already acting to reduce LNAPL and COPC mass.

Similar to the attenuation of VOCs in the vadose zone described above, a dissolved-phase plume is expected to evolve. Evolution and natural attenuation of dissolved-phase petroleum hydrocarbon plumes is widely understood to go through four phases (e.g., ASTM 2010, Connor et al. 2015):

1) Plume expansion immediately following a release when the rate of dissolution to and advection in groundwater exceeds the rate of biodegradation in groundwater;
2) Plume stabilization when the rate of dissolution to and advection in groundwater equals the rate of biodegradation in groundwater;

3) Plume contraction when the rate of dissolution to and advection in groundwater is less than the rate of biodegradation in groundwater; and

4) Plume exhaustion when little to no source mass remains and groundwater concentrations are either below detection limits or low and limited to the residual source zone footprint.

It is likely that the groundwater plume is still in phase 1, but only one groundwater monitoring event has been conducted and did not find any detectable gasoline constituents in groundwater outside the source zone. In general, the groundwater gradient is to the south, so plume expansion is expected mainly to the south. Local, limited-duration groundwater pumping may also induce short-term migration in other directions. In particular, the irrigation well about 50 ft northeast of the LNAPL extent may induce migration toward it. No gasoline constituents have been detected in groundwater between the LNAPL and the irrigation well and have not been detected in irrigation water produced from that well, with the exception of one very low concentration detection of xylenes on July 10, 2019 (2.7 µg/L; Arcadis 2019j). Proposed groundwater monitoring is discussed in Section 7.

5.8 Inventory of Water Wells and Monitoring

A review of the New Mexico Office of the State Engineers New Mexico Water Rights Reporting System was conducted to identify wells located within a 3/4-mile radius of the 3 Saints Road release point. Table 7 summarizes the wells identified within that search radius and provides available well construction information and distances from the release point. Figure 8 shows the locations of the wells relative to the release point.

Approximately 70 wells were identified in the search radius and are shown on Figure 8. The distance of the wells from the site is broken down as follows:

- only six wells are located within 0.1 miles of the boundary of the source zone
- Thirty-one wells are located within 0.5 miles of the release point
- The remaining 33 wells are greater than 0.5 miles from the release point.

The direction of the wells from the release point can be broken down as follows:

- Twenty-one (21) are to the north and assumed to be upgradient based on general southerly groundwater flow direction.
- Nine (9) are to the east or west and assumed to be cross gradient based on the general southerly groundwater flow direction.
- Forty (40) are to the south and assumed to be located downgradient based on the general southerly groundwater flow direction.

The specified use of the wells can be broken down as follows:

- Thirty-eight (38) wells are identified with a domestic, domestic and livestock watering, non 72-12-1 domestic and livestock, or non 72-12-1 domestic designation.
- Twenty-seven (27) are identified as irrigation wells.
- Three (3) are identified as other uses.
- Two (2) did not have a use associated with them in the database.

5.8.1 Sampling of Water Wells

Water samples collected from local residences, irrigation and Elephant Butte Irrigation District (EBID) wells were submitted for laboratory analysis of VOCs following EPA Method 8260B, PAHs by EPA Method 8270SIM and TPH by EPA Method SW8015B. Well sampling details are summarized below. The locations of these wells are shown in Figure 9.

5.8.1.1 Residential Well Sampling

Water samples were collected from local residences upon their request. Following receipt of laboratory analytical reports, letters summarizing the analytical results were submitted to the respective residents, NMED and Kinder Morgan. Below is a list of dates water samples were collected from individual residences followed by the dates that the analytical results were provided to the respective residents. No VOCs, PAHs or TPH GRO were detected in any of the samples collected, unless otherwise noted.

Samples collected December 15, 2018 from the following properties:

- **Garcia property well**: *Analytical Results for Well Sampling, Garcia Property, 4721 Three Saints Road, Anthony, New Mexico*, dated December 21, 2018.
- **Kraemer property well**: *Analytical Results for Well Sampling, Kramer Property, 4725 Three Saints Road, Anthony, New Mexico*, dated December 21, 2018.
- **Russell property pond**: *Analytical Results for Pond Sampling, Kramer Property, 3701 Three Saints Road, Anthony, New Mexico*, dated December 21, 2018.
- **Trujillo property well**: *Analytical Results for Well Sampling, Trujillo Property, 4189 Three Saints Road, Anthony, New Mexico*, dated December 21, 2018.

Samples collected December 20, 2018 from the following property:

- **Farm One LTD CO (Cobos) property well**, *Analytical Results for Well Sampling, Farm One LDT CO Property, 3925 Three Saints Road, Anthony, New Mexico*, dated January 18, 2019.
    - Naphthalene was detected at an estimated concentration of 0.02 µg/l. This concentration is below the laboratory reporting limit and well below the NMED water quality standard of 30 µg/l. DRO and ORO were detected at estimated concentrations of 0.0599 mg/l and 0.0711 mg/l, respectively. These concentrations are below the laboratory reporting limits but above the method detection limits.

Samples collected January 22, 2019 from the following property:

Farm One LTD Co (Cobos) property well: *Analytical Results for Well Sampling, Cobos Property, 3925 Three Saints Road, Anthony, New Mexico*, dated January 31, 2019.January 23, 2019 from the following property:

- **Kraemer property well**: *Analytical Results for Well Sampling, Kramer Property, 4725 Three Saints Road, Anthony, New Mexico*, January 31, 2019.

Samples collected March 19, 2019 from the following properties:

- **Kraemer property well**: *Analytical Results for Well Sampling, Kramer Property, 4725 Three Saints Road, Anthony, New Mexico*, April 5, 2019.

Samples collected April 11, 2019 from the following properties:

- **Mora residential property well**: *Analytical Results for Well Sampling, 4217 Three Saints Road, Anthony, New Mexico*
- **Trujillo residential property well**, *Analytical Results for Well Sampling, 4189 Three Saints Road, Anthony, New Mexico,* dated April 15, 2019.

Samples collected June 10, 2019 from the following properties:

- **Garcia property well**: *Analytical Results for Well Sampling, Garcia Property, 4721 Three Saints Road, Anthony, New Mexico*, dated July 9, 2019.

5.8.1.2 Irrigation Well Sampling

Water samples were collected from irrigation wells from January through April 2019, upon request of the well owners. Similar to residential well samples, letters summarizing analytical results were submitted to the respective well owners, NMED and Kinder Morgan. Below is a list of dates water samples were collected from individual irrigation wells followed by the dates that the analytical results were provided to the respective well owners. No VOCs, PAHs or TPH GRO were detected in any of the samples collected, unless otherwise noted.

5.8.1.2.1 De Ruyter Wells

Samples have been collected from the two De Ruyter wells daily when the wells were operating beginning in February 2019. The samples were collected from the discharge outfalls of well LRG-01281-POD5 (De Ruyter North Well) and well LRG-01281-S-2 (De Ruyter South Well) at the Kilgore Lateral in February, March, and April 2019. Subsequent sampling was conducted from a bypass that discharged into De Ruyter's feeder laterals approximately 1,250 feet east of the Kilgore Lateral/Anthony Drain crossing. The following summarizes the analytical results.

- February 2019 – wells operated for two days (*Results of Irrigation Well Sampling at the Kilgore Lateral, Anthony, New Mexico*, dated April 2, 2019)
  - No VOCs, PAHs, or TPH were detected above laboratory reporting limits.
- March 2019 – wells operated for 7 days (*Results of Irrigation Well Sampling at the Kilgore Lateral, Anthony, New Mexico*, dated April 2, 2019)
  - No VOCs, PAHs, or GRO were detected above laboratory reporting limits except DRO and ORO at concentrations of 0.21 mg/L and 1.6 mg/L, respectively in the March 26, 2019 sample.
- April 2019 – wells operated for five days (*Results of Irrigation Well Sampling at the Kilgore Lateral in April 2019, Anthony, New Mexico*, dated May 16, 2019)
  - No VOCs, PAHs, or TPH were detected above laboratory reporting limits.
- May 2019 – wells operated for ten days (*Results of Irrigation Well Sampling from De Ruyter's Wells in May 2019, Anthony, New Mexico*, dated July 16, 2019)
  - The following PAHs were detected at concentrations above the laboratory reporting limits but below their respective groundwater standard in sample DW-N-AM-051719: benzo[a]pyrene (0.087

µg/L), benzo[b]fluoranthene (0.11 µg/L), benzo[g,h,i]perylene (0.10 µg/L), benzo[k]fluoranthene (0.12 µg/L), fluoranthene (0.11 µg/L), indeno[1,2,3-cd]pyrene (0.13 µg/L), and phenanthrene (0.14 µg/L).
  - Benzo[a]pyrene was detected in sample DW-S-AM-051719 at a concentration of 0.033 µg/L, which was below the NMED Groundwater Standard of 0.2 µg/L.
  - Chloromethane was detected in sample DW-S-PM-052319 at a concentration of 3.6 µg/L, which was below the NMED Tapwater Screening Level of 20.3 µg/L.
  - 1,2-Dichloroethane was detected in sample DW-S-AM-052419 at a concentration of 1.1 µg/L, which was below the NMED Groundwater Standard of 5 µg/L.
  - TPH ORO was detected in sample DW-S-PM-053019 at a concentration of 1.6 mg/L, which was above the NMED Groundwater Screening Level for #3 and #6 Fuel Oil of 0.0209 mg/L.
- June 2019 – wells operated for seven days (*Results of Irrigation Well Sampling from De Ruyter's Wells in June 2019, Anthony, New Mexico*, dated July 16, 2019)
  - TPH DRO and ORO were detected in sample DW-N-AM-060319 at a concentration of 0.86 mg/L and 0.91 mg/L, respectively. These concentrations were above the NMED Groundwater Screening Level for Diesel #2/Crankcase Oil of 0.0167 mg/L and #3 and #6 Fuel Oil of 0.0209 mg/L.
  - TPH ORO was detected in sample DW-North-PM-062119 at a concentration of 0.30 mg/L, which was above the NMED Groundwater Screening Level for #3 and #6 Fuel Oil of 0.0209 mg/L.
  - TPH ORO was detected in sample DW-South-PM-062119 at a concentration of 0.35 mg/L, which was above the NMED Groundwater Screening Level for #3 and #6 Fuel Oil of 0.0209 mg/L.
  - Benzo(a)pyrene was detected in sample DW-S-AM-062219 at a concentration of 0.032 µg/L, which was below the NMED Groundwater Standard of 0.2 µg/L.
  - Benzo(a)pyrene was detected in sample DW-N-PM-062219 at a concentration of 0.031 µg/L, which was below the NMED Groundwater Standard of 0.2 µg/L.
- July 2019 – wells operated for four days (*Results of Irrigation Well Sampling from De Ruyter's Wells in July 2019, Anthony, New Mexico*, dated September 27, 2019)
  - Xylenes (total) was detected in sample DW-N-AM-071019 at a concentration of 2.7 µg/L, which is below the NMED Tapwater Screening Level of 193 µg/L.
- August 2019 – wells operated for four days (*Results of Irrigation Well Sampling from De Ruyter's Wells in July 2019, Anthony, New Mexico*, submittal pending)
  - No VOCs, PAHs, or TPH were detected above laboratory reporting limits.
- September 2019 – wells operated for four days (*Results of Irrigation Well Sampling from De Ruyter's Wells in July 2019, Anthony, New Mexico*, submittal pending)
  - No VOCs, PAHs, or TPH were detected above laboratory reporting limits.

5.8.1.2.2 Other Irrigation Wells

Samples collected January 23, 2019 from six irrigation wells owned by Mr. McNamee at multiple locations:

- **Bowman** – West Well
- **Sommerville** – North Well
- **Sommerville** – South Well
- **Farm One** – East Well:
- **Farm One** – West Well

  - Oil range organics (ORO; C23-C40 range) was detected at a concentration of 0.48 mg/L. The laboratory reporting limit for ORO was 0.47 mg/L. There is no NMED water quality standard for TPH. It should be noted that field observations indicated the presence of oil on the well equipment.
- **Boyd Well**
- *Analytical Results for Well Sampling, McNamee Irrigation Wells, Multiple Locations, Anthony, New Mexico,* dated February 4, 2019.

Samples collected February 5, 2019 from Berino Farms LTD four irrigation wells owned by Mr. David Salopek:

- **Well 402**
- **Well 403**
  - TPH diesel range organics (DRO; C10-C28 range) and oil range organics (ORO; C23-C40 range) were detected at concentrations of 2.6 mg/L and 4.3 mg/L, respectively. There is no NMED water quality standard for TPH.
  - It should be noted that the well has a turbine pump and field observations indicated the presence of oil on the well equipment.
- **Well 404**
- **Drain Ditch Well**
  - TPH DRO (C10-C28 range) and ORO (C23-C40 range) were detected at concentrations of 0.82 mg/L and 1.2 mg/L, respectively. The well was located in the bottom of an irrigation drain and the water sample was collected from the end of a PVC pipe that discharged into a nearby lateral. There is no NMED water quality standard for TPH.
  - It should be noted that the purge water was black in color and did not clean-up after several minutes of purging.
  - *Analytical Results for Well Sampling, Wells 402, 403, 404 and Drain Ditch Well Multiple Locations, Anthony, New Mexico,* dated March 18, 2019.

Samples collected April 11, 2019 from the following properties:

- **Mora irrigation well**: *Analytical Results for Well Sampling, 4217 Three Saints Road, Anthony, New Mexico,* dated April 15, 2019.
- **Trujillo irrigation well**, *Analytical Results for Well Sampling, 4189 Three Saints Road, Anthony, New Mexico*, dated April 15, 2019.

Samples collected April 25, 2019 from eight irrigation wells owned by Mr. McNamee at multiple locations:

- **Bowman** – **West Well**
- **Bowman** – **East Well**
  - ORO (C23-C40 range) was detected at a concentration of 0.54 mg/L. The NMED Groundwater Screening Level for unknown oil and waste oil are 0.0858 mg/L and 60.2 mg/L, respectively.
  - It should be noted that field observations of the purged water indicated a yellowish color. No hydrocarbon odor was detected. The absence of detections of TPH GRO and specific gasoline-related compounds indicates that the detection of ORO is not related to the gasoline release at the Anthony Drain.

- **Sommerville – North Well**
- **Sommerville – South Well**
- **Farm One – East Well**
- **Farm One – West Well**
- **Boyd Well**
- **McReynolds**
- *Analytical Results for Well Sampling, McNamee Irrigation Wells, Multiple Locations, Anthony, New Mexico,* dated May 6, 2019.

Samples collected August 1, 2019 from Alvarez property two irrigation wells:

- **FEOEAST – East well**: 1,2-dichloropropane at a concentration of 0.57 micrograms per liter (µg/L), which is below the NMED Groundwater Standard of 5 µg/L.
- **FEOWEST- West Well**
- *Analytical Results for Well Sampling, Alvarez Irrigation Wells, 600 Harding Road, New Mexico,* dated September 19, 2019.

Samples collected August 8, 2019 from Pinkerton property two irrigation wells:

- **Pinkerton East Well** and **Pinkerton West Well**: *Analytical Results for Well Sampling, Pinkerton Irrigation Wells, 215 Jacques Road, New Mexico,* dated August 20, 2019.

5.8.1.3 Elephant Butte Irrigation District (EBID) wells

Water samples were collected from the following EBID wells on December 16, 2018. Sampling activities and analytical results are presented in the Revised CAR (Arcadis, 2019b) and are summarized below.

- MES_22R
- MES_23R
- MES_28R
- MES_30R

GRO, ORO, and VOCs were not detected above the laboratory reporting limits. Naphthalene was detected in samples MES_22R and MES_28R at estimated concentrations of 0.117 µg/l and 0.0707 µg/l, respectively. These concentrations are below the laboratory reporting limit and well below the NMED water quality standard of 30 µg/l. DRO was detected in all four wells at estimated concentrations below the laboratory reporting limit but above the method detection limit. Based on the distance and direction of these wells with respect to the release point and the time between the release and sampling, the detections are not related to the pipeline release.

6 DATA GAP ANALYSIS

Overall, characterization of the source (LNAPL) zone is complete. The data and conceptual model presented in this report and the supporting investigation reports already submitted are sufficient to select and design an effective abatement option for the source zone and should be considered equivalent to a final site investigation report for the source zone. Because petroleum hydrocarbons outside the source

zone attenuate rapidly, source zone abatement is the most important step and, at most petroleum hydrocarbons sites, the only abatement required.

Groundwater conditions outside the source zone were characterized soon after the release, during the period from late February to early March 2019. Groundwater conditions, including water levels, groundwater gradients, and distribution of dissolved-phase COPCs are expected to change over time. Monitoring groundwater conditions over time allows ongoing assessment of these conditions and their variations. Filling this data gap should include:

1) Monitoring groundwater elevation and gradient;
2) Monitoring the nature and extent of site-specific dissolved phase COPCs in groundwater;
3) Monitoring sentinel wells around the perimeter of the LNAPL zone for the occurrence of LNAPL.

As discussed above, a well search was conducted previously at a ¾-mile radius from the release point. An additional search will be conducted to meet the 1-mile radius requirement. Only six wells are located within 0.1 miles of the boundary of the source zone. The updated well data from this search will be evaluated to determine if any wells are potential receptors.

7 PROPOSED GROUNDWATER MONITORING

As described above in the data gap analysis, groundwater monitoring is necessary to 1) characterize groundwater elevation and gradient; 2) characterize and monitor the distribution of dissolved phase petroleum hydrocarbons in groundwater; and 3) verify the stability of the LNAPL source zone by providing sentinel wells along the currently characterized edge of the LNAPL zone.

The Groundwater Monitor Well Work Plan, 3 Saints Road Release Site, Anthony, New Mexico, dated April 24, 2019, proposed locations to install groundwater monitor wells to monitor the nature and extent of dissolved phase gasoline constituents and, as directed by NMED, 1,4-dioxane (NMED 2019a). A total of 14 groundwater monitor wells (12 shallow, one intermediate and one deep) are proposed. Routine monitoring will assist in determining groundwater elevation, gradient, direction, rate of migration of dissolved-phase COPCs, and the stability of the LNAPL zone. The data collected will support updates to and refinement of the conceptual site mode (CSM). The data and the CSM, may also support determination of the necessity of and the development of any supplemental abatement required. The groundwater monitoring work plan was prepared following the tentative schedule in the Revised CAR (Arcadis, 2019b) and Conditional Approval by the NMED letter (NMED, 2019b).

8 QUALITY ASSURANCE PROJECT PLAN

The measures used to control and document the quality of the procedures during this investigation are presented in Appendix A. Tables 3 and 4 of the QAPP present NMED approved soil reporting limits compared to Dilution Attenuation Factor (DAF) 1 and DAF 20 soil screening levels and NMED acceptable reporting limits in lieu of the Soil Screening Levels (SSLs; NMED, 2019c). Test America reporting limits compared to NMED Groundwater Standard or NMED Tapwater Screening Levels are presented in Table 5 of the QAPP. NMED approval of the Test America reporting limits where the laboratory cannot meet the screening levels will also be required prior to initiation of the groundwater sampling program.

9 HEALTH AND SAFETY PLAN

Work associated with implementation of this Stage 1 Abatement Plan will follow the health and safety protocols described in the updated Site-Specific Health and Safety Plan presented in Appendix B. The Site-Specific Health and Safety Plan will be updated iteratively, as necessary, to address any additional activities or changes in Site conditions.

10 PROPOSED SCHEDULE

This plan includes a summary of information that should be considered as submittal of the final site investigation report for the source zone that adequately defines source zone conditions and provides the data necessary to select and design an effective source zone abatement option. Approval of this document as the final site investigation report for the source zone is requested, so that a Stage 2 abatement plan proposal can be submitted for selection and design of a source zone abatement option.

The proposed schedule for Stage 1 Abatement Plan activities are as follows:

- Quarterly progress and groundwater monitoring reports summarizing Stage 1 Abatement Plan project activities, schedule, and deliverables will be submitted to NMED 30 days following the end of the quarter.
- Within 5 days of NMED approval of this Stage 1 Abatement Plan and the referenced *Groundwater Monitoring Well Work Plan* (Arcadis 2019e), Arcadis will initiate the permitting and access agreement process for the proposed monitor wells and begin coordination with drilling contractor regarding availability. Drilling will begin within 30 days following receipt of all permits and access agreements, contingent upon contractor availability.
    - Notification will be provided to NMED, EBID, and Doña Ana County once the scheduling has been finalized.
- A summary of field activities, data collection methods, deviations from the Groundwater Monitor Well Work Plan and results of the data will be included in a Monitor Well Installation Report, which will be submitted to NMED 30 days following receipt of the last laboratory analytical report.
- Groundwater level measurements and groundwater quality samples will be collected from all monitor wells on a quarterly basis.
- The first quarterly progress and monitoring report to include groundwater data will also contain an overall evaluation of groundwater conditions observed since project inception and will constitute a final site investigation report for groundwater.
- A Stage 2 abatement plan for source zone abatement will be submitted within 60 days of NMED's approval of this Stage 1 Abatement plan as a final site investigation report for the source zone.
- A Stage 2 abatement plan for groundwater outside the source zone will be submitted within 60 days of NMED's approval of the final site investigation report for groundwater outside the source zone.

11 LIMITATIONS STATEMENT

The opinions and recommendations presented in this work plan are based upon the scope of services, information obtained through the performance of the services, and the schedule as agreed upon by Arcadis and the party for whom this work plan was originally prepared. This work plan is an instrument of

professional service and was prepared in accordance with the generally accepted standards and level of skill and care under similar conditions and circumstances established by the environmental consulting industry. No representation, warranty, or guarantee, express or implied, is intended or given. To the extent that Arcadis relied upon any information prepared by other parties not under contract to Arcadis, Arcadis makes no representation as to the accuracy or completeness of such information. This work plan is expressly for the sole and exclusive use of the party for whom this work plan was originally prepared for a particular purpose. Only the party for whom this work plan was originally prepared and/or other specifically named parties have the right to make use of and rely upon this work plan. Reuse of this work plan or any portion thereof for other than its intended purpose, or if modified, or if used by third parties, shall be at the user's sole risk.

Results of any investigations or testing and any findings presented in this work plan apply solely to conditions existing at the time when Arcadis' investigative work was performed. It must be recognized that any such investigative or testing activities are inherently limited and do not represent a conclusive or complete characterization. Conditions in other parts of the project site may vary from those at the locations where data were collected. Arcadis' ability to interpret investigation results is related to the availability of the data and the extent of the investigation activities. As such, 100 percent confidence in environmental investigation conclusions cannot reasonably be achieved.

Arcadis, therefore, does not provide any guarantees, certifications, or warranties regarding any conclusions regarding environmental contamination of any such property. Furthermore, nothing contained in this document shall relieve any other party of its responsibility to abide by contract documents and applicable laws, codes, regulations, or standards.

12 REFERENCES

Arcadis, 2018. Site-Specific Health & Safety Plan, 3 Saints Road Release Site, Anthony, New Mexico, December 14.

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TABLES

Table 1
Analytical Results in Direct Push Soil Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Location	Sample ID	Sample Date	Sample Depth (feet bgs)	VOCs (via Method 8260B)									
				Benzene (mg/kg)	n-Butylbenzene (mg/kg)	sec-Butylbenzene (mg/kg)	Ethylbenzene (mg/kg)	Isopropylbenzene (mg/kg)	p-Isopropyltoluene (mg/kg)	Methylene chloride (mg/kg)	Naphthalene (mg/kg)	n-Propylbenzene (mg/kg)	Toluene (mg/kg)
SB-1	SB-1-11'-12'	12/28/2018	11 to 12	<0.00122	<0.0153	<0.0153	<0.00306	<0.00306	<0.00612	**0.00973**	<0.0153	<0.00612	**0.0149**
SB-2	SB-2-10'-11'	12/28/2018	10 to 11	<0.00127	<0.0158	<0.0158	<0.00317	<0.00317	<0.00633	**0.00877**	<0.0158	<0.00633	**0.0088**
SB-3	SB-3-11'-12'	12/28/2018	11 to 12	**40.3**	**5.61**	**3.75**	**152**	**15.7**	**1.75**	<12.3	**20.7**	**29.8**	**463**
SB-19	SB-19-11-12	12/28/2018	11 to 12	**453**	**98.1**	**50.6**	**1,970**	**229**	ND	<356	**172**	**467**	**5,470**
SB-22	SB-22-2.5-3.0	12/30/2018	2.5 to 3	**47.6**	**5.08**	**3.24**	**149**	**14.7**	**1.53**	<12.9	**18.9**	**28.3**	**483**
DAF-1 Soil Screening Level (SSL)				**0.0019**	**3.23**	**5.87**	**0.0132**	**0.569**	**NE**	**0.0235**	**0.00411**	**0.738**	**0.607**
Reporting Limit > SSL				**0.005**						**0.025**	**0.01**		

NOTES
- **Bold** = analyte detected above reporting limit
- **Bold** = analyte detected above soil screening level (SSL)
- bgs = below ground surface
- mg/kg = milligrams per kilogram.
- TPH = Total Petroluem Hydrocarbons).
  - GRO = Gasoline Range Organics.
  - DRO = Diesel Range Organics.
  - ORO = Oil Range Organics.
- NE = not established

Table 1
Analytical Results in Direct Push Soil Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Location	Sample ID	Sample Date	Sample Depth (feet bgs)	Trichloroethene (mg/kg)	1,2,4-Trimethylbenzene (mg/kg)	1,2,3-Trimethylbenzene (mg/kg)	1,3,5-Trimethylbenzene (mg/kg)	Xylenes (total) (mg/kg)	TPH (via Method SW8015) GRO (mg/kg)	DRO (mg/kg)	ORO (mg/kg)
SB-1	SB-1-11'-12'	12/28/2018	11 to 12	**0.000514**	<0.00612	<0.00612	<0.00612	<0.00796	<3.06	<4.90	<4.90
SB-2	SB-2-10'-11'	12/28/2018	10 to 11	<0.00127	<0.00633	<0.00633	<0.00633	<0.00823	<3.17	<5.07	<5.07
SB-3	SB-3-11'-12'	12/28/2018	11 to 12	<0.491	**167**	**40.1**	**36.4**	**589**	**9,440**	**1,100**	<4.91
SB-19	SB-19-11-12	12/28/2018	11 to 12	<14.2	**2,010**	**442**	**458**	**7,200**	**55,400**	**3,270**	<4.95
SB-22	SB-22-2.5-3.0	12/30/2018	2.5 to 3	<0.517	**155**	**37**	**34.2**	**580**	**10,600**	**1,890**	**4.6**
DAF-1 Soil Screening Level (SSL)				**0.000804**	**0.0081**	**0.0808**	**0.0087**	**0.149**	**100**	**100**	**100**
Reporting Limit > SSL				**0.005**							

NOTES
- **Bold** = analyte detected above reporting limit
- **Bold** = analyte detected above soil screening level (SSL)
- bgs = below ground surface
- mg/kg = milligrams per kilogram.
- TPH = Total Petroluem Hydrocarbons).
  - GRO = Gasoline Range Organics.
  - DRO = Diesel Range Organics.
  - ORO = Oil Range Organics.
- NE = not established

Table 2
1,4-Dioxane Analytical Results in Soil Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Location	Sample ID	Sample Date	Sample Depth (inches bgs)	VOCs (via Method 8260B_SIM) 1,4-Dioxane (mg/kg)
1	Ditch-1 (6-12)	1/14/2019	6 to 12	<0.27
	Ditch-1 (12-18)		12 to 18	<0.51
2	Ditch-2 (6-12)	1/14/2019	6 to 12	<31
	Ditch-2 (12-18)		12 to 18	<26
3	Ditch-3 (6-12)	1/14/2019	6 to 12	<0.57
	Ditch-3 (12-18)		12 to 18	<27
NMED Risk-based SSL, DAF1				**0.000814**
Reporting Limit > SSL				**0.005**

NOTES
· **Bold** = analyte detected above reporting limit or method detection limit
· **Bold** = analyte detected above standard
· Non-detects whose reporting limits exceed the Screening Level are displayed in blue.
· bgs = below ground surface
· mg/kg = milligrams per kilogram.

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-1 2/24/2019 Shallow	GW-2 2/25/2019 Shallow Parent	GW-2 2/25/2019 Shallow Duplicate	GW-3 2/24/2019 Shallow	GW-4 2/24/2019 Shallow	GW-5 2/23/2019 Shallow	GW-6 2/25/2019 Shallow	GW-7 2/18/2019 Shallow	GW-7 2/18/2019 Deep	GW-8 2/25/2019 Shallow
Volatile Organic Compounds															
	1,2,4-Trimethylbenzene		56	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	1,3,5-Trimethylbenzene		60	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	2-Butanone (MEK)		5,560	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Acetone		14,100	µg/L	NMED Tapwater Screening Level	<20	<20	<20	<20	<20	NA	<20	<20	<20	<20
	Benzene	5		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Cyclohexane		13,000	µg/L	USEPA Tapwater RSL	<10	<10	<10	<10	<10	NA	<10	<10	<10	<10
	Ethylbenzene	700		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Isopropylbenzene		447	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Methylcyclohexane		6,260	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	NA	<10	<10	<10	<10
8260B	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Butylbenzene		1,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Hexane		319	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	NA	<2.0	<2.0	<2.0	<2.0
	n-Propylbenzene		N/A	µg/L	N/A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Propene		N/A	µg/L	N/A	<5.0	<5.0	<5.0	<5.0	<5.0	NA	<5.0	<5.0	<5.0	<5.0
	sec-Butylbenzene		2,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Styrene	100		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	tert-Butylbenzene		690	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Toluene	1,000		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Xylenes, Total	620		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<10	<10	<10	<10	<10	<2.0	<10	<10	<10	<10

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-1 2/24/2019 Shallow	GW-2 2/25/2019 Shallow Parent	GW-2 2/25/2019 Shallow Duplicate	GW-3 2/24/2019 Shallow	GW-4 2/24/2019 Shallow	GW-5 2/23/2019 Shallow	GW-6 2/25/2019 Shallow	GW-7 2/18/2019 Shallow	GW-7 2/18/2019 Deep	GW-8 2/25/2019 Shallow
Semivolatile Organic Compounds															
	1-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.27	<0.50	<0.50	<0.50	<0.50
	2-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.27	<0.50	<0.50	<0.50	<0.50
	Acenaphthene		535	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
	Acenaphthylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
	Anthracene	1,720		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
	Benzo[a]pyrene	0.2		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.020	<0.020	<0.020	<0.020	<0.020	<0.27	<0.020	<0.020	<0.020	<0.020
	Benzo[b]fluoranthene	0.343		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
	Benzo[g,h,i]perylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
8270SIM	Benzo[k]fluoranthene	3.43		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
	Chrysene		34.3	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
	Dibenz(a,h)anthracene		0.0343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
	Fluoranthene	802		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
	Fluorene		288	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
	Indeno[1,2,3-cd]pyrene		0.343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
	Phenanthrene	170		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10
	Pyrene	117		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27	<0.10	<0.10	<0.10	<0.10

NOTES

· Concentrations are expressed in micrograms per liter (µg/L).

· Detected analytes are displayed in **bold**.

· Detected concentrations exceeding the Screening Level are displayed in orange.

· Non-detects whose reporting limits exceed the Screening Level are displayed in blue.

· < = Analyte not detected above indicated reporting limit.

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-9 2/19/2019		GW-10 2/24/2019	GW-11 2/19/2019			GW-12 2/24/2019	GW-13 2/19/2019		GW-14 2/23/2019
						Shallow	Deep	Shallow	Shallow		Deep	Shallow	Shallow	Deep	Shallow
									Parent	Duplicate					
Volatile Organic Compounds															
8260B	1,2,4-Trimethylbenzene		56	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	1,3,5-Trimethylbenzene		60	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	2-Butanone (MEK)		5,560	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Acetone		14,100	µg/L	NMED Tapwater Screening Level	<20	<20	<20	<20	<20	<20	<20	<20	<20	NA
	Benzene	5		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Cyclohexane		13,000	µg/L	USEPA Tapwater RSL	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	Ethylbenzene	700		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Isopropylbenzene		447	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Methylcyclohexane		6,260	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	NA
	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Butylbenzene		1,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Hexane		319	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NA
	n-Propylbenzene		N/A	µg/L	N/A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Propene		N/A	µg/L	N/A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	NA
	sec-Butylbenzene		2,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Styrene	100		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	tert-Butylbenzene		690	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Toluene	1,000		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Xylenes, Total	620		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<2.0

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-9 2/19/2019		GW-10 2/24/2019	GW-11 2/19/2019			GW-12 2/24/2019	GW-13 2/19/2019		GW-14 2/23/2019
						Shallow	Deep	Shallow	Shallow		Deep	Shallow	Shallow	Deep	Shallow
									Parent	Duplicate					
Semivolatile Organic Compounds															
8270SIM	1-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.27
	2-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.27
	Acenaphthene		535	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Acenaphthylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Anthracene	1,720		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Benzo[a]pyrene	0.2		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.27
	Benzo[b]fluoranthene	0.343		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Benzo[g,h,i]perylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Benzo[k]fluoranthene	3.43		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Chrysene		34.3	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Dibenz(a,h)anthracene		0.0343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Fluoranthene	802		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Fluorene		288	µg/L	NMED Tapwater Screening Level	<0.10	**0.10**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Indeno[1,2,3-cd]pyrene		0.343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Phenanthrene	170		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27
	Pyrene	117		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.27

NOTES

· Concentrations are expressed in micrograms per liter (µg/L).

· Detected analytes are displayed in **bold**.

· Detected concentrations exceeding the Screening Level are displayed in orange.

· Non-detects whose reporting limits exceed the Screening Level are displayed in blue.

· < = Analyte not detected above indicated reporting limit.

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-15 2/20/2019		GW-16 2/22/2019		GW-16 2/22/2019	GW-17 2/20/2019		GW-18 2/22/2019		GW 2/20/
						Shallow	Deep	Shallow		Deep	Shallow	Deep	Shallow	Deep	Shallow
								Parent	Duplicate						
Volatile Organic Compounds															
8260B	1,2,4-Trimethylbenzene		56	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	1,3,5-Trimethylbenzene		60	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	2-Butanone (MEK)		5,560	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Acetone		14,100	µg/L	NMED Tapwater Screening Level	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	Benzene	5		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Cyclohexane		13,000	µg/L	USEPA Tapwater RSL	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Ethylbenzene	700		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Isopropylbenzene		447	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Methylcyclohexane		6,260	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Butylbenzene		1,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Hexane		319	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	n-Propylbenzene		N/A	µg/L	N/A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Propene		N/A	µg/L	N/A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	sec-Butylbenzene		2,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Styrene	100		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	tert-Butylbenzene		690	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Toluene	1,000		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Xylenes, Total	620		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-15 2/20/2019		GW-16 2/22/2019		GW-16 2/22/2019	GW-17 2/20/2019		GW-18 2/22/2019		GW 2/20/
						Shallow	Deep	Shallow		Deep	Shallow	Deep	Shallow	Deep	Shallow
								Parent	Duplicate						
Semivolatile Organic Compounds															
8270SIM	1-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	2-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Acenaphthene		535	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Acenaphthylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Anthracene	1,720		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[a]pyrene	0.2		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.020	<0.020	**0.046**	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Benzo[b]fluoranthene	0.343		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[g,h,i]perylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[k]fluoranthene	3.43		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chrysene		34.3	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Dibenz(a,h)anthracene		0.0343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Fluoranthene	802		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Fluorene		288	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Indeno[1,2,3-cd]pyrene		0.343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Phenanthrene	170		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Pyrene	117		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

NOTES

· Concentrations are expressed in micrograms per liter (µg/L).

· Detected analytes are displayed in **bold**.

· Detected concentrations exceeding the Screening Level are displayed in orange.

· Non-detects whose reporting limits exceed the Screening Level are displayed in blue.

· < = Analyte not detected above indicated reporting limit.

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	-19 2019	GW-20 2/21/2019		GW-21 2/21/2019		GW-22 2/21/2019	GW-22 2/21/2019	GW-30 2/28/2019	GW-31 2/28/2019 Shallow	
						Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Parent	Duplicate
Volatile Organic Compounds															
	1,2,4-Trimethylbenzene		56	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	1,3,5-Trimethylbenzene		60	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	2-Butanone (MEK)		5,560	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Acetone		14,100	µg/L	NMED Tapwater Screening Level	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	Benzene	5		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Cyclohexane		13,000	µg/L	USEPA Tapwater RSL	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Ethylbenzene	700		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Isopropylbenzene		447	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Methylcyclohexane		6,260	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
8260B	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Butylbenzene		1,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Hexane		319	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	n-Propylbenzene		N/A	µg/L	N/A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Propene		N/A	µg/L	N/A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	sec-Butylbenzene		2,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Styrene	100		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	tert-Butylbenzene		690	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Toluene	1,000		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Xylenes, Total	620		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	-19 2019	GW-20 2/21/2019		GW-21 2/21/2019		GW-22 2/21/2019	GW-22 2/21/2019	GW-30 2/28/2019	GW-31 2/28/2019 Shallow	
						Deep	Shallow	Deep	Shallow	Deep	Shallow	Deep	Shallow	Parent	Duplicate
Semivolatile Organic Compounds															
	1-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	2-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Acenaphthene		535	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Acenaphthylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Anthracene	1,720		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[a]pyrene	0.2		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Benzo[b]fluoranthene	0.343		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[g,h,i]perylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8270SIM	Benzo[k]fluoranthene	3.43		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chrysene		34.3	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Dibenz(a,h)anthracene		0.0343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Fluoranthene	802		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Fluorene		288	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Indeno[1,2,3-cd]pyrene		0.343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Phenanthrene	170		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Pyrene	117		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

NOTES

· Concentrations are expressed in micrograms per liter (µg/L).

· Detected analytes are displayed in **bold**.

· Detected concentrations exceeding the Screening Level are displayed in orange.

· Non-detects whose reporting limits exceed the Screening Level are displayed in blue.

· < = Analyte not detected above indicated reporting limit.

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-32 2/28/2019 Shallow	GW-33 3/1/2019 Shallow	GW-34 3/1/2019 Shallow	GW-35 3/1/2019 Shallow	GW-36 3/1/2019 Shallow	GW-37 3/2/2019 Shallow	GW-38 3/2/2019 Shallow	GW-39 3/2/2019 Shallow	GW-40 3/2/2019 Shallow	GW-41 3/3/2019 Shallow
Volatile Organic Compounds															
	1,2,4-Trimethylbenzene		56	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**33**	<2.0	<2.0	<2.0
	1,3,5-Trimethylbenzene		60	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**8.4**	<2.0	<2.0	<2.0
	2-Butanone (MEK)		5,560	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Acetone		14,100	µg/L	NMED Tapwater Screening Level	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	Benzene	5		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**30**	<2.0	<2.0	<2.0
	Cyclohexane		13,000	µg/L	USEPA Tapwater RSL	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Ethylbenzene	700		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**49**	<2.0	<2.0	<2.0
	Isopropylbenzene		447	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**3.9**	<2.0	<2.0	<2.0
	Methylcyclohexane		6,260	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
8260B	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Butylbenzene		1,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Hexane		319	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**5.9**	<2.0	<2.0	<2.0
	n-Propylbenzene		N/A	µg/L	N/A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**7.7**	<2.0	<2.0	<2.0
	Propene		N/A	µg/L	N/A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	sec-Butylbenzene		2,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Styrene	100		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	tert-Butylbenzene		690	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Toluene	1,000		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**210**	<2.0	<2.0	<2.0
	Xylenes, Total	620		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<10	<10	<10	<10	<10	<10	**180**	<10	<10	<10

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-32 2/28/2019 Shallow	GW-33 3/1/2019 Shallow	GW-34 3/1/2019 Shallow	GW-35 3/1/2019 Shallow	GW-36 3/1/2019 Shallow	GW-37 3/2/2019 Shallow	GW-38 3/2/2019 Shallow	GW-39 3/2/2019 Shallow	GW-40 3/2/2019 Shallow	GW-41 3/3/2019 Shallow
Semivolatile Organic Compounds															
8270SIM	1-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.63**	<0.50	<0.50	<0.50
	2-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**1.1**	<0.50	<0.50	<0.50
	Acenaphthene		535	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Acenaphthylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Anthracene	1,720		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[a]pyrene	0.2		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Benzo[b]fluoranthene	0.343		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[g,h,i]perylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[k]fluoranthene	3.43		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chrysene		34.3	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Dibenz(a,h)anthracene		0.0343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Fluoranthene	802		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Fluorene		288	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**0.14**	<0.10
	Indeno[1,2,3-cd]pyrene		0.343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**2.8**	<0.10	**0.26**	<0.10
	Phenanthrene	170		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	**0.12**	<0.10
	Pyrene	117		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

NOTES

· Concentrations are expressed in micrograms per liter (µg/L).

· Detected analytes are displayed in **bold**.

· Detected concentrations exceeding the Screening Level are displayed in orange.

· Non-detects whose reporting limits exceed the Screening Level are displayed in blue.

· < = Analyte not detected above indicated reporting limit.

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-42 3/3/2019 Shallow	GW-43 3/3/2019 Shallow	GW-44 3/3/2019 Shallow	GW-45 3/3/2019 Shallow	GW-46 3/3/2019 Shallow	GW-47 3/4/2019 Shallow	GW-48 3/4/2019 Shallow	GW-49 3/4/2019 Shallow	GW-50 3/4/2019 Shallow	
														Parent	Duplicate
Volatile Organic Compounds															
	1,2,4-Trimethylbenzene		56	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	1,3,5-Trimethylbenzene		60	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	2-Butanone (MEK)		5,560	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Acetone		14,100	µg/L	NMED Tapwater Screening Level	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	Benzene	5		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Cyclohexane		13,000	µg/L	USEPA Tapwater RSL	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Ethylbenzene	700		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Isopropylbenzene		447	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Methylcyclohexane		6,260	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
8260B	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Butylbenzene		1,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Hexane		319	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	n-Propylbenzene		N/A	µg/L	N/A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Propene		N/A	µg/L	N/A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	sec-Butylbenzene		2,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Styrene	100		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	tert-Butylbenzene		690	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Toluene	1,000		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Xylenes, Total	620		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-42 3/3/2019 Shallow	GW-43 3/3/2019 Shallow	GW-44 3/3/2019 Shallow	GW-45 3/3/2019 Shallow	GW-46 3/3/2019 Shallow	GW-47 3/4/2019 Shallow	GW-48 3/4/2019 Shallow	GW-49 3/4/2019 Shallow	GW-50 3/4/2019 Shallow	
														Parent	Duplicate
Semivolatile Organic Compounds															
8270SIM	1-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	2-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Acenaphthene		535	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Acenaphthylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Anthracene	1,720		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[a]pyrene	0.2		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.020	<0.020	**0.082**	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Benzo[b]fluoranthene	0.343		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	**0.10**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[g,h,i]perylene		N/A	µg/L	N/A	<0.10	<0.10	**0.11**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[k]fluoranthene	3.43		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	**0.11**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chrysene		34.3	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	**0.10**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Dibenz(a,h)anthracene		0.0343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	**0.11**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Fluoranthene	802		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Fluorene		288	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Indeno[1,2,3-cd]pyrene		0.343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	**0.12**	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Phenanthrene	170		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Pyrene	117		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

NOTES

· Concentrations are expressed in micrograms per liter (µg/L).

· Detected analytes are displayed in **bold**.

· Detected concentrations exceeding the Screening Level are displayed in orange.

· Non-detects whose reporting limits exceed the Screening Level are displayed in blue.

· < = Analyte not detected above indicated reporting limit.

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-51 3/5/2019 Shallow	GW-52 3/5/2019 Shallow	GW-53 3/5/2019 Shallow	GW-54 3/5/2019 Shallow	GW-55 3/5/2019 Shallow	GW-56 3/6/2019 Shallow	GW-57 3/6/2019 Shallow	GW-58 3/6/2019 Shallow	GW-59 3/6/2019 Shallow	GW 3/6/ Sha Parent
Volatile Organic Compounds															
	1,2,4-Trimethylbenzene		56	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	1,3,5-Trimethylbenzene		60	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	2-Butanone (MEK)		5,560	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Acetone		14,100	µg/L	NMED Tapwater Screening Level	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
	Benzene	5		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Cyclohexane		13,000	µg/L	USEPA Tapwater RSL	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	Ethylbenzene	700		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Isopropylbenzene		447	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Methylcyclohexane		6,260	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
8260B	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Butylbenzene		1,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	n-Hexane		319	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	n-Propylbenzene		N/A	µg/L	N/A	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Propene		N/A	µg/L	N/A	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	sec-Butylbenzene		2,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Styrene	100		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	tert-Butylbenzene		690	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Toluene	1,000		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Xylenes, Total	620		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-51 3/5/2019 Shallow	GW-52 3/5/2019 Shallow	GW-53 3/5/2019 Shallow	GW-54 3/5/2019 Shallow	GW-55 3/5/2019 Shallow	GW-56 3/6/2019 Shallow	GW-57 3/6/2019 Shallow	GW-58 3/6/2019 Shallow	GW-59 3/6/2019 Shallow	GW 3/6/ Sha Parent
Semivolatile Organic Compounds															
	1-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	2-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Acenaphthene		535	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Acenaphthylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Anthracene	1,720		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[a]pyrene	0.2		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Benzo[b]fluoranthene	0.343		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[g,h,i]perylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
8270SIM	Benzo[k]fluoranthene	3.43		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chrysene		34.3	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Dibenz(a,h)anthracene		0.0343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Fluoranthene	802		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Fluorene		288	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Indeno[1,2,3-cd]pyrene		0.343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Phenanthrene	170		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Pyrene	117		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10

NOTES

· Concentrations are expressed in micrograms per liter (µg/L).

· Detected analytes are displayed in **bold**.

· Detected concentrations exceeding the Screening Level are displayed in orange.

· Non-detects whose reporting limits exceed the Screening Level are displayed in blue.

· < = Analyte not detected above indicated reporting limit.

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	-60 2019 llow Duplicate	GW-61 3/7/2019 Shallow	GW-62 3/7/2019 Shallow	GW-63 3/7/2019 Shallow		
Volatile Organic Compounds											
	1,2,4-Trimethylbenzene		56	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0		
	1,3,5-Trimethylbenzene		60	µg/L	USEPA Tapwater RSL	<2.0	<2.0	<2.0	<2.0		
	2-Butanone (MEK)		5,560	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10		
	Acetone		14,100	µg/L	NMED Tapwater Screening Level	<20	<20	<20	<20		
	Benzene	5		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0		
	Cyclohexane		13,000	µg/L	USEPA Tapwater RSL	<10	<10	<10	<10		
	Ethylbenzene	700		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0		
	Isopropylbenzene		447	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0		
	Methylcyclohexane		6,260	µg/L	NMED Tapwater Screening Level	<10	<10	<10	<10		
8260B	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<5.0	<5.0	<5.0	<5.0		
	n-Butylbenzene		1,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0		
	n-Hexane		319	µg/L	NMED Tapwater Screening Level	<2.0	<2.0	<2.0	<2.0		
	n-Propylbenzene		N/A	µg/L	N/A	<2.0	<2.0	<2.0	<2.0		
	Propene		N/A	µg/L	N/A	<5.0	<5.0	<5.0	<5.0		
	sec-Butylbenzene		2,000	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0		
	Styrene	100		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0		
	tert-Butylbenzene		690	µg/L	USEPA Tapwater RSL	<5.0	<5.0	<5.0	<5.0		
	Toluene	1,000		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<2.0	<2.0	<2.0	<2.0		
	Xylenes, Total	620		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<10	<10	<10	<10		

Table 3
Analytical Results in Groundwater, Direct Push Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	-60 2019 llow Duplicate	GW-61 3/7/2019 Shallow	GW-62 3/7/2019 Shallow	GW-63 3/7/2019 Shallow		
Semivolatile Organic Compounds											
	1-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50		
	2-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.50	<0.50	<0.50	<0.50		
	Acenaphthene		535	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10		
	Acenaphthylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10		
	Anthracene	1,720		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10		
	Benzo[a]pyrene	0.2		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.020	<0.020	<0.020	<0.020		
	Benzo[b]fluoranthene	0.343		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10		
	Benzo[g,h,i]perylene		N/A	µg/L	N/A	<0.10	<0.10	<0.10	<0.10		
8270SIM	Benzo[k]fluoranthene	3.43		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10		
	Chrysene		34.3	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10		
	Dibenz(a,h)anthracene		0.0343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10		
	Fluoranthene	802		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10		
	Fluorene		288	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10		
	Indeno[1,2,3-cd]pyrene		0.343	µg/L	NMED Tapwater Screening Level	<0.10	<0.10	<0.10	<0.10		
	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10		
	Phenanthrene	170		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10		
	Pyrene	117		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.10	<0.10	<0.10	<0.10		

NOTES

· Concentrations are expressed in micrograms per liter (µg/L).

· Detected analytes are displayed in **bold**.

· Detected concentrations exceeding the Screening Level are displayed in orange.

· Non-detects whose reporting limits exceed the Screening Level are displayed in blue.

· < = Analyte not detected above indicated reporting limit.

Table 4
Analytical Results in Groundwater, Ditch Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-23 2/23/2019	GW-24 2/26/2019	GW-25 2/25/2019	GW-26 2/28/2019	GW-27 2/28/2019	GW-28 3/7/2019	GW-29 3/4/2019
Volatile Organic Compounds												
	1,2,4-Trimethylbenzene		56	µg/L	USEPA Tapwater RSL	<10	**30**	**290**	**870**	**880**	**1,600**	**1,300**
	1,3,5-Trimethylbenzene		60	µg/L	USEPA Tapwater RSL	<10	**32**	**69**	**200**	**210**	**350**	**280**
	2-Butanone (MEK)		5,560	µg/L	NMED Tapwater Screening Level	<50	<100	<100	<100	**170**	<1,000	**1,200**
	Acetone		14,100	µg/L	NMED Tapwater Screening Level	NA	<200	<200	**200**	**260**	<2,000	**2,300**
	Benzene	5		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	**89**	<20	**530**	**2,700**	**500**	**17,000**	**20,000**
	Cyclohexane		13,000	µg/L	USEPA Tapwater RSL	NA	<100	<100	<100	<100	<1,000	<500
	Ethylbenzene	700		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	**24**	<20	**71**	**1,000**	**590**	**4,000**	**4,100**
	Isopropylbenzene		447	µg/L	NMED Tapwater Screening Level	<10	<20	<20	**82**	**76**	<200	**150**
	Methylcyclohexane		6,260	µg/L	NMED Tapwater Screening Level	NA	<100	<100	<100	<100	<1,000	<500
8260B	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<25	<50	**95**	**310**	**380**	<500	<250
	n-Butylbenzene		1,000	µg/L	USEPA Tapwater RSL	<25	<50	<50	<50	<50	<500	<250
	n-Hexane		319	µg/L	NMED Tapwater Screening Level	NA	<20	**50**	**120**	**130**	**380**	**330**
	n-Propylbenzene		N/A	µg/L	N/A	<10	<20	<20	**120**	**110**	**320**	**270**
	Propene		N/A	µg/L	N/A	NA	<50	<50	<50	<50	<500	<250
	sec-Butylbenzene		2,000	µg/L	USEPA Tapwater RSL	<25	<50	<50	<50	<50	<500	<250
	Styrene	100		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<10	<20	<20	<20	<20	<200	<100
	tert-Butylbenzene		690	µg/L	USEPA Tapwater RSL	<25	<50	<50	<50	<50	<500	<250
	Toluene	1,000		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	**230**	<20	**1,900**	**13,000**	**4,400**	**52,000**	**46,000**
	Xylenes, Total	620		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	**73**	**390**	**1,700**	**7,000**	**5,000**	**13,000**	**14,000**

Table 4
Analytical Results in Groundwater, Ditch Samples
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Method	Analyte	Groundwater Standard	Screening Level	Units	Reference	GW-23 2/23/2019	GW-24 2/26/2019	GW-25 2/25/2019	GW-26 2/28/2019	GW-27 2/28/2019	GW-28 3/7/2019	GW-29 3/4/2019
Semivolatile Organic Compounds												
8270C SIM	2-Methylnaphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.27	**0.82**	**44**	**100**	**100**	**64**	**46**
	Acenaphthene		535	µg/L	NMED Tapwater Screening Level	<0.27	**0.71**	**0.32**	**0.58**	**0.45**	**0.35**	**0.19**
	Acenaphthylene		N/A	µg/L	N/A	<0.27	**0.63**	**0.33**	**0.52**	**0.67**	**0.14**	<0.10
	Anthracene	1,720		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.27	**1.1**	**0.54**	**0.42**	**0.85**	<0.10	<0.10
	Benzo[a]pyrene	0.2		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.27	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Benzo[b]fluoranthene	0.343		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.27	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[g,h,i]perylene		N/A	µg/L	N/A	<0.27	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Benzo[k]fluoranthene	3.43		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.27	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chrysene		34.3	µg/L	NMED Tapwater Screening Level	<0.27	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Dibenz(a,h)anthracene		0.0343	µg/L	NMED Tapwater Screening Level	<0.27	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Fluoranthene	802		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.27	**0.31**	<0.10	<0.10	<0.10	<0.10	<0.10
	Fluorene		288	µg/L	NMED Tapwater Screening Level	<0.27	**1.5**	**0.67**	**0.80**	**0.68**	**0.33**	**0.18**
	Indeno[1,2,3-cd]pyrene		0.343	µg/L	NMED Tapwater Screening Level	<0.27	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Naphthalene	30		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	**0.48**	**1.8**	**75**	**260**	**280**	**240**	**240**
	Phenanthrene	170		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.27	**2.1**	**1.0**	**0.60**	**0.79**	**0.22**	<0.10
	Pyrene	117		µg/L	NMAC 20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	<0.27	<0.10	<0.10	<0.10	**0.10**	<0.10	<0.10

NOTES
· Concentrations are expressed in micrograms per liter (µg/L).
· Detected analytes are displayed in bold.
· Detected concentrations exceeding the Screening Level are displayed in orange.
· Non-detects whose reporting limits exceed the Screening Level are displayed in blue.
· < = Analyte not detected above indicated reporting limit.

Table 5
1,4-Dioxane Analytical Results in Groundwater
Kinder Morgan, Inc.
Three Saints Release Site
Anthony, New Mexico

Boring ID	Date	Groundwater Standard	Units	Reference	Method	1,4-Dioxane Concentration
GW-23	2/23/2019	4.59	µg/L	20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	8260B SIM	<4.0
GW-24	2/26/2019	4.59	µg/L	20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	8270C	<1.0
GW-25	2/25/2019	4.59	µg/L	20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	8270C	<1.0
GW-26	2/28/2019	4.59	µg/L	20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	8270C	<1.0
GW-27	2/28/2019	4.59	µg/L	20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	8270C	<1.0
GW-28	3/7/2019	4.59	µg/L	20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	8270C	<1.0
GW-29	3/4/2019	4.59	µg/L	20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	8270C	<10
GW-34	3/1/2019	4.59	µg/L	20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	8270C	<1.0
GW-42	3/3/2019	4.59	µg/L	20.6.2.3103.A.(1) or 20.6.2.3103.A.(2) & Table A-1	8270C	<1.0

NOTES

· Concentrations are expressed in micrograms per liter (µg/L).

· Detected analytes are displayed in **bold**.

· Detected concentrations exceeding the Screening Level are displayed in orange.

· Non-detects whose reporting limits exceed the Screening Level are displayed in blue.

· < = Analyte not detected above indicated reporting limit.

Table 6
General Chemistry Analytical Results in Groundwater, Direct Push Sample GW-2
Kinder Morgan, Inc.
Three Saints Release SIte
Anthony, New Mexico

Method	Analyte	Units	Result
	General Chemistry		
300.0	Nitrate as N	mg/L	<0.10
	Chloride	mg/L	460
	Sulfate	mg/L	780
6010C	Arsenic	mg/L	<0.10
	Arsenic, Dissolved	mg/L	<0.10
	Barium	mg/L	0.083
	Barium, Dissolved	mg/L	0.076
	Cadmium	mg/L	<0.0050
	Cadmium, Dissolved	mg/L	<0.0051
	Calcium	mg/L	210
	Calcium, Dissolved	mg/L	220
	Chromium	mg/L	<0.010
	Chromium, Dissolved	mg/L	<0.010
	Copper	mg/L	<0.010
	Copper, Dissolved	mg/L	<0.010
	Iron	mg/L	0.86
	Iron, Dissolved	mg/L	<0.10
	Lead	mg/L	<0.015
	Lead, Dissolved	mg/L	<0.015
	Magnesium	mg/L	50
	Magnesium, Dissolved	mg/L	51
	Manganese	mg/L	0.99
	Manganese, Dissolved	mg/L	0.95
	Potassium	mg/L	31
	Potassium, Dissolved	mg/L	30
	Selenium	mg/L	<0.10
	Selenium, Dissolved	mg/L	<0.10
	Silver	mg/L	<0.010
	Silver, Dissolved	mg/L	<0.010
	Sodium	mg/L	480
	Sodium, Dissolved	mg/L	480
	Zinc	mg/L	<1.0
	Zinc, Dissolved	mg/L	<0.050
7470A	Mercury	mg/L	<0.00050
	Mercury, Dissolved	mg/L	<0.00050

Table 6
General Chemistry Analytical Results in Groundwater, Direct Push Sample GW-2
Kinder Morgan, Inc.
Three Saints Release SIte
Anthony, New Mexico

Method	Analyte	Units	Result
SM 2320B	Alkalinity as CaCO3	mg/L	410
	Bicarbonate Alkalinity as CaCO3	mg/L	410
	Carbonate Alkalinity as CaCO3	mg/L	<6.0
	Alkalinity, Phenolphthalein	mg/L	<6.0
	Hydroxide Alkalinity as CaCO3	mg/L	<6.0
SM 2540C	Total Dissolved Solids	mg/L	2400
SM 2510B	Specific Conductance	µmhos/cm	3700
SM 4500 H+ B	pH	S.U.	7.2
	Temperature	°C	17.4
Field Measurement	pH	S.U.	7.68
	Temperature	°C	19.5
	ORP	millivolts	-91.9
	Specific Conductance	µmhos/cm	3096
	Ferrous Iron	mg/L	0.7
	Manganese	mg/L	6.6

NOTES

· GW-2 is a groundwater grab sample collected via direct push rig on February 25, 2019.

· mg/L = milligrams per liter.

· µmhos/cm = microsiemens per centimeter.

· S.U. = standard units.

· °C = degrees Celsius.

Table 7
Wells Within 3/4-Mile From Release Point
Kinder Morgan, Inc.
3 Saints Release Site
Anthony, New Mexico

Map ID	Well ID	Longitude (dec. deg.)	Latitude (dec. deg.)	Total Depth (ft bgs)	Top of Screen Depth (ft bgs)	Bottom of Screen Depth (ft bgs)	Casing Diameter (in)	Well Use	Distance From Release Point (ft)
1	LRG-00507	-106.657540	32.067023	500	160	495	18	Irrigation	3,224
2	LRG-00507-POD4	-106.658420	32.062662	382	220	380	16	Irrigation	2,828
3	LRG-00507-POD5	-106.658219	32.065195	380	220	380	15.5	Irrigation	3,046
4	LRG-00507-S-2	-106.658417	32.062809	500	160	495	18	Irrigation	2,836
5	LRG-00700	-106.652139	32.058308	132	Unknown	Unknown	16	Irrigation	1,442
6	LRG-00737	-106.651846	32.066191	196	Unknown	Unknown	2.5	Domestic (one household, 72-12-1)	1,865
7	LRG-00740	-106.655104	32.067105	130	Unknown	Unknown	16	Irrigation	2,697
8	LRG-00740-S	-106.655112	32.063461	130	Unknown	Unknown	16	Irrigation	1,909
9	LRG-01027	-106.658412	32.060847	72	Unknown	Unknown	2.5	Domestic (one household, 72-12-1)	2,805
10	LRG-01207	-106.656138	32.069833	96	Unknown	Unknown	4	Domestic (one household, 72-12-1)	3,679
11	LRG-01208	-106.655106	32.070740	184	70	140	16	Irrigation	3,796
12	LRG-01208-POD4	-106.654694	32.069883	Unknown	Unknown	Unknown	Unknown	Irrigation	3,461
13	LRG-01274	-106.641295	32.060835	190	Unknown	Unknown	8	Domestic (non 72-12-1)	2,520
14	LRG-01275	-106.641295	32.060835	160	Unknown	Unknown	Unknown	Domestic (one household, 72-12-1)	2,520
15	LRG-01276	-106.641295	32.060835	190	Unknown	Unknown	Unknown	Domestic (one household, 72-12-1)	2,520
16	LRG-01277	-106.641295	32.060835	160	Unknown	Unknown	Unknown	Domestic (one household, 72-12-1)	2,520
17	LRG-01278	-106.641295	32.060835	250	Unknown	Unknown	Unknown	Domestic (one household, 72-12-1)	2,520
18	LRG-01279	-106.641295	32.060835	160	Unknown	Unknown	Unknown	Domestic (one household, 72-12-1)	2,520
19	LRG-01280	-106.649367	32.060539	140	Unknown	Unknown	Unknown	Domestic (non 72-12-1)	353
20	LRG-01280-POD2	-106.649318	32.060525	Unknown	Unknown	Unknown	Unknown	Domestic (non 72-12-1)	359
21	LRG-01281	-106.649145	32.067385	825	Unknown	Unknown	28	Irrigation	2,139
22	LRG-01281-POD4	-106.649264	32.058400	300	100	300	12	Irrigation	1,132
23	LRG-01281-POD5	-106.649180	32.064553	400	120	400	16	Unknown	1,109
24	LRG-01281-S	-106.649121	32.064230	250	Unknown	Unknown	18	Irrigation	993
25	LRG-01281-S-2	-106.647134	32.058528	210	Unknown	Unknown	16	Irrigation	1,290
26	LRG-01557-POD3	-106.640134	32.059858	155	80	155	16	Irrigation	2,930
27	LRG-01557-S	-106.640967	32.060458	88	Unknown	Unknown	10	Irrigation	2,638
28	LRG-01637	-106.647022	32.053436	160	Unknown	Unknown	18	Irrigation	3,027
29	LRG-01637-POD2	-106.646560	32.052577	170	80	170	16	Irrigation	3,366
30	LRG-05885-POD1	-106.652085	32.051778	77	Unknown	Unknown	Unknown	Domestic (non 72-12-1)	3,637
31	LRG-05885-POD2	-106.652105	32.052033	100	80	100	4	Domestic (non 72-12-1)	3,548
32	LRG-06825	-106.652688	32.051625	80	Unknown	Unknown	2.5	Domestic (one household, 72-12-1)	3,738
33	LRG-07067	-106.652925	32.052557	140	131	140	4.5	Domestic (one household, 72-12-1)	3,436
34	LRG-07176	-106.648678	32.052549	90	Unknown	Unknown	4	Domestic (one household, 72-12-1)	3,267
35	LRG-07396	-106.638017	32.063520	Unknown	Unknown	Unknown	Unknown	Domestic (one household, 72-12-1)	3,598
36	LRG-07426	-106.652762	32.059934	120	Unknown	Unknown	14	Irrigation	1,191
37	LRG-07426-POD3	-106.651023	32.058540	Unknown	Unknown	Unknown	Unknown	Irrigation	1,193
38	LRG-07426-S	-106.653124	32.059869	120	Unknown	Unknown	14	Irrigation	1,301

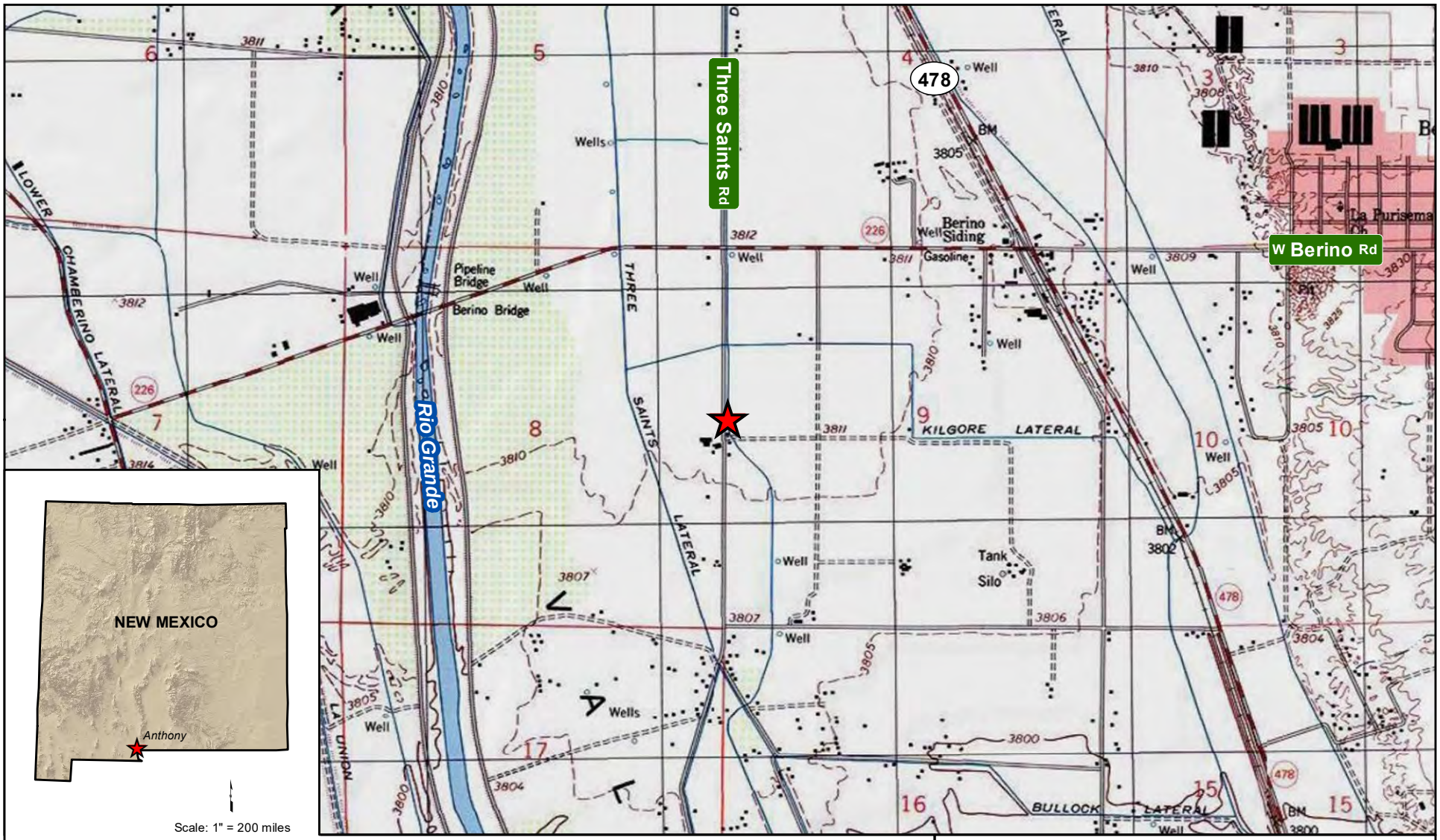
Table 7
Wells Within 3/4-Mile From Release Point
Kinder Morgan, Inc.
3 Saints Release Site
Anthony, New Mexico

Map ID	Well ID	Longitude (dec. deg.)	Latitude (dec. deg.)	Total Depth (ft bgs)	Top of Screen Depth (ft bgs)	Bottom of Screen Depth (ft bgs)	Casing Diameter (in)	Well Use	Distance From Release Point (ft)
39	LRG-07433	-106.654717	32.053429	180	Unknown	Unknown	4	Domestic (one household, 72-12-1)	3,371
40	LRG-07883	-106.638596	32.066406	170	Unknown	Unknown	4	Domestic (one household, 72-12-1)	3,789
41	LRG-08318	-106.650775	32.050781	101	Unknown	Unknown	4	Domestic (one household, 72-12-1)	3,926
42	LRG-08869	-106.650775	32.050781	120	100	120	4	Domestic (one household, 72-12-1)	3,926
43	LRG-09319-POD2	-106.652609	32.051470	Unknown	Unknown	Unknown	Unknown	Domestic (one household, 72-12-1)	3,786
44	LRG-09781	-106.650814	32.067098	420	200/381	220/420	4.5	Domestic (one household, 72-12-1)	2,080
45	LRG-10854	-106.642282	32.052596	160	150	160	4	Domestic (one household, 72-12-1)	3,920
46	LRG-10938	-106.650775	32.050781	45	Unknown	Unknown	2.5	Domestic (one household, 72-12-1)	3,926
47	LRG-11231	-106.655077	32.054423	180	160	180	4	Domestic (one household, 72-12-1)	3,122
48	LRG-11252	-106.650820	32.058583	160	150	160	4	Domestic (one household, 72-12-1)	1,153
49	LRG-11252-POD2	-106.650889	32.058528	260	0	260	4	Domestic (one household, 72-12-1)	1,180
50	LRG-11299	-106.642282	32.052596	80	Unknown	Unknown	2.38	Domestic (one household, 72-12-1)	3,920
51	LRG-11432	-106.642282	32.052596	75	Unknown	Unknown	2.38	Domestic (one household, 72-12-1)	3,920
52	LRG-11743	-106.648663	32.067063	Unknown	Unknown	Unknown	Unknown	Dewatering	2,033
53	LRG-11744	-106.648663	32.067063	Unknown	Unknown	Unknown	Unknown	Dewatering	2,033
54	LRG-11808	-106.642282	32.052596	200	Unknown	Unknown	4.5	Domestic (one household, 72-12-1)	3,920
55	LRG-12071	-106.650814	32.067098	Unknown	Unknown	Unknown	Unknown	Domestic (one household, 72-12-1)	2,080
56	LRG-12124	-106.650809	32.056219	150	40	150	16	Irrigation	1,974
57	LRG-12364	-106.651209	32.051747	Unknown	Unknown	Unknown	Unknown	Irrigation	3,596
58	LRG-12538-POD2	-106.638017	32.063520	200	100	200	16	Irrigation	3,598
59	LRG-13403-POD1	-106.650098	32.060385	140	120	140	4	Domestic (non 72-12-1)	464
60	LRG-13407-POD1	-106.660735	32.056702	Unknown	Unknown	Unknown	2	Domestic (non 72-12-1)	3,925
61	LRG-13948-POD1	-106.648671	32.059819	Unknown	Unknown	Unknown	Unknown	Livestock watering (non 72-12-1)	654
62	LRG-14270-POD1	-106.653100	32.053200	120	60	120	8	Irrigation	3,234
63	LRG-14270-POD2	-106.653032	32.053116	240	120	220	10	Irrigation	3,255
64	LRG-14498-POD1	-106.645466	32.054434	165	Unknown	Unknown	6	Domestic (non 72-12-1)	2,846
65	LRG-14498-POD2	-106.645368	32.054138	165	Unknown	Unknown	0.75	Domestic (non 72-12-1)	2,957
66	LRG-14615-POD1	-106.649221	32.068056	30	Unknown	Unknown	2	Monitoring well	2,382
67	LRG-14982-POD1	-106.652167	32.051500	200	0	200	4	Domestic (one household, 72-12-1)	3,741
68	LRG-15002-POD1	-106.656700	32.053400	240	0	240	4	Domestic (one household, 72-12-1)	3,719
69	LRG-15862-POD1	-106.648055	32.051389	160	80	160	10	Irrigation	3,705
70	LRG-16094-POD1	-106.654813	32.053086	202	0	200	8	Unknown	3,494

Notes:
· dec. deg. = decimal degree
· ft bgs = feet below ground surface
· in = inches
· ft = feet

FIGURES

\\Scottsdale-AZ\Project\KMEP (Kinder Morgan Energy Partners)\3 Saints and Harding\GIS\Projects\Stage 1 abatement plan 11-2019\Figure 1 site vicinity.mxd 11/6/2019



LEGEND

Approximate site location

NOTES

· Topographic map source: ESRI USA Topo Maps.

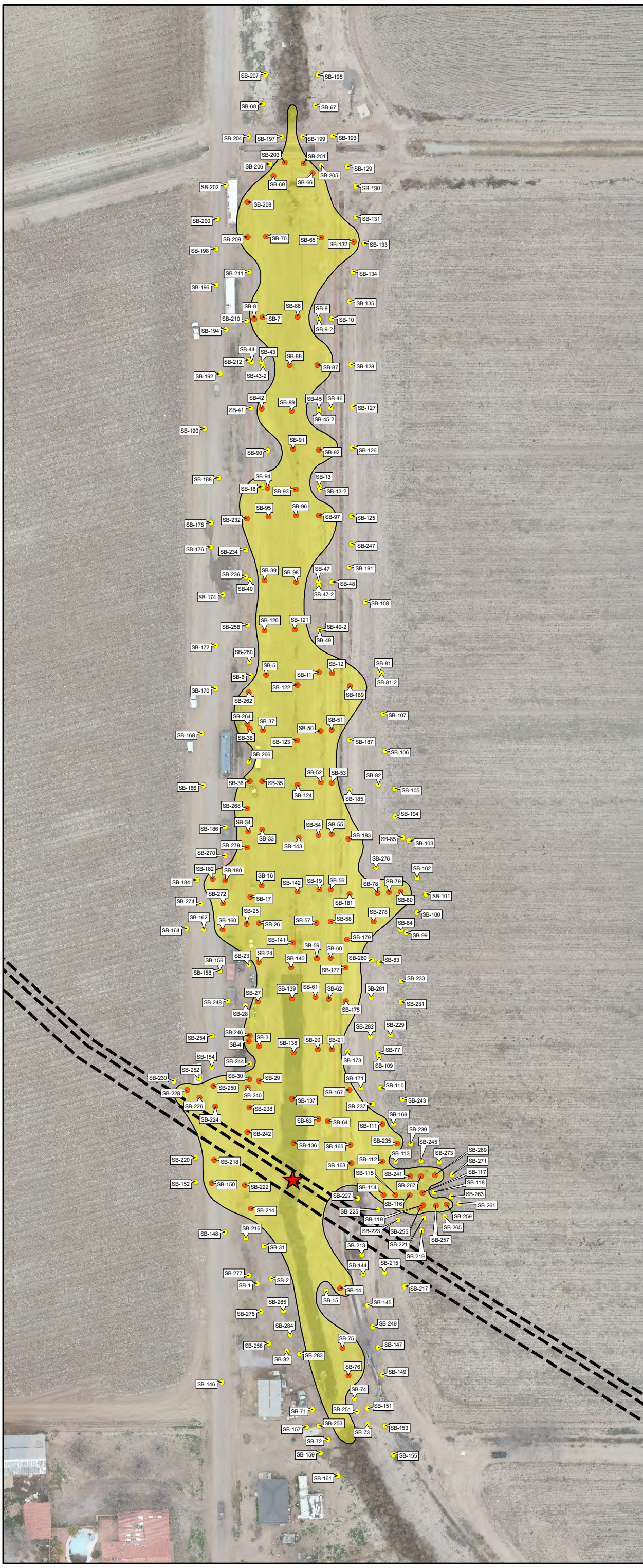
Feet
0 1,000 2,000
Scale: 1" = 2,000'

THREE SAINTS RELEASE SITE
ANTHONY, NEW MEXICO
STAGE 1 ABATEMENT PLAN

SITE VICINITY

ARCADIS

FIGURE
1



LEGEND

- Release point
- SFPP pipeline
- Estimated extent of LNAPL
- Direct push location (LNAPL not detected)
- Direct push location (LNAPL detected)

NOTES

· Aerial photo source: Arcadis drone photography (1/11/2019).
· LNAPL = Light Non-Aqueous Phase Liquid.

N

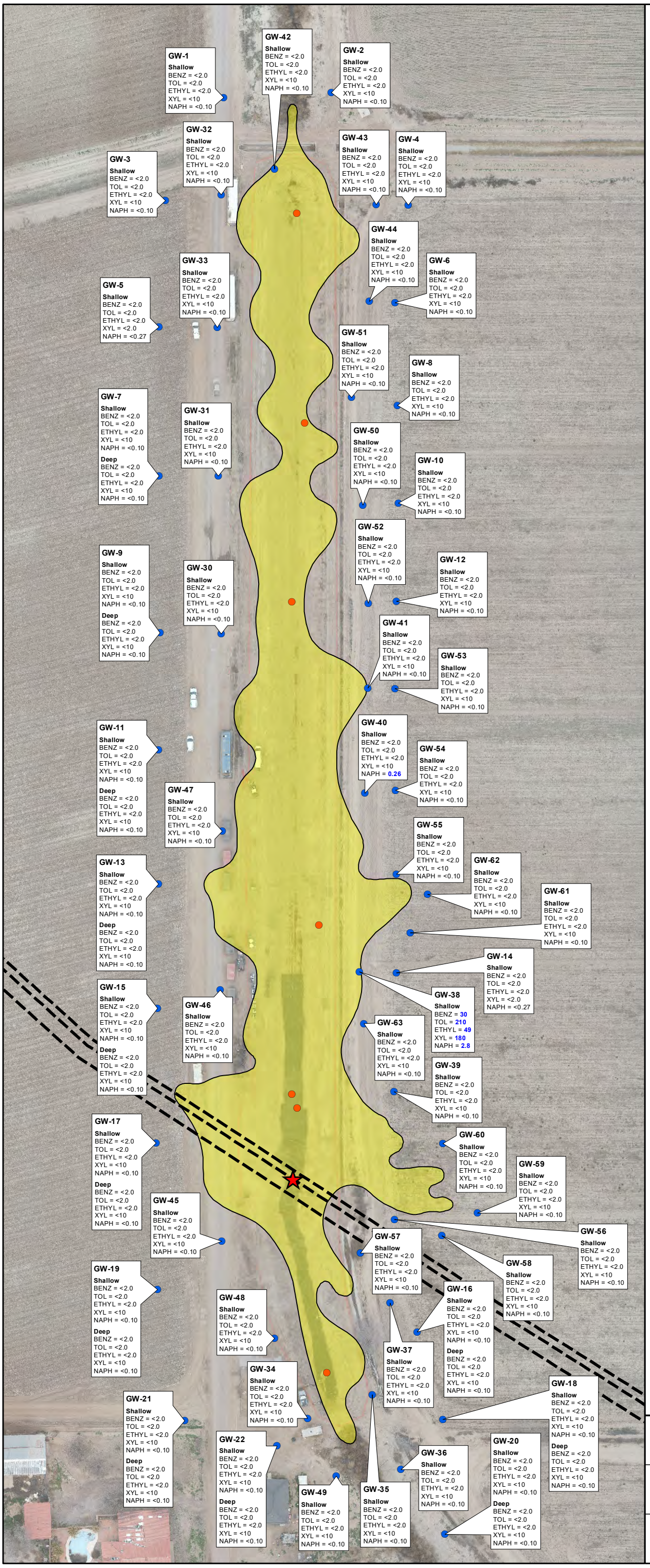
Feet
0 50 100
Scale: 1" = 100'

THREE SAINTS RELEASE SITE
ANTHONY, NEW MEXICO
STAGE 1 ABATEMENT PLAN

DIRECT PUSH BORING LOCATIONS

ARCADIS

FIGURE
2



LEGEND

- Release point
- SFPP pipeline
- Estimated extent of LNAPL
- Groundwater sampling location (direct push)
- Groundwater sampling location (ditch)

NOTES

- Aerial photo source: Arcadis drone photography (1/11/2019).
- Extent of Light Non-Aqueous Phase Liquid (LNAPL) is estimated based on data collected from direct push borings using an Ultra Violet Optical Screening Tool (UVOST).
- Direct push groundwater samples were collected from 2/18/2019 to 3/7/2019.
- **Shallow** samples were collected at an interval of 2 to 5 feet below the water table, while **Deep** samples were collected at an interval of 17 to 20 feet below the water table.
- Benzene (BENZ), toluene (TOL), ethylbenzene (ETHYL), and total xylene (XYL) concentrations were determined via analytical method 8260B, while naphthalene (NAPH) concentrations were determined via analytical method 8270C SIM. For a summary of all detections and other analytes of interest in direct push samples, see Table 3.
- Concentrations are expressed in micrograms per liter (µg/L).
- Concentrations of detected analytes are displayed in **blue**.
- < = Analyte not detected above indicated laboratory reporting limit.

N

0 50 100 Feet

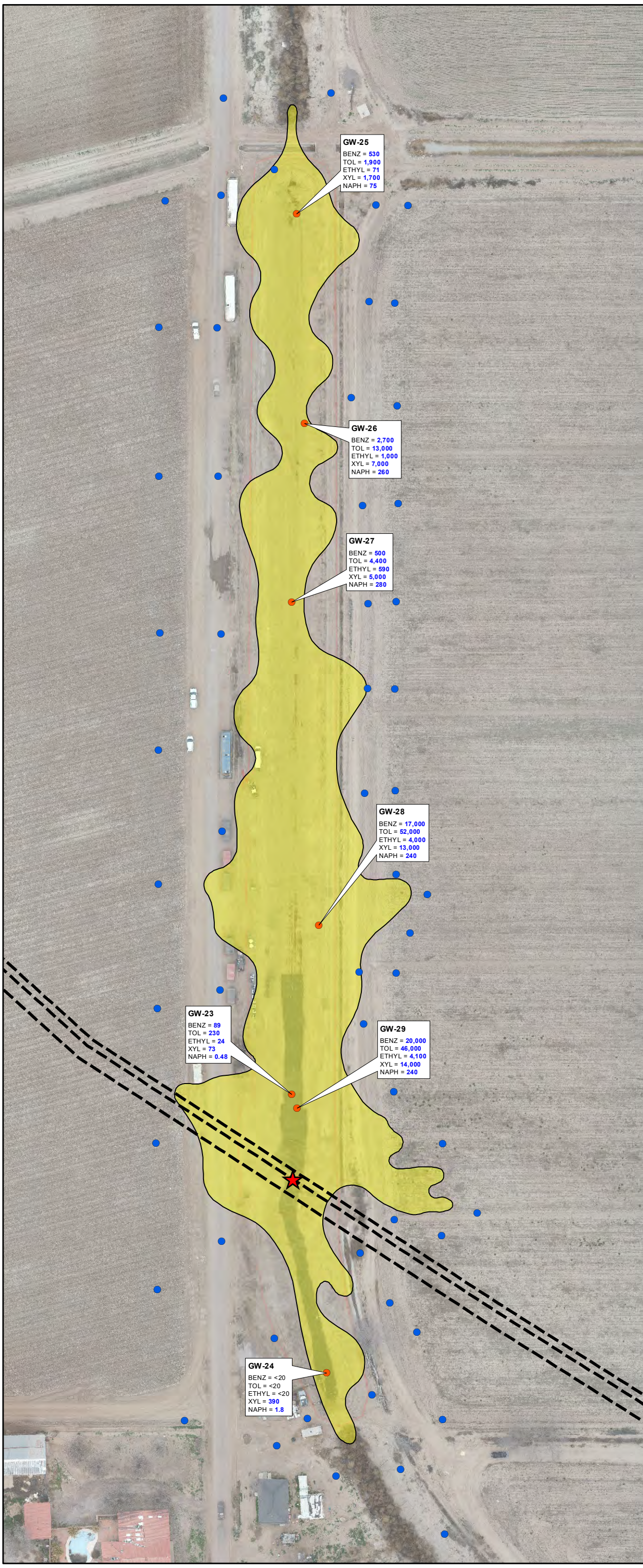
Scale: 1" = 100'

THREE SAINTS RELEASE SITE
ANTHONY, NEW MEXICO
STAGE 1 ABATEMENT PLAN

DIRECT PUSH GROUNDWATER SAMPLING RESULTS FOR SELECTED ANALYTES

ARCADIS

FIGURE
3



LEGEND

- Release point
- SFPP pipeline
- Estimated extent of LNAPL
- Groundwater sampling location (direct push)
- Groundwater sampling location (ditch)

NOTES

- Aerial photo source: Arcadis drone photography (1/11/2019).
- Extent of Light Non-Aqueous Phase Liquid (LNAPL) is estimated based on data collected from direct push borings using an Ultra Violet Optical Screening Tool (UVOST).
- Ditch groundwater samples were collected from 2/23/2019 to 3/7/2019.
- Benzene (BENZ), toluene (TOL), ethylbenzene (ETHYL), and total xylene (XYL) concentrations were determined via analytical method 8260B, while naphthalene (NAPH) concentrations were determined via analytical method 8270C SIM. For a summary of all detections and other analytes of interest in ditch samples, see Table 4.
- Concentrations are expressed in micrograms per liter (µg/L).
- Concentrations of detected analytes are displayed in **blue**.
- < = Analyte not detected above indicated laboratory reporting limit.

N

0 50 100 Feet

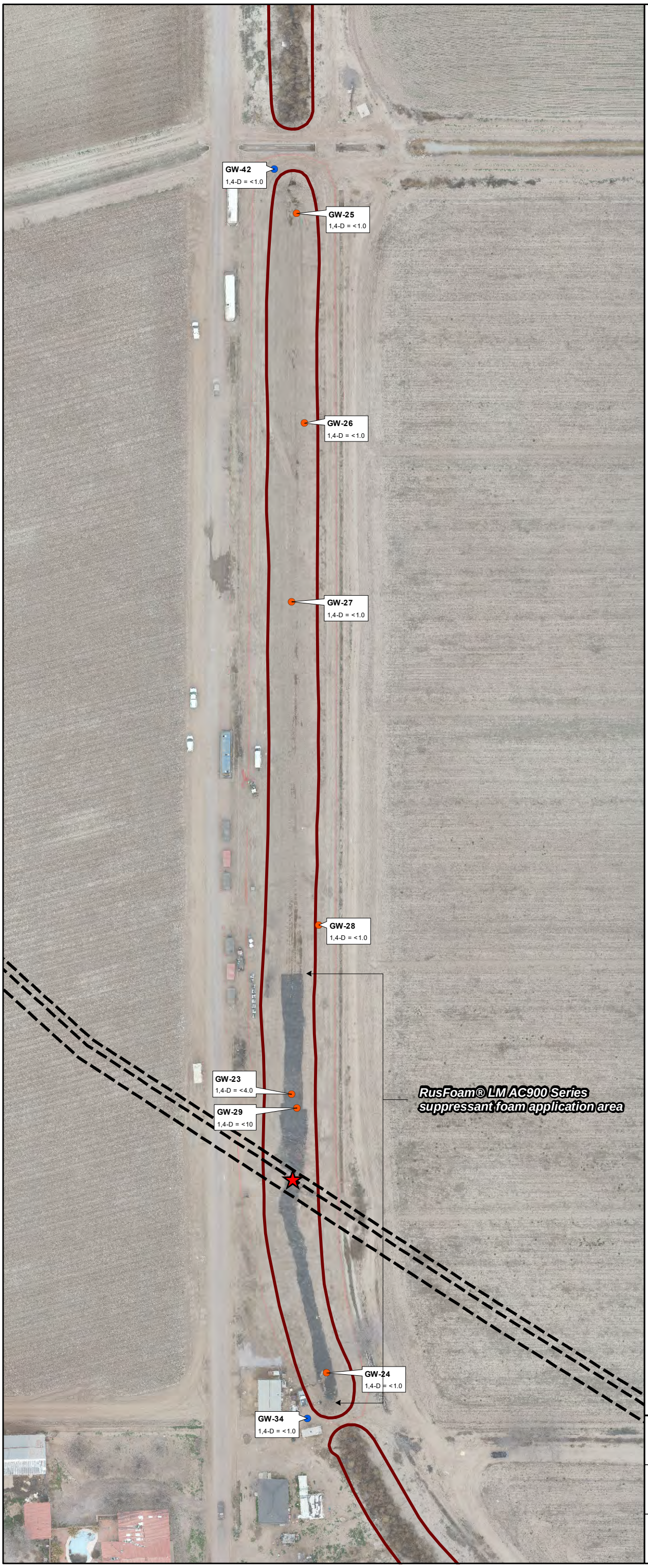
Scale: 1" = 100'

THREE SAINTS RELEASE SITE
ANTHONY, NEW MEXICO
STAGE 1 ABATEMENT PLAN

DITCH GROUNDWATER SAMPLING RESULTS FOR SELECTED ANALYTES

ARCADIS

FIGURE
4



LEGEND

- Release point
- SFPP pipeline
- Upper ditch edge
- Groundwater sampling location (direct push)
- Groundwater sampling location (ditch)

NOTES

- Aerial photo source: Arcadis drone photography (1/11/2019).
- Groundwater samples were collected from 2/23/2019 to 3/7/2019.
- 1,4-dioxane (1,4-D) concentrations were determined via analytical methods 8260B SIM (for GW-23) and 8270C (for all other samples).
- Concentrations are expressed in micrograms per liter (µg/L).
- < = Analyte not detected above indicated laboratory reporting limit.

N

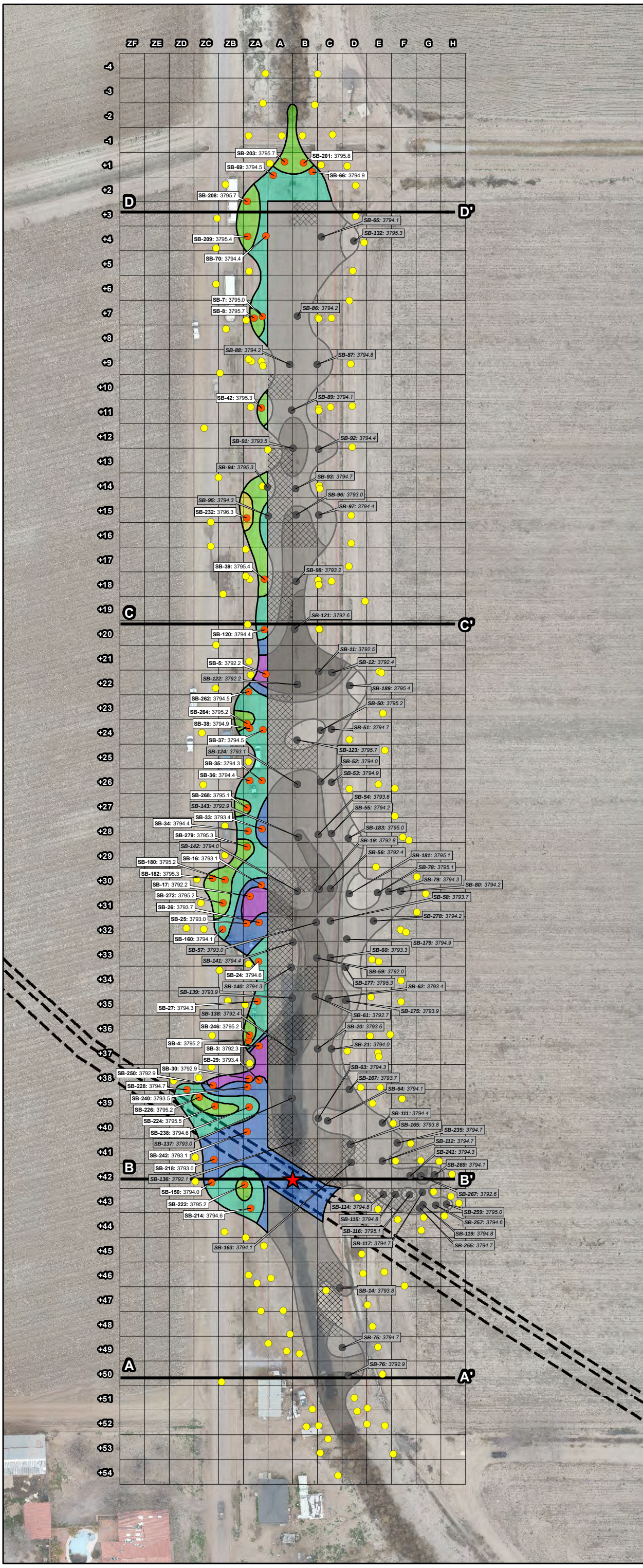
Feet
0 50 100
Scale: 1" = 100'

THREE SAINTS RELEASE SITE
ANTHONY, NEW MEXICO
STAGE 1 ABATEMENT PLAN

1,4-DIOXANE GROUNDWATER SAMPLING RESULTS

ARCADIS

FIGURE
5



LEGEND

- Release point
- SFPP pipeline
- A—A' Cross-section location (see Figure 7)
- Excavated cell with possible LNAPL remaining post-excavation

DIRECT PUSH LOCATIONS

- LNAPL not detected
- LNAPL detected (not excavated)
- LNAPL detected (excavated)
- SB-42: 3795.3 Boring ID and elevation of bottom of LNAPL (not excavated)
- SB-89: 3794.1 Boring ID and elevation of bottom of LNAPL (excavated)

BOTTOM OF LNAPL ELEVATIONS

Elevation	Not excavated	Excavated
3,796 to 3,797 ft amsl		N/A
3,795 to 3,796 ft amsl		
3,794 to 3,795 ft amsl		
3,793 to 3,794 ft amsl		
3,792 to 3,793 ft amsl		

NOTES

- Aerial photo source: Arcadis drone photography (1/11/2019).
- Light non-aqueous phase liquid (LNAPL) elevations are based on data collected from direct push borings using an Ultra Violet Optical Screening Tool (UVOST) and are expressed in feet above mean sea level (ft amsl).

N

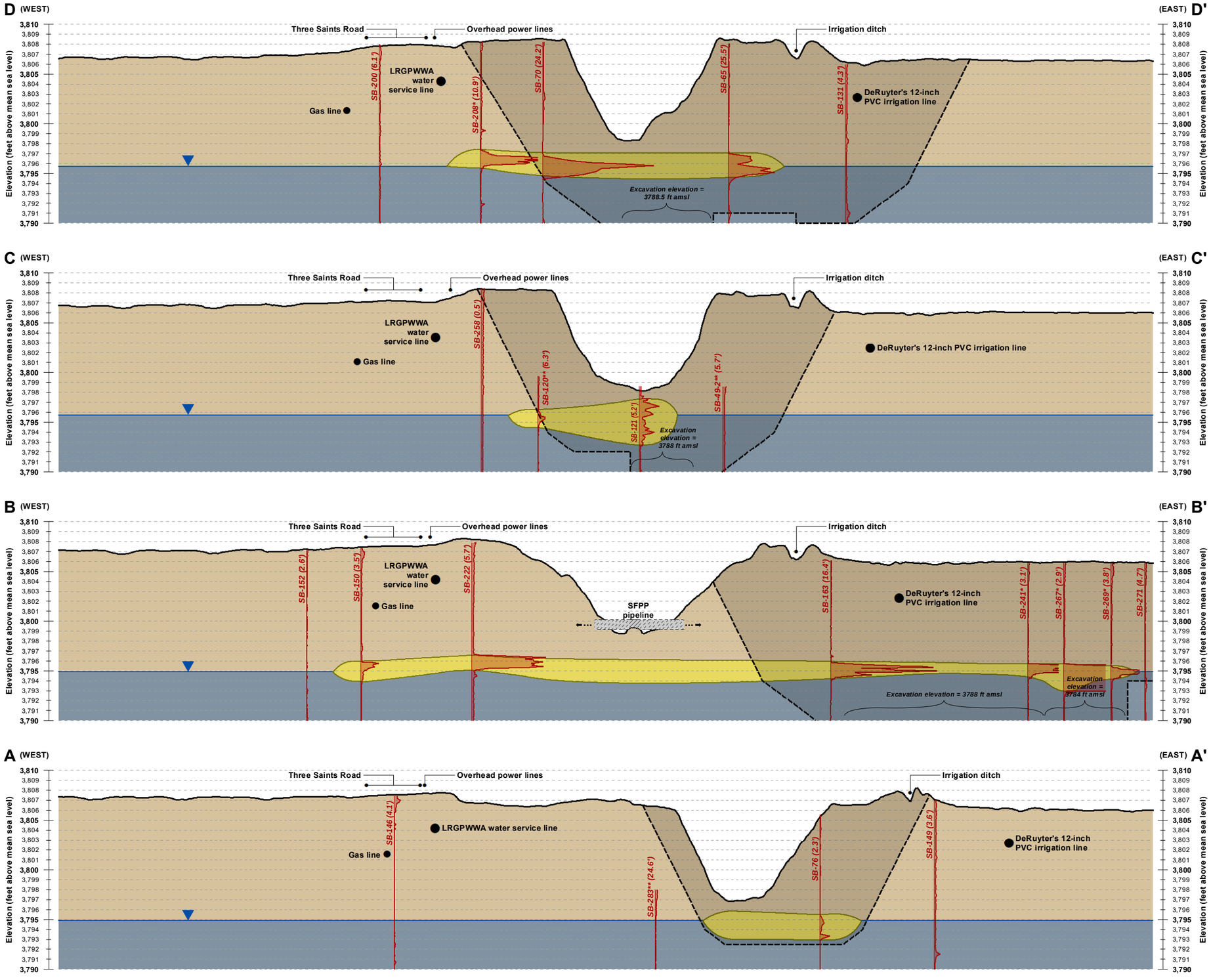
Feet
0 50 100
Scale: 1" = 100'

THREE SAINTS RELEASE SITE
ANTHONY, NEW MEXICO
STAGE 1 ABATEMENT PLAN

APPROXIMATE EXTENT OF LNAPL PRE- AND POST-EXCAVATION

ARCADIS

FIGURE
6



LEGEND

- Ground surface/soil
- Estimated extent of LNAPL
- Estimated groundwater table
- SB-152 (2.6') — Projection of direct push boring location, with UVOST-generated total fluorescence vs. depth curve, including boring ID and distance from cross-section line in feet (ft)
- Approximate subsurface utility location
- Approximate extent of excavated soil

NOTES

- The ground surface displayed on the cross-sections was recorded by an Arcadis drone survey on 1/11/2019.
- The estimated extent of Light Non-Aqueous Phase Liquid (LNAPL) is interpreted from data collected via an Ultra Violet Optical Screening Tool (UVOST) in 291 direct push borings.
- * = The UVOST total fluorescence curves for **SB-208**, **SB-241**, **SB-267**, and **SB-269** have been truncated to avoid overlap with other borings.
- ** = The tops of borings **SB-49-2**, **SB-120**, and **SB-283** appear signficantly below the ground surface; this is a result of excavation activities at these locations after the drone topographic survey was performed but before the borings were drilled and the UVOST data collected.

Vertical scale
1" = 10'

Horizontal scale
1" = 30'

Vertical exaggeration
3x

0 15 30 Feet

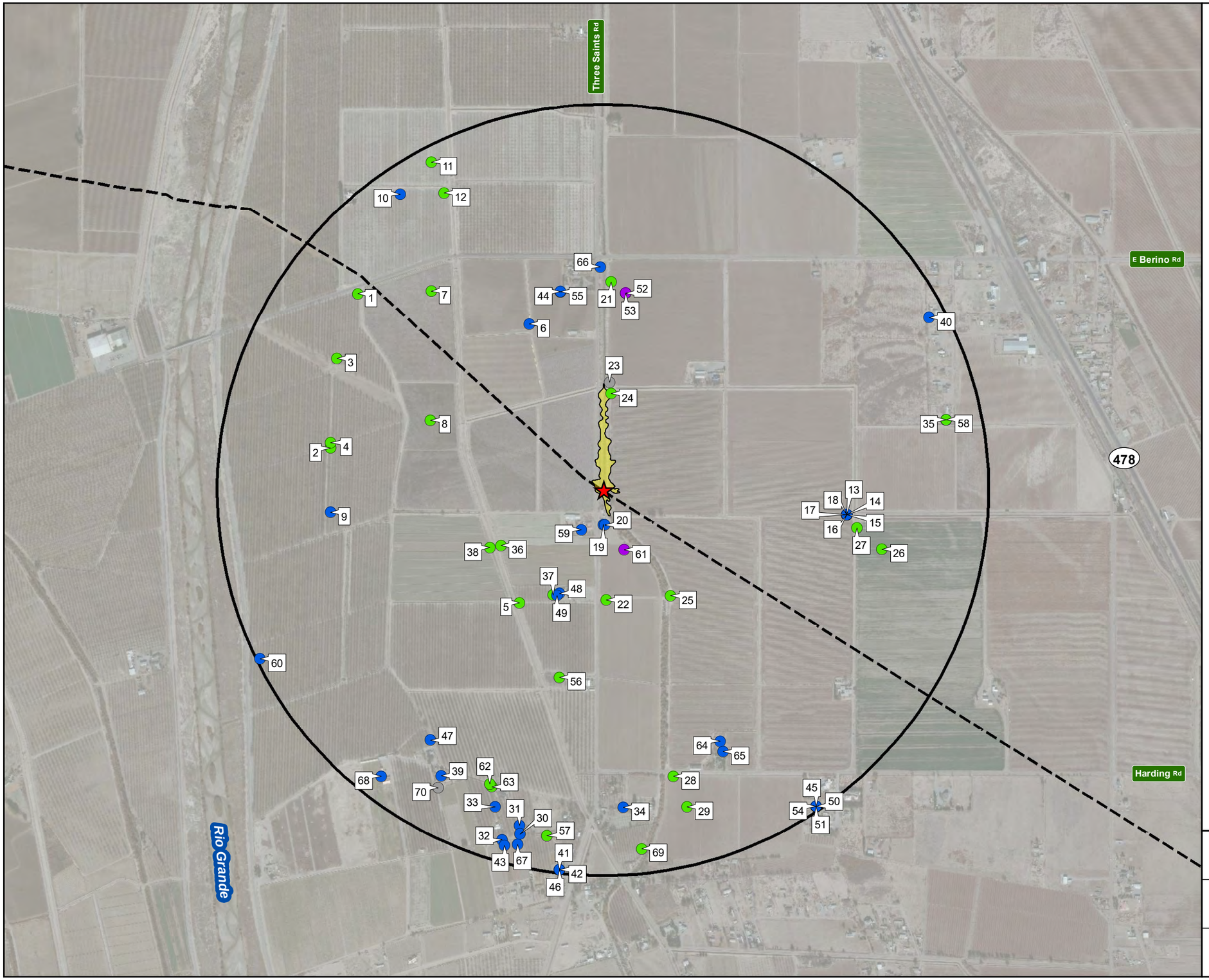
THREE SAINTS RELEASE SITE
ANTHONY, NEW MEXICO
STAGE 1 ABATEMENT PLAN

CROSS-SECTIONS OF EXCAVATED AREA

ARCADIS

FIGURE
7

\\Scottsdale-AZ\Project\KMEP (Kinder Morgan Energy Partners)\3 Saints and Harding\GIS\Projects\Stage 1 abatement plan 11-2019\Figure 7 cross-sections of excavated area.mxd 11/7/2019



LEGEND

- Release point
- SFPP pipeline
- Estimated extent of LNAPL
- ¾-mile radius around release point
- Groundwater well (domestic use)
- Groundwater well (irrigation use)
- Groundwater well (other use)
- Groundwater well (unknown use)

NOTES

· Aerial photo source: ESRI World Imagery.
· Only wells within ¾-mile of the release point are displayed.
· Well details are displayed in Table 7.
· LNAPL = Light Non-Aqueous Phase Liquid.

N

Feet
0 500 1,000
Scale: 1" = 1,000'

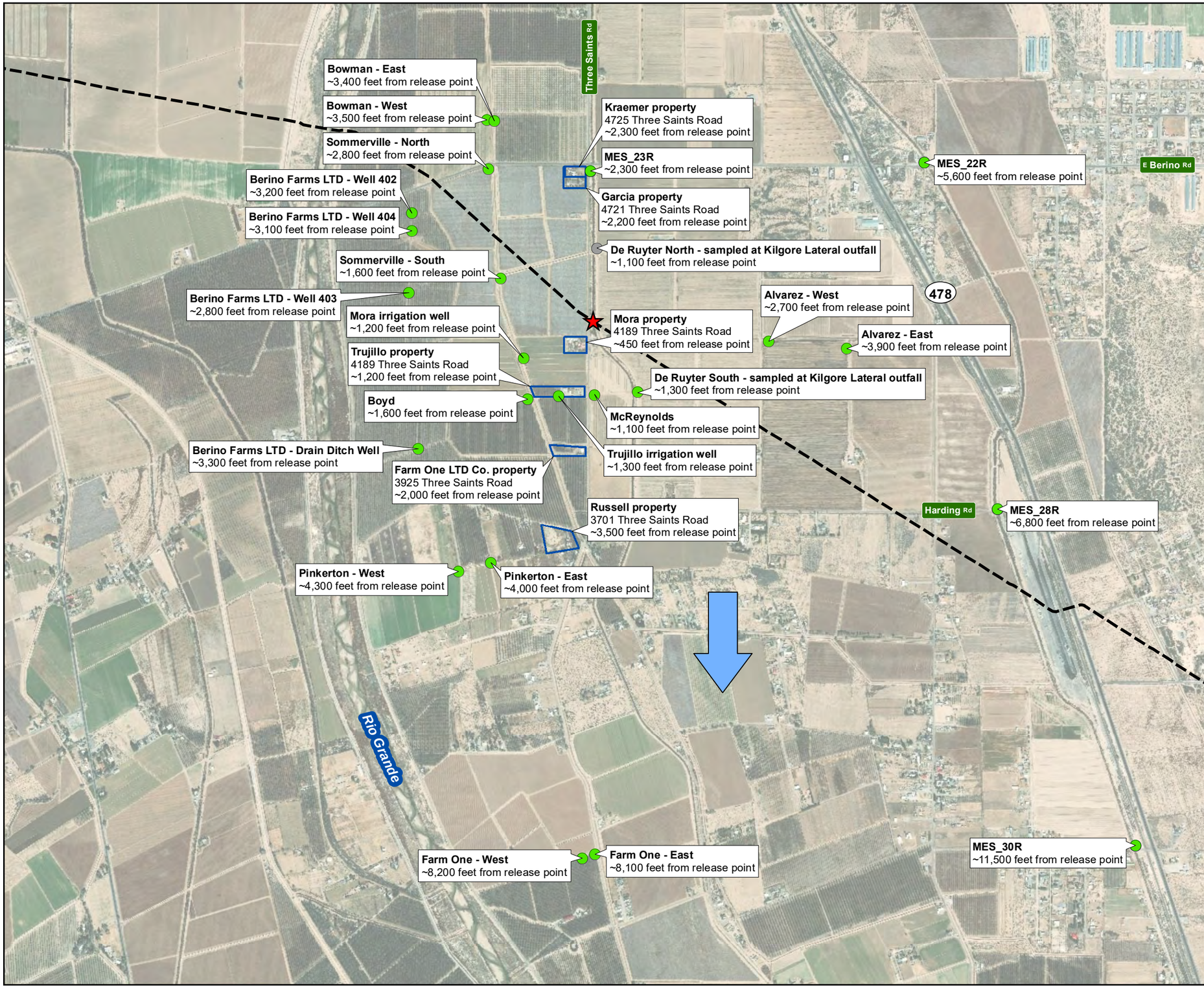
THREE SAINTS RELEASE SITE
ANTHONY, NEW MEXICO
STAGE 1 ABATEMENT PLAN

WELLS WITHIN ¾-MILE OF RELEASE POINT

ARCADIS

FIGURE
8

\\Scottsdale-AZ\Project\KMEP (Kinder Morgan Energy Partners)\3 Saints Release Site\GIS\Projects\Stage 1 abatement plan 11-2019\Figure 8 wells within three-quarter-mile radius.mxd 11/6/2019



LEGEND

- Release point
- SFPP pipeline
- Residential property with sampled well
- Irrigation well (sampled by Arcadis)
- Approximate direction of groundwater flow

NOTES

· Aerial photo source: ESRI World Imagery.

N

0 750 1,500 Feet

Scale: 1" = 1,500'

THREE SAINTS RELEASE SITE
ANTHONY, NEW MEXICO
STAGE 1 ABATEMENT PLAN

SAMPLED IRRIGATION AND RESIDENTIAL WELL LOCATIONS

ARCADIS

FIGURE
9

\\Scottsdale-AZ\Project\KMEP (Kinder Morgan Energy Partners)\3 Saints and Harding\GIS\Projects\Stage 1 abatement plan 11-2019\Figure 9 irrigation and residential well locations.mxd 11/6/2019

APPENDIX A

Quality Assurance Project Plan

SFPP, L.P., an operating partnership of
Kinder Morgan Energy Partners, L.P.

QUALITY ASSURANCE PROJECT PLAN

VERSION 1

Three Saints Road Release Site
Anthony, New Mexico

November 2019

QUALITY ASSURANCE PROJECT PLAN

VERSION 1

Three Saints Road Release Site

Anthony, New Mexico

Prepared for:

Kinder Morgan Inc.

1001 Louisiana Street

Houston, TX 77002

Prepared by:

Arcadis U.S., Inc.

410 N. 44th Street

Suite 1000

Phoenix

Arizona 85008

Tel 602 438 0883

Fax 602 438 0102

Our Ref.:

30036536

Date:

November 8, 2019

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Lyndi Mott

Quality Assurance Coordinator

Robert Forsberg, RG (Arizona)

Principal Geologist

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1 Site Location

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B Arcadis Standard Operating Procedure: Sample Chain-of-Custody
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D Corrective Action Form

ACRONYMS AND ABBREVIATIONS

Arcadis	Arcadis U.S., Inc.
ASCII	American Standard Code for Information Interchange
CSV	comma-separated value
DQO	data quality objective
DV	data validation
EDD	electronic data deliverable
FSP	Field Sampling Plan
GC	gas chromatography
GC/MS	gas chromatography/mass spectrometry
H&S	health and safety
HASP	Health and Safety Plan
IDW	Investigation Derived Waste
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MS	matrix spike
MSD	matrix spike duplicate
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
OSWER	Office of Solid Waste and Emergency Response
QA/QC	quality assurance/quality control
QAC	Quality Assurance Coordinator
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
RPD	relative percent difference
SDG	sample delivery group
SOP	Standard Operating Procedure
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WP	Work Plan

1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) provides site-specific quality assurance/quality control (QA/QC) standards and procedures that will be used at the Three Saints Road Release Site (the Site) in Anthony, New Mexico (Figure 1). The QAPP has been prepared by Arcadis U.S., Inc. (Arcadis) on behalf of Kinder Morgan Inc. (Kinder Morgan), and describes the policies and procedures for ensuring that work processes and products satisfy stated expectations or specifications.

1.1 Regulatory Agency Quality Assurance Project Plan Guidance

The New Mexico Environment Department (NMED) notified Kinder Morgan in a letter dated September 4, 2019 that a Stage 1 Abatement Plan was required for this Site in accordance with Subsection A of 20.6.2.4106 NMAC (New Mexico Administrative Code). The Stage 1 Abatement Plan requires that the QAPP be prepared in accordance with the sampling and analytical techniques listed in Subsection B of Section 20.6.2.3107 NMAC and with Section 20.6.4.10 NMAC of the Water Quality Standards for Interstate and Intrastate Streams in New Mexico.

1.2 QAPP Organization

This QAPP has been prepared in accordance with the United States Environmental Protection Agency (USEPA) Requirements for Quality Assurance Project Plans (USEPA 2001) and is organized into the following sections:

Section	Contents
1	Introduction
2	Project Management
3	Field Sample Collection and Data Generation Procedures
4	Laboratory Analysis and Data Generation Procedures
5	Inspection and Acceptance Requirements for Supplies and Consumables
6	Data Acquisition Requirements for Non-Direct (Historical) Measurements
7	Data Management
8	Quality Control Requirements
9	Assessment and Response Actions
10	Reports to Management
11	Data Reduction and Review
12	References

1.3 Objectives of the QAPP

The objective of this QAPP is to provide quality specifications and methods that will be used to establish technical accuracy and precision, statistical validity, and documentary evidence of environmental data generated during all field sampling activities conducted at the Site.

This QAPP provides field, office, data validators, database administrators, and laboratory personnel with instructions regarding activities to be performed before, during, and after field sampling activities. These instructions are intended to ensure that data collected for use in project decisions will be of the type and quality needed and expected for their intended purposes. The policies and procedures outlined in this QAPP apply to sample collection, sample analysis, and data generation.

1.4 Distribution and Revision of the QAPP

The QAPP is considered a controlled document. Controlled distribution will be implemented to ensure that only the most current approved version is used. A sequential revision numbering system will be in place to identify changes in the controlled versions of the QAPP. Versions will be provided to all managers, quality assurance coordinators, field personnel, and subcontractor representatives, if applicable.

Addenda, updates, or revisions to the QAPP may be prepared annually (if necessary); or if guidelines, procedures, regulatory documents, or standard operating procedures (SOPs) are revised; or when project objectives, scope, or Site activities change.

2 PROJECT MANAGEMENT

2.1 Project Description

This QAPP is intended to provide general information to support other documents that detail QA/QC requirements for specific field sampling activities. Details of the work to be performed, products to be produced, and the schedule for implementation of specific field sampling activities will be provided in task-specific plans (e.g., Field Sampling Plans [FSPs], Remedial Action Plans [RAPs], and Work Plans [WPs]) and are not repeated in this QAPP. Task-specific plans will refer to and build on the information provided in this QAPP to document a complete quality assurance program.

2.2 Project Background

The Three Saints Road Release Site is located adjacent to 4220 Three Saints Road in Anthony, New Mexico, 88021 (Figure 1). Adjacent and nearby land use include community ditches, canals, privately owned farmland and single-family home residences immediately north and south; Three Saints Road,

privately owned farmland and community ditches to the west; and privately-owned farmland, unpaved access road and community ditches west of the Site.

On December 13, 2018 at 11:41 pm Mountain Standard Time, the SFPP's El Paso Breakout, Deming 12-inch pipeline automatically shut down as a result of gasoline discharge due to a pipeline leak in the vicinity of 4220 Three Saints Road in Anthony, New Mexico (Arcadis 2019a). The location and nature of the discharge was identified at 12:51 am on December 14, 2018. On December 14, 2018 at 0309 am, the gasoline discharge that was reported to the NMED. The duration of the release is unknown; however, SFPP estimates approximately 10,910 barrels of gasoline was discharged (Arcadis 2019a).

2.3 Project Organization

The field sampling activities to be performed at the Site will require integration of personnel from the organizations identified below, collectively referred to as the "project team." On behalf of Kinder Morgan, Arcadis manages the field sampling activities. Arcadis personnel will perform field sampling tasks, evaluate data, and prepare deliverables. Project direction will be provided by Kinder Morgan, with oversight by NMED. The analytical laboratory will conduct analyses of samples collected at the Site. Subcontractors, if employed, are required to operate under the requirements of this QAPP, as applicable. The responsibilities of the various team members are summarized below by organization. A list of key project management and task management personnel is provided in Table 1.

2.3.1 NMED

Project Manager

Responsibilities and duties include:

- Coordinate and/or review and approve work products, supporting documents, and future deliverables.
- Communicate agency requirements to Kinder Morgan and Arcadis Project Managers.
- Monitor progress of field sampling activities.

2.3.2 Kinder Morgan

Remediation Manager

Responsibilities and duties include:

- Provide overall direction of Site field sampling activities.
- Fund necessary tasks.
- Direct Arcadis.

- Review Arcadis work products, including data, memoranda, letters, reports, and all other documents transmitted to ADEQ.

2.3.3 Arcadis

Program Manager/Principal in Charge

Responsibilities and duties include:

- Identify client requirements and communicate to the Arcadis team.
- Oversee Arcadis work products and project performance.
- Provide Arcadis approval for major project deliverables.

Project Manager

Responsibilities and duties include:

- Manage and coordinate the project with an emphasis on adhering to the objectives of the Three Saints Road Release Site field sampling activities.
- Define, plan, and control the project.
- Maintain and track project schedule and budget.
- Provide sufficient resources to carry out QAPP requirements.
- Review documents prepared by Arcadis.
- Ensure that corrective actions are taken for deficiencies cited during Site activities.

Quality Assurance Coordinator (QAC)/Data Validator

Responsibilities and duties include the following; however, they may be shared with the Project Manager or the Task Manager:

- Review laboratory data packages.
- Coordinate field QA/QC procedures with Task Managers concentrating on field analytical measurements and practices to meet data quality objectives (DQOs).
- Prepare and review QA/QC reports in accordance with USEPA guidelines, which includes an evaluation of laboratory data and data usability reports.

Task Manager

Responsibilities and duties include:

- Maintain the official approved QAPP.
- Provide current copies of the QAPP to personnel and communicate expectations.
- Manage relevant day-to-day activities.

- Verify that personnel have appropriate required training.
- Review field reports.
- Develop, establish, and maintain files.
- Review data reductions.
- Coordinate with the analytical laboratory.
- Perform final data review of field data reductions and reports.
- Ensure that corrective actions are taken for deficiencies cited during Site activities.
- Perform overall project QA/QC.
- Review chains of custody and relevant field records and logs.
- Instruct personnel working on Site activities.
- Coordinate field and laboratory schedules.
- Review and verify that field instrumentation, maintenance, and calibration meet quality objectives.
- Prepare reports.
- Maintain field and laboratory files of logbooks/logs, data reductions, and calculations.

Health and Safety Coordinator

Responsibilities and duties include:

- Exercise authority for health and safety (H&S) compliance and Health and Safety Plan (HASP) conformance for the project.
- Administer the H&S program.
- Determine the level of personal protection required.
- Update equipment or procedures based on new information.
- Establish air-monitoring parameters based on expected contaminants.
- Conduct reviews of project H&S in accordance with HASP.
- Assist in injury, illness, and near-miss investigation and follow-up.

Database Administrator

Responsibilities and duties include:

- Review laboratory data packages against data in the EDD to confirm accuracy.
- Load analytical data from electronic data deliverables (EDDs) into the project database.
- Maintain and ensure quality of data in the database.
- Provide data tables to meet project and deliverable needs.

Field/Office Personnel

Responsibilities and duties include:

- Read and comply with the QAPP.
- Perform and comply with field procedures associated with the activities proposed in WPs, FSPs, and other documents.
- Perform field analyses and collect quality assurance samples.
- Calibrate, operate, and maintain field equipment.
- Reduce field data.
- Maintain sample custody.
- Prepare field records and logs.

2.3.4 Analytical Laboratories

General responsibilities and duties of the analytical laboratories include:

- Perform sample analyses and associated laboratory QA/QC procedures.
- Supply sampling containers and shipping containers.
- Maintain laboratory custody of sample.
- Strictly adhere to all protocols in the QAPP and laboratory QA guidance.
- Provide reports summarizing the results of the analyses including the QA/QC information.

Project Manager

Responsibilities and duties include:

- Serve as primary communication link between Arcadis and laboratory technical staff.
- Monitor workloads and ensure availability of resources.
- Oversee preparation of analytical reports.
- Supervise in-house chain of custody.

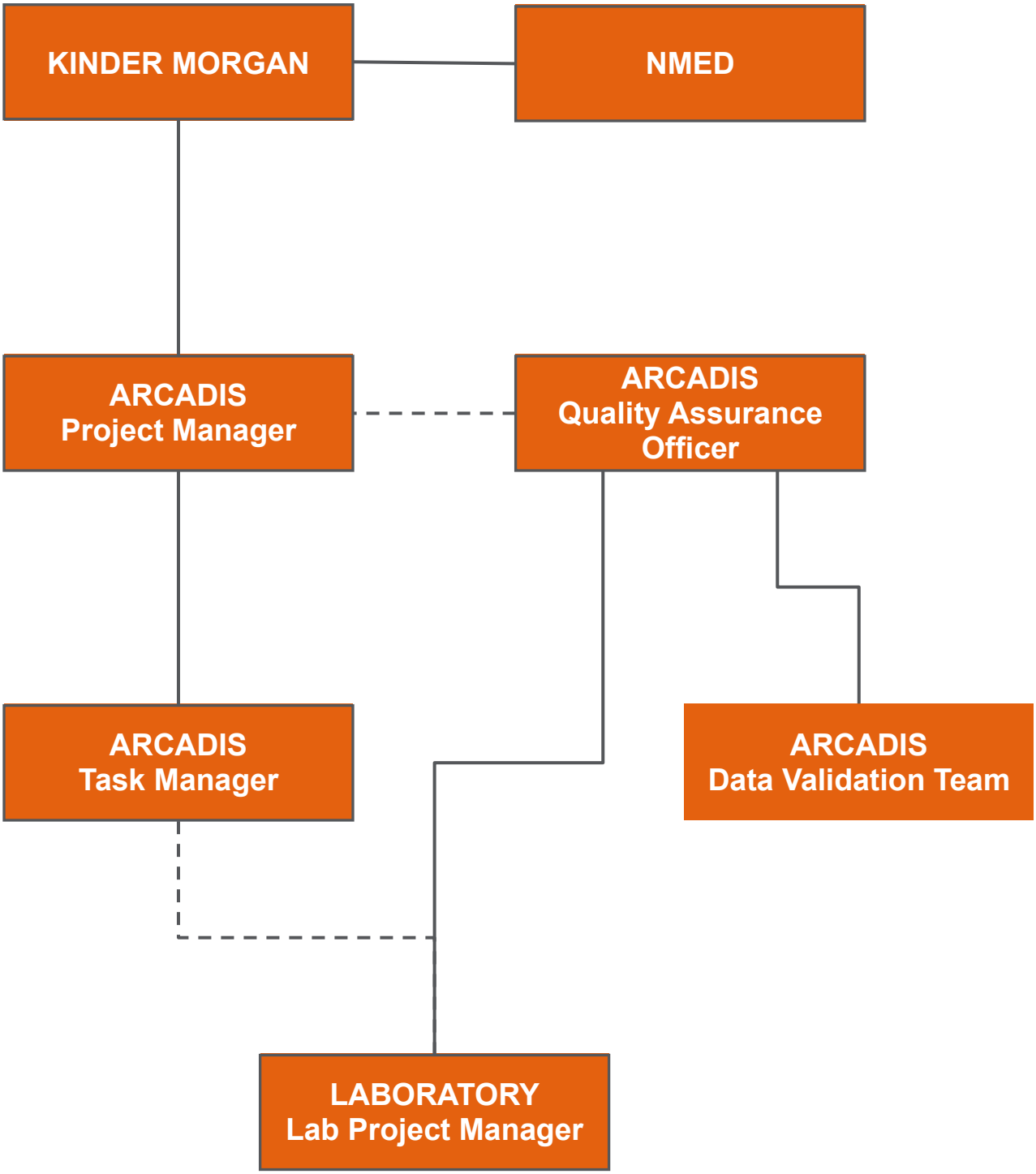
Quality Assurance Manager

Responsibilities and duties include:

- Supervise personnel reviewing and inspecting all project-related laboratory activities.
- Conduct periodic audits and product reviews of all laboratory activities.

2.3.5 Organization Chart

The following organization chart illustrates the chain of command for the Project team.



2.4 Project File

Arcadis maintains an electronic copy of project files. Each client project is assigned a file/job number. Project files will be maintained for at least 10 years after project close-out. The project file includes, but is not limited to the following:

- Agreements/Proposals
- Change Orders/Purchase Orders
- Invoices
- Correspondence
- Notes and Data
- Public Relations Information
- Regulatory Documents
- Final Reports/Presentations
- Documents Prepared by Others.

2.5 Quality Objectives and Criteria for Measurement Data

2.5.1 Data Quality Objectives

The DQO process, as described in the Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA/240/B-06/001 (USEPA 2006), is intended to provide a “logical framework” for planning field investigations. DQOs specify the type, quality, quantity, and uses of project data needed to make decisions. They are the basis for designing data collection activities. DQOs for groundwater sampling activities are included in Table 2 of this QAPP. Other task specific DQOs will be presented in companion documents prepared for each specific sampling program, as applicable (e.g., FSPs, RAPs, WPs) and are not repeated in this QAPP.

2.5.2 Data Categories

Three data categories have been defined to address various analytical data uses and the associated QA/QC effort and methods required to achieve the desired levels of data quality. These categories are:

Screening Data: Screening data afford a quick assessment of Site characteristics or conditions and include data collection activities that involve rapid, non-rigorous methods of analysis and quality assurance. This data category is generally applied to physical and/or chemical properties of samples, degree of contamination relative to concentration differences, and preliminary H&S assessments.

Screening Data with Definitive Confirmation: Screening data allow rapid identification and quantitation, although the quantitation can be relatively imprecise. This data category is available for data collection activities that require qualitative and/or quantitative verification of a select portion of sample findings (10% or more). This data category can also be used to verify less rigorous laboratory-based methods.

Definitive Data: Definitive data are generated using analytical methods such as approved USEPA reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files.

The laboratory will be report results in a Level 2 report as defined below. All definitive data will be generated through a fixed laboratory, with the exception of quantitative field measurements (e.g., those gathered using photoionization detectors, YSI multi-meter).

For this project, two levels of data reporting have been defined. They are as follows:

Level 1 – Minimal Reporting: Minimal or "results only" reporting is used for analyses that, either due to their nature (e.g., field monitoring) or the intended data use (e.g., preliminary screening), do not generate or require extensive supporting documentation.

Level 2 – Modified Reporting: Modified reporting is used for analyses performed following standard USEPA-approved methods and QA/QC protocols and that, based on the intended data use, require some supporting documentation but not, however, full "contract laboratory program-type" reporting.

Level 2 Laboratory data report required elements:

- Chain-of custody;
- Case Narrative;
- Final parameter concentration for all samples;
- Preparation or extraction and analysis dates/times;
- Method Blanks;
- Surrogate recoveries;
- Matrix Spike and Matrix Spike Duplicate recoveries and RPD;
- Laboratory Duplicate RPD;
- Laboratory Control Sample recoveries

2.6 Special Training and Certification Requirements

This QAPP should be reviewed annually or prior to commencing activities by all staff intending to take part in field sampling activities at the Site.

Task-specific plans, such as FSPS, RAPs, or WPs, should also be reviewed annually or prior to commencing activities by all staff intending to take part in field sampling activities at the Site.

H&S training is required to comply with the site-specific HASP. The HASP should be revised and updated annually, and all staff intending to take part in Site activities should review the updated HASP.

2.7 Documents and Records

The reports and records to be produced during and following field sampling activities will be detailed in the task-specific plans and are not repeated in this QAPP. All final reports will be maintained in the project file.

3 FIELD SAMPLE COLLECTION AND DATA GENERATION PROCEDURES

3.1 Sampling Process Design

The types and numbers of samples, sampling locations and frequencies, sample matrices, measurement parameters, and rationale for the sampling process design will be provided in task-specific plans and are not repeated in this QAPP. The following sections detail general sample collection and data generation procedures to be applied to all field sampling activities at the Site.

3.2 Field Equipment

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated and maintained according to manufacturer specifications, and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

3.2.1 Maintenance and Inspection

Each piece of field equipment used in support of the field sampling activities that directly affect the quality of the analytical data will be subject to preventative maintenance measures that minimize equipment downtime. Equipment will be examined to ensure that it is in operating condition. This includes checking the manufacturer's operating manual to ensure that all maintenance requirements are being observed in accordance with manufacturer specifications. Field notes from previous sampling events will be reviewed

to ensure that any prior equipment problems are not overlooked, and that any necessary repairs to equipment have been carried out.

Prior to field sampling activities, each piece of field equipment will be inspected to ensure that it is operational. If the equipment is not operational, it will be taken out of use until it can be serviced. All meters that require charging of batteries will be fully charged, and fresh batteries will be kept on hand. If instrument servicing is required, it is the responsibility of the appropriate Task Manager and field personnel to follow the maintenance schedule and arrange for timely service.

Field equipment returned from a site will be inspected to confirm that it is in working order. The inspection will be recorded in the field logs, as appropriate. It will also be the obligation of the last user to record any equipment problems in the logs. Non-operational field equipment will either be repaired or replaced. Appropriate spare parts will be made available for field equipment.

3.2.2 Calibration

As part of data quality assurance procedures, field monitoring and detection equipment will be routinely calibrated according to manufacturer specifications. Instrument calibration ensures that equipment used is of the proper type, range, accuracy, and precision to provide data compatible with the specified requirements and desired results. In order to demonstrate that established calibration procedures have been followed, calibration records will be prepared and maintained on the appropriate logs provided in the task-specific plans. The calibration record will serve as a written account of monitoring or detection equipment QA. All erratic behavior or failures of field equipment will be subsequently recorded in the calibration log.

If a calibrated instrument fails to meet calibration verification, it will be removed from use until it can be serviced. Equipment found to be out of tolerance during the period of use will be removed from use and measuring and testing activities performed using the equipment will be noted as such in the field logs.

3.3 Field Data Documentation

Data collection activities designed to gather the information necessary to make decisions require consistent documentation and accurate record keeping. During field sampling activities at the Site, standardized procedures will be used to document data collection activities performed in the field, data security, and quality assurance.

Field personnel will provide comprehensive documentation covering all aspects of field sampling, field analysis, and sample chain of custody as specified in the task-specific plans and herein. This documentation provides records of activities and allows for reconstruction of field events to aid in the data review and interpretation process. Documents, records, and information relating to the performance of the field work will be retained in the project file.

Each page or entry of field notes will be dated and initialed by the field personnel at the time of entry. Errors in entry will be crossed out in indelible ink with a single stroke, corrected without the use of white-out or by obliterating or writing directly over the erroneous entry, and initialed and dated by the individual making the correction. Pages that are not used will be completed by lining out unused portions, if applicable. To ensure at any future date that pages are not missing, each page will be sequentially numbered.

The various forms of documentation to be maintained throughout the field sampling activities may include, but are not limited to, those described in the following subsections.

3.3.1 Daily Activity Logs

A field book or daily logs will be used to record daily activities performed at the Site. Entries will be described in as much detail as possible so that persons going to the Site could reconstruct a particular situation without reliance on memory. The minimum field documentation requirements are detailed in the Arcadis Quality Procedure for Field Activities Documentation (Appendix A). Detailed requirements and specific forms to be used will be provided in the task-specific plans.

3.3.2 Sampling Logs

Detailed notes will be made as to the exact sampling location, sample number, date and time of sampling, sample collector’s name or initials, physical observations, and weather conditions (as appropriate). This information will be documented on the appropriate field forms as directed by and included in the task-specific plans.

3.3.3 Chain-of-Custody Forms

Chain-of-custody forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. An example chain-of-custody form is provided in the Arcadis SOP for Sample Chain of Custody, which is included in Appendix B. Chain-of-custody forms will be filled out at each sampling location or at the end of each day of sampling for all samples submitted to the laboratory by

Arcadis field personnel in accordance with the Arcadis SOP for Sample Chain of Custody (Appendix B). The chain-of-custody forms will contain the unique sample ID, sample date and time, sample type, preservation (if any), and analyses required. If errors on the chain of custody are noted after the samples are delivered, the required changes will be documented in an e-mail or letter to the laboratory. If the laboratory has already submitted the results, a resubmission may be required, depending on the error.

When the samples are relinquished from one person or entity to another, the chain-of-custody form will be signed and dated by the appropriate personnel to document the sample transfer. The original chain-of-custody form will accompany the samples to the laboratory, and a copy will be retained for the project files.

Whenever samples are split with a government agency or other party, a separate chain-of-custody form will be prepared for those samples and marked to indicate with whom the samples are being split. The person relinquishing the samples to the facility or agency should request the representative's signature acknowledging sample receipt. If the representative is unavailable or refuses, this is noted in the "Received By" space.

3.3.4 Field Equipment Calibration and Maintenance Logs

To document the calibration and maintenance of field instruments, calibration and maintenance logs will be completed for each piece of field equipment. Appropriate field equipment and calibration and maintenance forms will be included in the associated task-specific plan.

3.3.5 Field Data Forms

Information collected in the field through visual observation, manual measurement, and/or field instrumentation will be recorded in field logbooks or data sheets and/or on forms included in the associated task-specific plan.

3.4 Sampling Methods

Sampling methods and equipment will be consistent with Arcadis Technical Guidance Instructions (TGIs), industry best practices, and regulatory agency guidelines. Additional information on sampling methods and equipment will be provided in the task-specific plans and are not repeated in this QAPP.

3.4.1 Sample Containers and Preservation

Appropriate sample containers, preservation methods, and method holding times will be used and applied for all samples collected at the Site. The analytical laboratory will supply appropriate sample containers and preservatives, as necessary. The bottles will be pre-cleaned according to USEPA Office of Solid Waste and Emergency Response (OSWER) Directive 9240.05A requirements (USEPA 1992a). The field personnel will be responsible for properly labeling containers and preserving samples (as appropriate) in accordance with the analytical methods.

3.4.2 Sample Labelling

Sample labels will be completed for each sample using waterproof ink. The completed sample labels will be affixed to each sample container and covered with clear tape. The following information is required on each sample label:

- Sample ID
- Analysis required
- Date collected
- Time sampled
- Initials of sampling personnel
- Preservative added, if applicable.

3.4.3 Sample Designation System

Samples will be identified with a unique designation system to facilitate sample tracking. The sample designation system to be employed during the field sampling activities will be consistent, yet flexible enough to accommodate unforeseen sampling events and conditions. An alpha-numeric system is considered appropriate and will be used by field personnel to assign each sample with a unique sample identification number (sample ID). In general, the sample ID will begin with a prefix indicating the sample type; followed by two or more digits indicating the location identifier (i.e., monitoring well number); and an eight-digit date code in month, day, year format (i.e., 06122019 for June 12, 2019). The sample ID may also include the sample matrix and/or depth. The specific sample ID syntax to be used for a particular sampling event will be detailed in the associated task-specific plan.

The sample types will be designated using the following codes (where applicable):

- Soil boring – “SB”

- Monitoring well – “MW”
- Injection well sample – “IW”
- Extraction well – “EW”
- Investigative Derived Waste – “Waste or IDW”
- Tracer gas – “Tracer”.

If needed, the sample matrix will be designated using the following codes:

- Soil – “SO”
- Soil Gas/Vapor – “SG”
- Ambient Air – “AA”
- Groundwater Sample – “GW”.

The quality control samples will be designated using the following codes:

- Trip Blank – “TB”
- Equipment Blank – “EB”
- Field Duplicates – “FD”
- Matrix Spike and Matrix Spike Duplicates – “MS” and “MSD”.

3.5 Sample Handling and Packing

Sample packaging and shipping procedures are designed to ensure that the samples will arrive at the laboratory intact and appropriately preserved with the chain-of-custody form. Requirements will be detailed in the associated task-specific plans.

3.6 Field Custody

The objective of continuous field sample custody is to ensure that samples are not tampered with from the time of sample collection through the time of transport to the analytical laboratory and to protect human health. Persons will have “custody of samples” when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

Field custody documentation consists of both field logs and field chain-of-custody forms, as described in Section 3.3. Proper sample labeling ensures that analytical results provided by the lab can be correctly linked to sample information recorded on field logs.

Measures will be taken during the field activities to ensure that samples and records are not lost, damaged, or altered. When not in use, all field logs will be stored in a secure location. When in use, all field logs will be with the field staff or locked in the field vehicle. Access to these files will be limited to the field personnel who use them.

3.7 Management of Investigation-Derived Materials

Investigation-derived wastes (IDW) and materials will be managed consistent with the USEPA document Guide to Management of Investigation-Derived Wastes (USEPA 1992b), city and state guidelines, and Kinder Morgan's requirements. Details of IDW management are included in the February 19, 2019 Waste Management Plan, Three Saints Road Release, Anthony, New Mexico (Arcadis 2019b) and summarized in the associated task-specific plans.

4 LABORATORY ANALYSIS AND DATA GENERATION PROCEDURES

Eurofins TestAmerica Laboratory (Eurofins TestAmerica) has been subcontracted to analyze Site samples and will perform the laboratory QA/QC procedures prescribed by the USEPA-approved method(s) and Subsection B of Section 20.6.2.3107 NMAC. If a specialty laboratory or other laboratory is required, approval from NMED will be received prior to usage. Test America's Laboratory Quality Assurance Manual (QAM) and SOPs are included in Appendix C.

4.1 Screening Levels

NMED approved dilution attenuation factor (DAF) 1 and DAF 20 target parameters, analytical methods, reporting limits, and screening levels for soil samples are included in Tables 3 and 4, respectively (NMED 2019b).

Proposed groundwater sample target parameters, analytical methods, reporting limits, and screening levels are provided in Table 5. Because laboratory reporting limits (RLs) are the minimum level where a laboratory can provide an accurate concentration, it is proposed that RLs be used as the minimum level provided by the lab where the laboratory cannot achieve the water standard. Comparison of Eurofins TestAmerica's RLs to NMED Groundwater Standards [NMAC 20.6.2.3103.A.(1) and NMAC 20.6.2.3103.A.(2) & Table A-1], NMED Tapwater Screening Levels, and EPA Tapwater RSLs are

included in Table 5. RLs provided by EPA Method 8260B and EPA Method 8270C meet screening levels with the exception of 1,2,3-trichloropropane, 1,2-dibromo-3-chloropropane, 1,2-dibromomethane (EDB), and 1,3-butadiene. RLs provided for EPA Method 8270 SIM meet screening levels for all compounds. RLs provided for EPA Method 6020 and 7470A meet screening levels for all analytes.

4.2 Laboratory Instruments and Equipment

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated and maintained according to manufacturer specifications, and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

4.2.1 Maintenance

Maintenance schedules for laboratory equipment will adhere to the manufacturer's recommendations. Records will reflect the complete history of each instrument and specify the time frame for future maintenance. Major repairs or maintenance will be performed through service contracts with the manufacturer or qualified contractors. The laboratory will keep paperwork associated with service calls and preventive maintenance calls on file.

Laboratory Managers are responsible for the routine maintenance of instruments used in their particular laboratory. Any routine preventive maintenance carried out will be logged into the appropriate logbooks. The frequency of routine maintenance will be dictated by the nature of samples being analyzed, the requirements of the method used, the manufacturer's recommendations, and/or the judgment of the Laboratory Manager.

All major instruments are backed up by comparable (if not equivalent) instrument systems in the event of unscheduled downtime. An inventory of spare parts will be also available to minimize equipment/instrument downtime.

4.2.2 Calibration

Laboratory instruments will be calibrated according to manufacturer specifications, and calibration will be verified at a designated frequency as described in Section 8.4.5.

4.2.3 Records

Laboratory instrument and equipment documentation should include details of any observed problems, corrective measure(s), routine maintenance, and instrument repair (which will include information regarding the repair and the individual who performed the repair).

4.2.4 Equipment Monitoring

The operation of balances, incubators, ovens, refrigerators, and water purification systems will be checked and documented on a routine basis. Any discrepancies will be immediately reported to the appropriate laboratory personnel for resolution.

4.3 Laboratory Custody

Upon sample receipt, laboratory personnel will be responsible for sample custody. The original field chain-of-custody form will accompany all samples requiring laboratory analysis. The laboratory will follow chain-of-custody guidelines described in USEPA guidance documents. Samples will be kept secured in the laboratory until all stages of analysis are complete. All laboratory personnel having samples in their custody will be responsible for documenting and maintaining sample integrity.

4.4 Sample Receipt and Storage

Immediately upon sample receipt, the laboratory sample custodian will verify the cooler seal, open the cooler, and compare the contents against the field chain-of-custody form. The Arcadis Project Manager or Task Manager may request the laboratory to provide a sample confirmation e-mail once the contents are evaluated. If a sample container is missing, a sample container is received broken, the sample is in an inappropriate container, or the sample has not been preserved by appropriate means, Arcadis will be notified. The laboratory sample custodian will be responsible for logging the samples in, assigning a unique laboratory identification number to each sample, labeling the sample bottle with the laboratory identification number, and moving the sample to an appropriate storage location to await analysis. The project name, field sample ID, laboratory sample ID, date sampled, date received, analysis required, storage location and date, and action for final disposition will be recorded in the laboratory tracking system. Relevant custody documentation will be placed in the project file.

4.5 Sample Analysis

The analytical methods to be used during field sampling activities will generally be approved USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (USEPA 1996) with Level 2 reporting

deliverables. Analysis of an acceptable sample will be initiated by completion of worksheets that contain all pertinent information for analysis. The laboratory will organize samples into sample delivery groups (SDGs). An SDG may contain up to 20 field samples (field duplicates, trip blanks, equipment blanks, and field blanks are considered field samples for the purposes of SDG assignment). Every SDG must include a minimum of one site-specific matrix spike (MS)/matrix spike duplicate (MSD) pair, which will be received by the laboratory at the start of the SDG assignment as required by the applicable analytical method. If an MS/MSD sample is not collected for each SDG, then a non-site-specific MS/MSD pair will be analyzed with each SDG as required by the applicable analytical method.

4.6 Sample Storage Following Analysis

Samples will be maintained by the laboratory for at least 1 month after the final report is delivered to Arcadis. The laboratory will be responsible for the eventual and appropriate disposal of the samples. The laboratory will dispose of unused portions of the samples, sample extracts, and associated wastes in accordance with applicable rules and regulations as specified in their SOP for waste disposal.

4.7 Laboratory Data Documentation

4.7.1 Laboratory Project Files

The laboratory will establish a file for all pertinent data. The file will include all correspondence, faxed information, phone logs, chain-of-custody forms, and data packages. The laboratory will retain all project files for a period of 10 years.

4.7.2 Laboratory Logbooks

Workbooks, bench sheets, instrument logbooks, and instrument printouts will be used to trace the history of samples through the analytical process and document important aspects of the work, including the associated quality controls. As such, logbooks, bench sheets, instrument logs, and instrument printouts will be part of the permanent record of the laboratory.

Each page or entry will be dated and initialed by the analyst at the time of entry. Errors in entry will be crossed out in indelible ink with a single stroke, corrected without the use of white-out or by obliterating or writing directly over the erroneous entry, and initialed and dated by the individual making the correction. Pages or portions of logbooks that are not used will be completed by lining out unused portions, as applicable.

The analyst will record information regarding the sample, analytical procedures performed, and the results of the testing on laboratory forms or personal notebook pages. These notes will be dated and will also identify the analyst, the instrument used, and the instrument conditions. Laboratory group leaders will periodically review laboratory notebooks for accuracy, completeness, and compliance to this QAPP and laboratory QA guidance. All entries and calculations completed by the analyst(s) will be verified by the laboratory department Managers or Supervisors. If all entries on the pages are correct, then the data will be released for reporting. Corrective action will be taken for incorrect entries before the laboratory project manager signs.

4.7.3 Electronic and Hard Copy Storage

All electronic files and deliverables will be retained by the laboratory for not less than 10 years; hard copy data packages (or electronic copies) will also be retained for not less than 10 years.

5 INSPECTION AND ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

All supplies to be used in the field and laboratory will be free of target chemicals and interferences.

All laboratory reagents will be tested prior to use with Site samples. All standards will be verified against a second source standard. The laboratory will follow a “first in, first out” procedure for the storage and use of all consumables to minimize the risk of contamination and degradation. The various supplies and consumables required on site will be described in the task-specific plans and associated SOPs.

6 DATA ACQUISITION REQUIREMENTS FOR NON-DIRECT (HISTORICAL) MEASUREMENTS

If historical data will be used in a risk assessment or to demonstrate compliance, the historical datasets will be reviewed according to the procedures identified in this section to determine the appropriate uses of such data. The extent to which these data can be validated will be determined by the analytical level and QC data available. The evaluation of historical data requires the following:

- Identification of analytical levels
- Evaluation of QC data, when available
- Development of conclusions regarding the acceptability of the data for intended uses
- Verification of the accuracy of the results compared to the analytical reports.

Acceptability of historical data for intended uses will be determined by application of these procedures and professional judgment. If the historical data quality cannot be determined, its use will be limited to general trend evaluations. If non-direct (historical) data are deemed to be of acceptable quality, they may be added to appropriate database tables.

7 SAMPLE AND DATA MANAGEMENT

The purpose of data management is to ensure that all of the necessary data are accurate and readily accessible to meet the analytical and reporting objectives of the project. The field investigations may encompass a large number of samples and analytes from multiple locations over a long period of time. Due to the large amount of resulting data, the need arises for a structured, comprehensive, and efficient program for data management.

The data management program established for the project includes field documentation and sample QA/QC procedures, methods for tracking and managing the data, and a system for filing all Site-related information. More specifically, data management procedures will be employed to efficiently process the information collected such that the data are readily accessible and accurate.

The data management has five elements:

- The sample designation system described in Section 3.4.3
- Data collection activities described in Sections 3 and 4
- Sample tracking and management described in Section 7.1
- The data management system described in Section 7.2
- Data analysis and reporting described in Section 7.3.

7.1 Sample Tracking and Management

A record of all field documentation will be maintained to ensure the validity of data used in the Site analysis. To effectively execute such documentation, specific sample tracking and data management procedures will be used throughout the project.

Sample tracking will begin with the completion of chain-of-custody forms as previously summarized. The Task Manager will compare completed chain-of-custody forms to the sample list included in the task-specific plan to ensure that all samples were collected, and all analyses were requested. Copies of all completed chain-of-custody forms will be maintained in the project file. The laboratory will verify and communicate receipt of the samples electronically (via email) within 24 hours. If the samples are delivered

by Arcadis to the laboratory, the Task Manager will be notified by the Arcadis staff. The Task Manager will compare the laboratory sample receipt summary against the chain-of-custody forms to ensure that all samples IDs, analyses, variations, and instructions were property entered by the laboratory.

When analytical data are received from the laboratory, the QAC, Data Validator, and/or Task Manager will review the incoming analytical data packages against the information on the chain-of-custody forms and in the task-specific plan to confirm that the correct analyses were performed for each sample and that results for all samples submitted for analysis were received. Any discrepancies (e.g., missed holding times) noted will be promptly followed up by the QAC, Data Validator, and/or Task Manager.

7.2 Data Management System

In addition to the sample tracking and management system, a data management system will be implemented. A project database for the Site, to be maintained by the Database Administrator, will combine pertinent geographical, field, and analytical data. Information used to populate the database will be derived from three primary sources: surveying of sampling locations, field observations, and analytical results. Each of these sources is discussed in the following sections.

7.2.1 Survey Data

In general, each location sampled as part of the investigation will be surveyed to ensure accurate documentation of sample locations for mapping and geographic information system (GIS) purposes (if appropriate), to facilitate the re-sampling of select sample locations during future investigative activities, if needed, and for any potential remediation activities. Survey data will be collected by a New Mexico-licensed surveyor. The survey crew will use their own field logs and will supply the sampling location coordinates and coordinate system to Arcadis. Survey of vertical coordinates (including measuring point elevations or critical infrastructure) will be accurate to 0.01 foot and horizontal coordinates will be within 1 foot. All field logs associated with the surveying activities will be stored as a record of the project activities.

7.2.2 Field Data

An important part of the information that will ultimately reside in the data management system for use during the project will originate from measurements recorded in the field.

The Task Manager will review field data for accuracy and for consistency. Concerns identified as a result of this review will be discussed with the field personnel, corrected if possible, and (as necessary)

incorporated into the data evaluation process. The original field logs, documents, and data reductions will be kept in the project files.

Numerical data generated during field sampling activities (such as field parameter readings or depth to groundwater measurements) or calculated data (such as groundwater elevations) will be manually entered into a spreadsheet, subjected to 100% review against the field notes for accuracy and completeness, and used to populate the appropriate database tables. After entry into the database, database tables will undergo 100% completeness review and 20% correctness review against the field forms to ensure that data were uploaded correctly.

7.2.3 Laboratory Data

All laboratory analytical data will be reported electronically in EDDs and PDFs of lab reports. Laboratory reports will include documentation required to complete data verification and validation. The individual EDDs supplied by the laboratory will be in either an American Standard Code for Information Interchange (ASCII), comma-separated value (CSV) format, or in a Microsoft Excel worksheet. The format of the EDD will be specified when the bottle order is submitted.

The data packages will be examined to ensure that the correct analyses were performed for each sample submitted and that all of the analyses requested on the chain-of-custody form were performed. Each data package will be validated in accordance with the procedures in Section 11. If discrepancies are noted, the QAC, Data Validator, and/or Task Manager will be notified and will promptly follow up with the laboratory to resolve any issues.

EDDs will be loaded into the appropriate database table. Analytical data that cannot be provided by the laboratory in electronic format will be entered manually. Hand-keyed data, including flags, will be reviewed for completeness and accuracy. After entry into the database, the EDD data will be compared to the field information previously entered into the database to confirm that all requested analytical data were received and that the database is accurate and complete.

EDDs should include any applicable laboratory data qualifiers, which will be loaded into the database with the analytical results. Following data verification and validation (DV), in accordance with the procedures presented in Section 11, data validation qualifier codes will be entered into the database and reviewed for completeness and accuracy.

A minimum of 20% review will be conducted of all analytical data imported into the database from EDDs to verify correctness and 100% review will be conducted to verify completeness. Completeness will be checked by verifying all samples and lab methods are accounted for and using sample and analyte/result counts. Analytical data manually entered into the database will require 100% correctness and completeness verification of all key parameters. Reviews of correctness and completeness will be documented in the project file.

At a minimum, the database tables will include the following:

- Sample identification number
- Date sampled
- Date analyzed
- Parameter name
- Analytical result
- Units
- Reporting limit
- Method detection limit
- Qualifier(s).

7.3 Data Analysis and Reporting

The database management system will have several functions to facilitate the review, analysis, and reporting of the data. Data entry forms will be developed to assist in the keypunching of field observations.

8 QUALITY CONTROL REQUIREMENTS

8.1 Quality Assurance Indicators

The overall quality assurance objective is to develop and implement procedures for sampling, chain of custody, instrument calibration, laboratory analysis, data reduction and reporting, internal quality control, audits, preventive maintenance, and corrective action, such that valid data will be generated. These procedures are presented or referenced in the following subsections of the QAPP.

Quality assurance indicators are generally defined in terms of the following six parameters:

- Representativeness

- Comparability
- Completeness
- Precision
- Accuracy
- Sensitivity.

Each parameter is defined below. Specific objectives for the Three Saints Road Release Site actions are set forth in other sections of this QAPP or will be provided in task-specific plans.

8.1.1 Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent Site conditions and is dependent on sampling and analytical variability and the variability of environmental media at the Site. Field sampling activities will be designed to assess the presence of the chemical constituents at the time of sampling. This QAPP presents field sampling and laboratory analytical methodologies. The use of the prescribed field and laboratory analytical methods with associated holding times and preservation requirements are intended to provide representative data.

8.1.2 Comparability

Comparability is the degree of confidence with which one dataset can be compared to another. Comparability among field sampling events will be maintained through consistent sampling and analytical methodologies set forth in this QAPP and the task-specific plans.

8.1.3 Completeness

Completeness is a measure of the amount of valid data obtained from a field sampling event compared to the total amount obtained. This will be determined upon final assessment of the analytical results.

Completeness is also a measure of the amount of data collected compared to the amount of data intended to be collected as described in the task-specific plan. This will be determined upon completion of the field sampling activities.

8.1.4 Precision

Precision is the measure of reproducibility of sample results. The goal is to maintain a level of analytical precision consistent with the project objectives. Checks for analytical precision will include the analysis of laboratory control sample duplicates (LCSDs), MSDs, and field duplicates.

8.1.5 Accuracy

Accuracy is the deviation of a measurement from the true value of a known standard. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, internal standards, laboratory control samples (LCSs), MSs, blank spikes, and surrogates (system monitoring compounds) will be used to assess the accuracy of the laboratory analytical data.

8.1.6 Sensitivity

Sensitivity is the ability of the instrument or method to detect target analytes at the levels of interest. The method reporting limits and the performance criteria for relevant analytical methods will be provided in the task-specific plans. However, the reporting limits may vary depending on matrices and other factors (e.g., dilutions).

8.2 Data Usability

Validation results will determine whether data can be used. Following data validation (DV), the data will be flagged as discussed in Section 11.3 as appropriate, and any use restrictions will be noted. Task-specific plans will be devised so that the loss of any single data point will not hinder description of the distribution of potential COCs.

8.3 Field Quality Control Checks

The following sections detail the required quality control procedures to be followed in the field.

8.3.1 Field Measurements

To verify the quality of data collected using field instrumentation, duplicate measurements may be obtained and reported for some field measurements. The specific field measurements that require duplication and the frequency of duplication will depend on the specific field sampling activities and will be detailed in the associated task-specific plans.

8.3.2 Sample Containers

The laboratory will supply certified-clean sample containers. The specific sample container types, materials, volumes, and preservatives will be detailed in the task-specific plans.

8.3.3 Field Duplicate Samples

A field duplicate sample is a second sample collected at the same location as the primary (original) sample (to replicate the primary). Duplicate samples are collected simultaneously or in immediate succession using identical collection techniques, and are treated in an identical manner during storage, transportation, and analysis. Field duplicate samples will be collected to verify the reproducibility of the sampling methods. In general, field duplicate samples will be collected at a 10% frequency (one duplicate for every 10 samples), and field duplicate samples will be analyzed for the same constituents requested for the primary sample.

8.3.4 Equipment Blank Samples

Equipment blank samples are used to monitor the cleanliness of the sampling equipment and the effectiveness of the cleaning procedures. Equipment blank samples will be prepared and submitted for analysis at a 5% frequency (one equipment blank for every 20 samples). The equipment blank sample will be analyzed for the same constituents requested for the primary samples. Equipment blank samples will be prepared by filling sample containers with analyte-free water that has been routed through a cleaned sampling device. When dedicated sampling devices or sample containers are used to collect the samples, equipment blanks will not be necessary.

8.3.5 Trip Blank Samples

Trip blank samples will be used to assess whether Site samples have been exposed to non-site-related volatile constituents during storage and transport or if the potential for cross-contamination among collected samples exists. Trip blank samples are prepared by the laboratory using analyte-free water and are stored and transported in the same manner as the samples being collected. The trip blank will be kept with the samples at all times and will be analyzed at a frequency of one per cooler (for water and soil samples) containing samples to be analyzed for VOCs. Trip blank samples are only analyzed for VOCs.

8.4 Analytical Laboratory Quality Control Checks

Internal laboratory quality control checks will be used to monitor data integrity. These checks may include, but are not limited to, method blanks, MS/MSD samples, surrogate spikes, laboratory duplicates, calibration standards, internal standards, LCSs, and LCSDs. Laboratory control charts will be used to identify long-term instrument trends. The specific laboratory quality control checks employed will depend on the sample matrix and analytical method. The specific quality control checks to be used and the limits for each check are method-dependent and will be provided in the associated task-specific plans.

8.4.1 Method Blanks

Sources of contamination in the analytical process, whether specific analyses or interferences, need to be identified, isolated, and corrected. The method blank is useful in identifying possible sources of contamination within the analytical process. For this reason, it is necessary that the method blank is initiated at the beginning of the analytical process and encompasses all aspects of the analytical work. As such, the method blank would assist in accounting for any potential contamination attributable to glassware, reagents, instrumentation, or other sources which could affect sample analysis. In general, one method blank will be analyzed with each SDG associated with no more than 20 samples.

8.4.2 Matrix Spike/Matrix Spike Duplicate

MS/MSDs will be used to measure the accuracy and precision of analyte recovery from the sample matrices and will be site-specific. MS/MSD pairs will be analyzed at a 5% frequency (one MS/MSD for every 20 samples).

If an SDG does not have a site-specific MS/MSD sample associated, the laboratory may use another MS/MSD source for this QA/QC purpose.

When MS/MSD recoveries are outside quality control limits, associated control sample and surrogate spike recoveries will be evaluated, as applicable, to attempt to verify the reason for the deviation and determine the effect on the reported sample results.

8.4.3 Surrogate Spikes

Surrogates are compounds that are unlikely to occur under natural conditions that have properties similar to the analytes of interest. Surrogate spike compounds are selected using the guidance provided in the analytical methods. This type of control is primarily used for organic samples analyzed by gas chromatography/mass spectrometry (GC/MS) and GC methods, and is added to the samples prior to purging or extraction. The surrogate spike is used to provide broader insight into the proficiency and efficiency of an analytical method on a sample-specific basis. This control reflects analytical conditions that may not be attributable to sample matrix.

If surrogate spike recoveries do not meet the specified quality control limits, the analytical results need to be evaluated thoroughly in conjunction with other control measures. In the absence of other control measures, the integrity of the data may not be verifiable, and reanalysis of the samples with additional control may be necessary.

8.4.4 Laboratory Duplicates

For inorganics, laboratory duplicates will be analyzed to assess laboratory precision. Laboratory duplicates are defined as a separate aliquot of an individual sample that is analyzed as a separate sample.

8.4.5 Calibration Standards

Calibration check standards analyzed within a particular analytical series provide insight regarding the instruments' stability. A calibration check standard will be analyzed at the beginning and end of an analytical series, or periodically throughout a series containing a large number of samples.

In general, calibration check standards will be analyzed every 12 hours, or more frequently, as specified in the applicable analytical method. For analyses where internal standards are used, a calibration check standard will only be analyzed at the beginning of an analytical series. If results of the calibration check standard exceed specified tolerances, then all samples analyzed since the last acceptable calibration check standard will be reanalyzed.

8.4.6 Internal Standards

Internal standard areas and retention times will be monitored for organic analyses performed by GC/MS methods. Method-specified internal standard compounds will be spiked into all field samples, calibration standards, and quality control samples after preparation and prior to analysis. If internal standard areas in one or more samples exceed the specified tolerances, the cause will be investigated, the instrument will be recalibrated if necessary, and all affected samples may be reanalyzed. The acceptability of internal standard performance will be determined using the guidance provided within the analytical methods.

8.4.7 Laboratory Control Sample/Laboratory Control Sample Duplicate

LCS/LCSDs are prepared reference standards of known concentration and independent in origin from the calibration standards. The intent of the LCS/LCSD analysis is to provide insight into the analytical proficiency within an analytical series. This includes validity of calibration, sample preparation, instrument setup, and the premises inherent in quantitation. LCS/LCSDs will be analyzed at the frequencies specified within the analytical methods.

8.5 Data Precision Assessment Procedures

Field precision is difficult to measure because of physical (heterogeneities) and temporal variations in field measurement parameters. However, precision will be controlled through the employment of

experienced field personnel, properly calibrated meters, and duplicate field measurements. Field duplicate samples will be used to assess precision for the entire measurement system including sampling, handling, shipping, storage, preparation, and analysis.

Laboratory data precision for analyses will be monitored through the use of MS/MSDs, laboratory duplicates, and LCS/LCSDs.

The precision of data will be measured by calculation of the relative percent difference (RPD) using the following equation:

$$RPD = \frac{|C_1 - C_2|}{\left(\frac{C_1 + C_2}{2}\right)} \times 100\%$$

Where:

C_1 = Analytical result from the primary sample

C_2 = Analytical result from the duplicate sample

Precision objectives for MSDs, LCSDs, and field duplicates are method-dependent and will be provided in the associated task-specific plans.

8.6 Data Accuracy Assessment Procedures

The accuracy of field measurements will be controlled by experienced field personnel, properly calibrated field meters, and adherence to established protocols. The accuracy of field meters will be assessed by review of calibration and maintenance logs.

Laboratory accuracy will be assessed via the use of MSs, LCSs, surrogate spikes, internal standards, and reference standards. Accuracy will be calculated in terms of percent recovery as follows:

$$\%\,Recovery = \frac{(X_S - X_U)}{B} \times 100\%$$

Where:

X_S = Value measured in spiked sample or standard

X_U = Value measured in original sample

B = True value of amount added to sample or true value of standard

This formula is derived under the assumption of constant accuracy over the original and spiked measurements. If any accuracy calculated by this formula is outside of the acceptable levels, data will be

evaluated to determine whether the deviation represents unacceptable accuracy or variable but acceptable accuracy. Accuracy objectives for MS, LCS, and surrogate recovery objectives are method-dependent and will be provided in the associated task-specific plans.

8.7 Data Completeness Assessment Procedures

Completeness of a field or laboratory dataset will be calculated by comparing the number of valid sample results generated to the total number of results generated using the following equation.

$$Completeness = \frac{Number\ of\ Valid\ Results}{Total\ Number\ of\ Results\ Generated} \times 100\%$$

As a general guideline, overall project completeness is expected to be at least 90%. The assessment of completeness will require professional judgment to determine data usability for intended purposes.

9 ASSESSMENT AND RESPONSE ACTIONS

9.1 Field Performance

The appropriate Task Manager will monitor field performance to verify that activities are performed according to established protocols. The Arcadis QAC or Data Validator will review field reports and communicate concerns to the Arcadis Project Manager and/or Task Managers, as appropriate. In addition, the Arcadis QAC or Data Validator will review the equipment blank, field blank, and trip blank data to identify potential deficiencies in field sampling and cleaning procedures. In addition, reviews comparing scheduled QA/QC activities from this document with actual QA/QC activities completed will be performed. The appropriate Task Manager and QAC will periodically confirm that work is being performed consistent with this QAPP, the task-specific plans, and the HASP.

9.2 Laboratory Audits

As deemed necessary by the Project Manager, Client, the laboratory, or regulatory agency, the laboratory QA Manager or Project Manager will conduct internal laboratory audits. As part of the audit, the overall performance of the laboratory staff is evaluated and compared to the performance criteria outlined in the laboratory quality assurance manual and SOPs. The results of the audits are summarized and issued to each department supervisor, the Laboratory Manager, and the Laboratory Director. The laboratory QA Manager also performs a systems audit of each laboratory to determine if the procedures implemented by each laboratory are in compliance with the quality assurance manual and SOPs.

In addition to the laboratory's internal audits, as participants in state and federal certification programs, representatives of the regulatory agency issuing certification also audit the laboratory. Audits are usually conducted annually and focus on laboratory conformance to the specific program protocols for which the laboratory is seeking certification. The auditor reviews sample handling and tracking documentation, analytical methodologies, analytical supportive documentation, and final reports. The audit findings are formally documented and submitted to the laboratory for corrective action, if necessary.

Arcadis reserves the right to conduct an on-site audit of the laboratory prior to the start of analyses for the project. Additional audits may be performed during the course of the project, as deemed necessary.

9.3 Corrective Action

Corrective actions are required when field or analytical data are not within the objectives specified in this QAPP or the task-specific plans. Corrective actions include procedures to promptly investigate, document, evaluate, and correct data collection and/or analytical procedures. Field and laboratory corrective action procedures for the actions are described below.

9.3.1 Field Procedures

When conducting the field work, if the field crew notes a condition that would have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition, as deemed necessary by the Project Manager. Condition identification, cause, and corrective action implemented by the field personnel will be documented on a Corrective Action Form (Appendix D) and reported to the appropriate Arcadis Task Manager, QAC, and/or Project Manager.

Examples of situations that would require corrective actions include:

- Protocols as defined by the QAPP and task-specific plans have not been followed.
- Equipment is not in proper working order or is not properly calibrated.
- Sample and test results are not completely traceable.
- QC requirements have not been met.
- Issues resulting from performance have not been resolved.

9.3.2 Laboratory Procedures

In the laboratory, when a condition is noted to have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause, and corrective action taken will be documented and reported to the appropriate Project Manager and QAC.

Corrective action may be initiated, at a minimum, under the following conditions:

- Specific laboratory analytical protocols have not been followed.
- Protocols as defined by this QAPP have not been followed.
- Predetermined data acceptance standards are not attained.
- Equipment is not in proper working order or calibrated.
- Sample and test results are not completely traceable.
- QC requirements have not been met.
- Issues resulting from performance or systems audits have not been resolved.

Corrective action is initiated at a point where the problem has been identified. At whatever level this occurs (analyst, supervisor, data review, or quality control), it is brought to the attention of the laboratory QAC and, ultimately, the Laboratory Director. Final approval of any action deemed necessary is at the discretion of the Laboratory Director.

Any corrective action deemed necessary based on system or performance audits or the results of data review will be implemented. The corrective action may include sample re-extraction, re-preparation, re-analysis, cleanup, dilutions, matrix modifications, equipment maintenance, or other activities.

10 REPORTS TO MANAGEMENT

The frequency and distribution of reports describing project status and outcomes will be detailed in the task-specific plans and are not repeated in this QAPP.

11 DATA REDUCTION AND REVIEW

After field and laboratory data are obtained, the data will be subject to the following in accordance with the applicable task-specific plan:

- Reduction, or manipulation mathematically, or otherwise into meaningful and useful documents
- Review
- Organization, interpretation, and reporting
- Data validation.

11.1 Field Data Reduction and Review

Information collected in the field through visual observation, manual measurement, and/or field instrumentation will be recorded in the field logs as specified in Section 3.3 and the task-specific plans.

The appropriate Task Manager will review such data for adherence to the task-specific plans and this QAPP and for consistency. Concerns identified as a result of this review will be discussed with the field personnel, corrected if possible, and, as necessary, incorporated into the data evaluation process.

Field logs will be checked for:

- General completeness
- Readability
- Usage of appropriate procedures
- Appropriate instrument calibration and maintenance
- Reasonableness in comparison to present and past data collected
- Correct sample locations
- Correct calculations and interpretations.

11.2 Laboratory Data Reduction and Review

The calculations used for data reduction will be specified in the relevant analytical method. Whenever possible, analytical data will be transferred directly from the instrument to a computerized data system. The data entered must be sufficient to document all factors used to arrive at the reported value.

Calculation procedures are method-dependent and will be provided in laboratory SOPs included in task-specific plans.

Data will be subject to multi-level review by the laboratory. The Department Manager or senior peer analyst will review all raw data prior to release for final data report generation. The laboratory report generation department will review the final data reports prior to shipment to Arcadis. The laboratory will qualify the data in accordance with the USEPA laboratory qualifier codes.

11.3 Data Verification and Validation

Data verification and validation (DV) of data collected at the Site will be addressed with a standard level evaluation, referred to as Tier II, which will be performed on data collected during field sampling activities using Level 2 Reporting.

All data generated for H&S, compliance investigation, and engineering design/control purposes will be subjected to the DV procedures outlined here. Data generated for waste disposal or verification purposes will be reviewed by the laboratory in accordance with their internal procedures.

DV entails a review of the quality control data to verify that the laboratory was operating within required limits; and which, if any, environmental samples were related to any out-of-control quality control samples. The objective of DV is to identify any questionable or invalid laboratory measurements.

DV also includes a review of the analytical results for field quality control samples, such as field duplicate, equipment blank, field blank, and trip blank samples. The RPD between the field duplicate sample and the associated primary sample is calculated. Detections of analytes in the equipment blank, field blank, and trip blank samples are reviewed to determine if any issues exist with the source water, cleaning procedures, or storage and transport.

The Data Validator will be a qualified Arcadis validator, he/she will validate all data generated, and he/she will produce a data review report using the most recent versions of the USEPA's Functional Guidelines for Data Review and previous versions (USEPA 1999, 2004), which directly apply to SW-846 analytical methodology. These procedures and criteria may be modified as necessary to address project-specific and method-specific criteria, control limits, and procedures. DV will consist of data screening, checking, reviewing, editing, and interpretation to document analytical data quality and to determine whether the quality is sufficient to meet the DQOs outlined in the task-specific plans.

The Data Validator will verify that reduction of laboratory measurements and laboratory reporting of analytical parameters is in accordance with the procedures specified for each analytical method and/or as specified in this QAPP and any task-specific plans. Any deviations from the analytical method, or any special reporting requirements apart from that specified in this QAPP, will be detailed on chain-of-custody forms.

Upon receipt of laboratory data, the following procedures will be executed by the Data Validator:

- Evaluate completeness of data package.
- Verify that field chain-of-custody forms were completed and that samples were handled properly.
- Verify that holding times were met for each parameter. Holding time exceedances, should they occur, will be documented. Data for all samples exceeding holding time requirements will be flagged as either estimated or rejected. The decision as to which qualifier is more appropriate will be made on a case-by-case basis.
- Verify that parameters were analyzed according to the methods specified.

- Review QA/QC data (i.e., make sure duplicates, blanks, and spikes were analyzed on the required number of samples, as specified in the method; verify that duplicate and MS recoveries are acceptable).
- Investigate anomalies identified during review. When anomalies are identified, they will be discussed with the Laboratory Project Manager and/or Laboratory Manager, as appropriate.
- If data appear suspect, investigate the specific data of concern.

Deficiencies discovered as a result of the data review, as well as the corrective actions implemented in response, will be documented and submitted in the form of a written report addressing the following topics as applicable to each method:

- Assessment of the data package
- Description of any protocol deviations
- Failures to reconcile reported and/or raw data
- Assessment of any compromised data
- Overall appraisal of the analytical data
- Table of Sample ID, Lab ID, matrix, sample collection date, parent sample (if the sample is a duplicate), and analyses performed.

Data that do not meet specified QA/QC standards will be flagged pending resolution of the issue. The flag will not be removed from the data until the issue associated with the sample results is resolved. The laboratory will qualify the data in accordance with the USEPA qualifier codes. The Data Validator will flag the data in accordance with National Functional Guidelines using the DV qualifier codes. DV codes will be maintained in the project database associated with the individual data to which they apply.

It should be noted that qualified results do not necessarily invalidate data. The goal to produce the best possible data does not necessarily mean that data must be produced without QC qualifiers. Qualified data can provide useful information. The exception is the rejected flag “R”, which indicates that the associated value is unusable. In other words, due to significant QC problems, the analysis is invalid and provides no reliable information as to whether the compound is present or not. Rejected values should not appear on data tables because they cannot be relied upon, even as a last resort.

It should also be noted that no compound concentration, even if it has passed all QC tests, is guaranteed to be accurate. Strict QC increases confidence in data, but any value potentially contains error.

Resolution of any issues regarding laboratory performance or deliverables will be handled between the laboratory and the Data Validator and/or Task Manager. The Data Validator and/or Task Manager may suggest reanalysis at this point.

Data validation reports will be kept in the project files.

11.4 Reconciliation with User Requirements

The data results will be examined to determine the performance that was achieved for each data usability criterion. The performance will then be compared with the project objectives and DQOs. Deviations from objectives will be noted. Additional action may be warranted when performance does not meet performance objectives for critical data. Options for corrective action relating to incomplete information, questionable results, or inconsistent data may include any or all of the following:

- Retrieval of missing information
- Request for additional explanation or clarification
- Reanalysis of sample from extract (when appropriate)
- Recalculation or reinterpretation of results by the laboratory or field staff.

These actions may improve the data quality, reduce uncertainty, and may eliminate the need to qualify or reject data.

If these actions do not improve the data quality to an acceptable level, the following additional actions may be taken:

- Extrapolation of missing data from existing data points
- Use of historical data
- Evaluation of the critical/non-critical nature of the sample.

If the data gap cannot be resolved by these actions, an evaluation of the data bias and potential for false negatives and positives can be performed. If the resultant uncertainty level is unacceptable, additional sample collection and analysis may be required.

12 REFERENCES

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NMED. 2019b. RE: Approval of Resubmittal of Revised Response to Conditional Approval, Santa Fe Pacific Pipeline (SFPP) Fuel Spill, Anthony, New Mexico, Dated June 13, 2019 Which Proposes to Use Laboratory Reporting Limits When Laboratory Cannot Attain New Mexico DAF 1 Soil Screening Levels. June 17.

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TABLES

Table 1
Key Personnel
Kinder Morgan, Inc.
3 Saints Release Site
Anthony, New Mexico

Company/Organization	Title	Name	Email	Phone Number
Project Management				
NMED	Project Manager	Dezbah Jesus	dezbah.jesus@state.nm.us	505 222 9555
Kinder Morgan	Remediation Manager	Scott Martin	scott_martin@kindermorgan.com	713 420 2832
Arcadis	Principal in Charge	Ned Overs	ned.overs@arcadis.com	602 763 6009
	Project Manager	Bob Forsberg	bob.forsberg@arcadis.com	480 535 7399
	Quality Assurance Coordinator	Lyndi Mott	lyndi.mott@arcadis.com	713 953 4829
Test America Laboratories	Project Manager	Carlene McCutchen	Carlene.McCutcheon@testamericainc.com	602 659 7612
	Quality Assurance Manager	TBD	-	-
Task Management				
Arcadis	Task Manager	Dakota Draper	dakota.draper@arcadis.com	915 747 3911
	Health and Safety Coordinator	Dakota Draper	dakota.draper@arcadis.com	915 747 3911
	Database Administrator	Jake Marzec	jacob.marzec@arcadis.com	718 397 2352
	Data Validator	Dennis Dyke	dennis.dyke@arcadis.com	510 596 9669
	Field Personnel	varies	-	-

Notes:
NMED = New Mexico Environment Department

Table 2
Groundwater Sampling Data Quality Objectives
Kinder Morgan, Inc.
3 Saints Release Site
Anthony, New Mexico

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
State the Problem	**Identify the Goal**	**Identify Inputs to the Decisions**	**Define the Study Boundary**	**Develop Decision Rules**	**Specify Tolerable Limits on Errors**	**Optimize Sampling Design**
The 3 Saints Release Site (Site) is located near 4220 3 Saints Road in Anthony, New Mexico. On December 13, 2018 at 11:41 pm Mountain Standard Time, the SFPP's El Paso Breakout, Deming 12- inch pipeline automatically shut down as a result of gasoline discharge due to a pipeline leak where the pipeline crosses the Anthony Drain. UVOST® and grab groundwater sample investigations were conducted to assess subsurface and groundwater impacts from the release. Based on the sampling results, additional characterization is needed to better define the lateral extent of groundwater impacts outside of the Anthony Drain area.	Evaluate the groundwater conditions offsite.	Permanent monitor wells around the Site analyzed for VOCs, PAHs, TPH, and 1,4-dioxane. Low laboratory reporting limits (RLs) sufficient to compare concentrations to screening criteria.	The study boundaries include the Site. Groundwater samples will be collected from the regional aquifer (approximately 15 feet bgs).	If concentrations of VOCs, PAHs, TPH, and 1,4-dioxane in groundwater are detected above NMED approved laboratory RLs, then the results will be compared to applicable regulatory standards and additional investigation of groundwater impacts may be warranted. If concentrations of VOCs, PAHs, TPH, and 1,4-dioxane in groundwater are not detected above NMED approved laboratory RLs, then additional investigation of groundwater impacts may not be warranted.	Sampling error and measurement error are associated with environmental data collection and may lead to decision errors. Sampling error occurs when the sample is not representative of the true condition of the environment at the site. Measurement error occurs because of random and systematic errors associated with sample collection, handling, preparation, analysis, data reduction, and data handling. Decision errors are controlled by adopting a scientific approach that uses hypothesis testing to minimize the potential for error. There are two types of decision error: false negative error and false positive error. A false negative decision error occurs when the null hypothesis is rejected, although it is true. The consequences of a false negative error would be that contaminated media that pose an unacceptable risk to potential human or ecological receptors at the site are not addressed. A false positive decision error occurs when the null hypothesis is not rejected, although it is false. The consequences of a false positive error are that unnecessary resources are expended on further action to address contaminated media that did not exist at levels that would exceed action levels or acceptable risk levels. Tolerable limits on sampling decision errors cannot be precisely defined; however, the decision errors will be minimized by evaluating the potential source area. For this investigation, sampling locations are in the suspected potential source area. Decision errors based on analytical data will be minimized by the use of USEPA-approved analytical methods.	Sixteen monitor well borings will be drilled along the perimeter of the Anthony Drain between the Kilgore Lateral to the north and 4220 3 Saints Road to the south to evaluate the lateral extent of potential groundwater impacts. A nested monitor well will be drilled near the Kilgore Lateral crossing to evaluate groundwater conditions at multiple depths. Groundwater sampling will be conduct quarterly. All groundwater samples will be submitted to Test America Laboratory for analysis for VOCs, PAHs, TPH, and 1,4-dioxane. Therefore, all samples are located in areas that will yield representative data that are necessary to make sound decisions and recommendations. Groundwater samples will be collected using standard methodology and equipment. The analytical methods selected for groundwater samples can detect potential contaminants of concern at concentrations above most screening level guidance. Analytical methods chosen are all USEPA approved and are commonly implemented. Sample collection methods and analytical methods are discussed in the Groundwater Monitor Well Work Plan and QAPP.

Notes:

· USEPA = U.S. Environmental Protection Agency
· VOC = volatile organic compounds
· PAH = Polyaromatic Hydrocarbons
· TPH = total petroleum hydrocarbons
· bgs = below ground surface
· RL = Reporting Limits
· QAPP = Quality Assurance Project Plan

Table 3
NMED Approved Soil Screening Levels When DAF 1 Soil Screening Levels Are Required
Kinder Morgan, Inc.
3 Saints Release
Anthony, New Mexico

Constituent Type	Method	Constituent	CAS Number	DAF 1 Screening Level (mg/kg)	Test America RL (mg/kg)	NMED Approved Screening Level When DAF 1 SSLs are Required (mg/kg)[1]	Notes
Volatile Organic Compounds	8260B	1,1,1,2-Tetrachloroethane	630-20-6	0.0018	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,1,1-Trichloroethane	71-55-6	2.55	0.005	2.55	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	1,1,2,2-Tetrachloroethane	79-34-5	0.00024	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,1,2-Trichloroethane	79-00-5	0.000111	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,1,2-Trichlorotrifluoroethane	76-13-1	160	N/A	N/A	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	1,1-Dichloroethane	75-34-3	0.0068	0.005	0.0068	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	1,1-Dichloroethene	75-35-4	0.0974	0.005	0.0974	NMED Risk-based SSL, DAF 1*
Volatile Organic Compounds	8260B	1,2,3-Trichlorobenzene	87-61-6	0.0021	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,2,3-Trichloropropane	96-18-4	0.00000291	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,2,3-Trimethylbenzene	526-73-8	0.0808	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	1,2,4-Trichlorobenzene	120-82-1	0.00882	0.005	0.00882	NMED Risk-based SSL, DAF 1*
Volatile Organic Compounds	8260B	1,2,4-Trimethylbenzene	95-63-6	0.0081	0.005	0.0081	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	1,2-Dibromo-3-Chloropropane	96-12-8	0.00000116	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,2-Dibromoethane (EDB)	106-93-4	0.0000176	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,2-Dichlorobenzene	95-50-1	0.229	0.005	0.229	NMED Risk-based SSL, DAF 1*
Volatile Organic Compounds	8260B	1,2-Dichloroethane	107-06-2	0.000407	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,2-Dichloropropane	78-87-5	0.00121	0.005	0.005	Test America RL
Volatile Organic Compounds	8260B	1,3,5-Trimethylbenzene	108-67-8	0.0087	0.005	0.0087	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	1,3-Butadiene	106-99-0	0.000104	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,3-Dichloropropane	142-28-9	0.0013	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,3-Dichloropropene	542-75-6	0.0017	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	1,4-Dichlorobenzene	106-46-7	0.0036	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,4-Dioxane	123-91-1	0.000814	***0.1***	NA	Use EPA Method 8260B SIM Analysis
Volatile Organic Compounds	8260B	2-Butanone	78-93-3	1.0	0.01	1.0	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	2-Chloro-1,3-butadiene	126-99-8	0.0000983	N/A	N/A	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	2-Chlorotoluene	95-49-8	0.023	0.005	0.023	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	2-Hexanone	591-78-6	0.00875	***0.01***	0.01	Test America RL
Volatile Organic Compounds	8260B	2-Nitropropane	79-46-9	0.00000545	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	4-Chlorotoluene	106-43-4	0.178	0.005	0.178	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	4-Methyl-2-Pentanone (MIBK)	108-10-1	0.24	0.01	0.24	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Acetone	67-64-1	2.49	0.05	2.49	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Acetonitrile	75-05-8	0.262	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Acrolein	107-02-8	0.00000729	N/A	N/A	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Acrylonitrile	107-13-1	0.0000977	N/A	N/A	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Allyl chloride	107-05-1	0.00234	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Benzene	71-43-2	0.0019	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	Benzyl chloride	100-44-7	0.000976	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Bromobenzene	108-86-1	0.0042	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	Bromochloromethane	74-97-5	0.0208	0.005	0.0208	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Bromodichloromethane	75-27-4	0.00031	***0.005***	0.005	Test America RL

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Kinder Morgan, Inc.
3 Saints Release
Anthony, New Mexico

Constituent Type	Method	Constituent	CAS Number	DAF 1 Screening Level (mg/kg)	Test America RL (mg/kg)	NMED Approved Screening Level When DAF 1 SSLs are Required (mg/kg)[1]	Notes
Volatile Organic Compounds	8260B	Bromofluorobenzene	460-00-4	0.00443	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Bromoform	75-25-2	0.00734	0.005	0.00734	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Bromomethane	74-83-9	0.00171	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	Carbon disulfide	75-15-0	0.221	0.005	0.221	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Carbon tetrachloride	56-23-5	0.00167	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	Chlorobenzene	108-90-7	0.0418	0.005	0.0418	NMED Risk-based SSL, DAF 1*
Volatile Organic Compounds	8260B	Chloroethane	75-00-3	5.37	0.005	5.37	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Chloroform	67-66-3	0.000546	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	Chloromethane	74-87-3	0.00476	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	cis-1,2-Dichloroethene	156-59-2	0.00918	0.005	0.00918	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	cis-1,4-Dichloro-2-butene	1476-11-5	0.00000622	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Cyclohexane	110-82-7	13	0.01	13	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Cyclohexanone	108-94-1	0.034	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Cyclohexene	110-83-8	0.0458	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Dibromochloromethane	124-48-1	0.000377	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	Dibromomethane	74-95-3	0.00168	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	Dichlorodifluoromethane	75-71-8	0.361	0.005	0.361	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Di-Isopropyl Ehter	108-20-3	0.372	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Ethyl acetate	141-78-6	0.0264	N/A	N/A	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Ethyl ether	60-29-7	0.76	N/A	N/A	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Ethyl methacrylate	97-63-2	0.0915	N/A	N/A	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Ethylbenzene	100-41-4	0.0132	0.005	0.0132	NMED Risk-based SSL, DAF 1*
Volatile Organic Compounds	8260B	Hexachlorobutadiene	87-68-3	0.00207	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	Hexane	110-54-3	2.78	0.005	2.78	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Isobutyl alcohol	78-83-1	1.05	N/A	N/A	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Isopropyl Alcohol	67-63-0	0.0838	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Isopropylbenzene	98-82-8	0.569	0.005	0.569	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	m,p-Xylenes	179601-23-1	N/A	0.01	0.01	--
Volatile Organic Compounds	8260B	Methacrylonitrile	126-98-7	0.000371	N/A	N/A	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Methyl acetate	79-20-9	3.55	N/A	N/A	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Methyl methacrylate	80-62-6	0.261	N/A	N/A	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Methyl Tert-Butyl Ether	1634-04-4	0.0277	0.005	0.0277	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Methylcyclohexane	108-87-2	15.8	N/A	N/A	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Methylene Chloride	75-09-2	0.0235	***0.025***	0.025	Test America RL
Volatile Organic Compounds	8260B	Naphthalene	91-20-3	0.00411	***0.01***	0.01	Test America RL
Volatile Organic Compounds	8260B	n-Butyl alcohol	71-36-3	0.407	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	n-Butylbenzene	104-51-8	3.23	0.005	3.23	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	n-Propylbenzene	103-65-1	0.12	0.005	0.12	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	o-Xylene	95-47-6	0.149	0.005	0.149	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Pentachloroethane	76-01-7	0.0031	N/A	N/A	USEPA Risk-based SSL

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Constituent Type	Method	Constituent	CAS Number	DAF 1 Screening Level (mg/kg)	Test America RL (mg/kg)	NMED Approved Screening Level When DAF 1 SSLs are Required (mg/kg)[1]	Notes
Volatile Organic Compounds	8260B	sec-Butylbenzene	135-98-8	5.87	0.005	5.87	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Styrene	100-42-5	1.03	0.005	1.03	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	tert-Butylbenzene	98-06-6	1.55	0.005	1.55	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Tetrachloroethene	127-18-4	0.016	0.005	0.016	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Tetrahydrofuran	109-99-9	0.075	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Toluene	108-88-3	0.607	0.005	0.607	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	trans-1,2-Dichloroethene	156-60-5	0.0235	0.005	0.0235	NMED Risk-based SSL, DAF 1*
Volatile Organic Compounds	8260B	trans-1,4-Dichloro-2-butene	110-57-6	0.00000622	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Trichloroethene	79-01-6	0.000804	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	Trichlorofluoromethane	75-69-4	0.784	0.005	0.784	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Vinyl acetate	108-05-4	0.0752	0.01	0.0752	NMED Risk-based SSL, DAF 1
Volatile Organic Compounds	8260B	Vinyl chloride	75-01-4	0.000108	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	Xylenes, Total	1330-20-7	0.149	0.01	0.149	NMED Risk-based SSL, DAF 1*
Volatile Organic Compounds	8260B-SIM	1,4-Dioxane	123-91-1	0.000814	***0.005***	0.005	Test America RL
Semi-Volatile Organic Compounds	8270-SIM	1-Methylnaphthalene	90-12-0	0.0447	***0.17***	0.17	Test America RL
Semi-Volatile Organic Compounds	8270-SIM	2-Methylnaphthalene	91-57-6	0.138	***0.17***	0.17	Test America RL
Semi-Volatile Organic Compounds	8270-SIM	Acenaphthene	83-32-9	4.12	0.17	4.12	NMED Risk-based SSL, DAF 1
Semi-Volatile Organic Compounds	8270-SIM	Anthracene	120-12-7	42.5	0.17	42.5	NMED Risk-based SSL, DAF 1
Semi-Volatile Organic Compounds	8270-SIM	Benzo[a]anthracene	56-55-3	0.0318	***0.17***	0.17	Test America RL
Semi-Volatile Organic Compounds	8270-SIM	Benzo[a]pyrene	50-32-8	0.221	0.17	0.221	NMED Risk-based SSL, DAF 1
Semi-Volatile Organic Compounds	8270-SIM	Benzo[b]fluoranthene	205-99-2	0.309	0.17	0.309	NMED Risk-based SSL, DAF 1
Semi-Volatile Organic Compounds	8270-SIM	Benzo[k]fluoranthene	207-08-9	3.02	0.17	3.02	NMED Risk-based SSL, DAF 1
Semi-Volatile Organic Compounds	8270-SIM	Chrysene	218-01-9	9.3	0.17	9.3	NMED Risk-based SSL, DAF 1
Semi-Volatile Organic Compounds	8270-SIM	Dibenz(a,h)anthracene	53-70-3	0.0984	***0.17***	0.17	Test America RL
Semi-Volatile Organic Compounds	8270-SIM	Fluoranthene	206-44-0	66.9	0.17	66.9	NMED Risk-based SSL, DAF 1
Semi-Volatile Organic Compounds	8270-SIM	Fluorene	86-73-7	4	0.17	4	NMED Risk-based SSL, DAF 1
Semi-Volatile Organic Compounds	8270-SIM	Indeno[1,2,3-cd]pyrene	193-39-5	1	0.17	1	NMED Risk-based SSL, DAF 1
Semi-Volatile Organic Compounds	8270-SIM	Naphthalene	91-20-3	0.00411	***0.17***	NA	Use EPA Method 8260B Analysis
Semi-Volatile Organic Compounds	8270-SIM	Phenanthrene	85-01-8	4.3	0.17	4.3	NMED Risk-based SSL, DAF 1
Semi-Volatile Organic Compounds	8270-SIM	Pyrene	129-00-0	9.59	0.17	9.59	NMED Risk-based SSL, DAF 1
Metals	6010B	Arsenic	7440-38-2	0.025	***2.0***	2.0	Test America RL
Metals	6010B	Barium	7440-39-3	135	1.0	135	NMED Risk-based SSL, DAF 1
Metals	6010B	Cadmium	7440-43-9	0.469	***0.5***	0.5	Test America RL
Metals	6010B	Chromium	7440-47-3	10300	1.0	10300	NMED Risk-based SSL, DAF 1*
Metals	6010B	Lead	7439-92-1	13.5	***0.5***	0.5	Test America RL
Metals	6010B	Selenium	7782-49-2	0.511	***1.0***	1.0	Test America RL
Metals	6010B	Silver	7440-22-4	0.688	0.5	0.688	NMED Risk-based SSL, DAF 1
Metals	6020	Uranium	7440-61-1	26.7	0.25	26.7	NMED Risk-based SSL, DAF 1
Metals	7471A	Mercury	7439-97-6	0.0327	***0.2***	0.2	Test America RL

Table 3
NMED Approved Soil Screening Levels When DAF 1 Soil Screening Levels Are Required
Kinder Morgan, Inc.
3 Saints Release
Anthony, New Mexico

Constituent Type	Method	Constituent	CAS Number	DAF 1 Screening Level (mg/kg)	Test America RL (mg/kg)	NMED Approved Screening Level When DAF 1 SSLs are Required (mg/kg)[1]	Notes

Notes:
1. NMED letter Approval of *Resubmittal of Revised Response to Conditional Approval, Santa Fe Pacific Pipeline (SFPP) Fuel Spill, Anthony, New Mexico* , Dated June 13, 2019 Which Proposes to Use Laboratory Reporting Limits When Laboratory Cannot Attain New Mexico DAF 1 Soil Screening Levels
* NMED Risk-based SSL, DAF 1 is less than NMED NMGW- or MCL-based SSL, DAF1
· mg/kg = milligram per kilogram

Legend

- Lab method detection meets NMED and/or EPA screening levels
- Lab method detection exceeds NMED and/or EPA screening levels
- Laboratory analytical data unavailable

Table 4
NMED Approved Soil Screening Levels When DAF 20 Soil Screening Levels Are Required
Kinder Morgan, Inc.
3 Saints Release
Anthony, New Mexico

Constituent Type	Method	Constituent	CAS Number	DAF 20 Screenig Level (mg/kg)	Test America RL (mg/kg)	NMED Approved Screening Level When DAF 20 SSLs are Required (mg/kg)[1]	Notes
Volatile Organic Compounds	8260B	1,1,1,2-Tetrachloroethane	630-20-6	0.036	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	1,1,1-Trichloroethane	71-55-6	51	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	1,1,2,2-Tetrachloroethane	79-34-5	0.0048	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,1,2-Trichloroethane	79-00-5	0.00222	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,1,2-Trichlorotrifluoroethane	76-13-1	3200	N/A	N/A	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	1,1-Dichloroethane	75-34-3	0.136	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	1,1-Dichloroethene	75-35-4	1.948	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	1,2,3-Trichlorobenzene	87-61-6	0.042	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	1,2,3-Trichloropropane	96-18-4	0.0000582	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,2,3-Trimethylbenzene	526-73-8	1.616	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	1,2,4-Trichlorobenzene	120-82-1	0.1764	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	1,2,4-Trimethylbenzene	95-63-6	0.162	0.005	0.005	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	1,2-Dibromo-3-Chloropropane	96-12-8	0.0000232	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,2-Dibromoethane (EDB)	106-93-4	0.000352	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,2-Dichlorobenzene	95-50-1	4.58	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	1,2-Dichloroethane	107-06-2	0.00814	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	1,2-Dichloropropane	78-87-5	0.0242	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	1,3,5-Trimethylbenzene	108-67-8	0.174	0.005	0.005	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	1,3-Butadiene	106-99-0	0.00208	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	1,3-Dichloropropane	142-28-9	0.026	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	1,3-Dichloropropene	542-75-6	0.034	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	1,4-Dichlorobenzene	106-46-7	0.072	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	1,4-Dioxane	123-91-1	0.01628	***0.1***	0.1	Use EPA Method 8260B SIM Analysis
Volatile Organic Compounds	8260B	2-Butanone	78-93-3	20	0.01	0.01	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	2-Chloro-1,3-butadiene	126-99-8	0.001966	N/A	N/A	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	2-Chlorotoluene	95-49-8	0.46	0.005	0.005	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	2-Hexanone	591-78-6	0.175	***0.01***	0.01	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	2-Nitropropane	79-46-9	0.000109	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	4-Chlorotoluene	106-43-4	3.56	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	4-Methyl-2-Pentanone (MIBK)	108-10-1	4.8	0.01	0.01	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Acetone	67-64-1	49.8	0.05	0.05	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Acetonitrile	75-05-8	5.24	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Acrolein	107-02-8	0.0001458	N/A	N/A	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Acrylonitrile	107-13-1	0.001954	N/A	N/A	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Allyl chloride	107-05-1	0.0468	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Benzene	71-43-2	0.038	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Benzyl chloride	100-44-7	0.01952	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Bromobenzene	108-86-1	0.084	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Bromochloromethane	74-97-5	0.416	0.005	0.005	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Bromodichloromethane	75-27-4	0.0062	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Bromofluorobenzene	460-00-4	0.0886	N/A	N/A	USEPA Risk-based SSL

Table 4
NMED Approved Soil Screening Levels When DAF 20 Soil Screening Levels Are Required
Kinder Morgan, Inc.
3 Saints Release
Anthony, New Mexico

Constituent Type	Method	Constituent	CAS Number	DAF 20 Screenig Level (mg/kg)	Test America RL (mg/kg)	NMED Approved Screening Level When DAF 20 SSLs are Required (mg/kg)[1]	Notes
Volatile Organic Compounds	8260B	Bromoform	75-25-2	0.1468	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Bromomethane	74-83-9	0.0342	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Carbon disulfide	75-15-0	4.42	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Carbon tetrachloride	56-23-5	0.0334	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Chlorobenzene	108-90-7	0.836	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Chloroethane	75-00-3	107.4	0.005	0.005	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Chloroform	67-66-3	0.01092	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Chloromethane	74-87-3	0.0952	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	cis-1,2-Dichloroethene	156-59-2	0.1836	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	cis-1,4-Dichloro-2-butene	1476-11-5	0.0001244	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Cyclohexane	110-82-7	260	0.01	0.01	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Cyclohexanone	108-94-1	0.68	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Cyclohexene	110-83-8	0.916	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Dibromochloromethane	124-48-1	0.00754	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Dibromomethane	74-95-3	0.0336	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Dichlorodifluoromethane	75-71-8	7.22	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Di-Isopropyl Ehter	108-20-3	7.44	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Ethyl acetate	141-78-6	0.528	N/A	N/A	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Ethyl ether	60-29-7	15.2	N/A	N/A	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Ethyl methacrylate	97-63-2	1.83	N/A	N/A	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Ethylbenzene	100-41-4	0.264	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Hexachlorobutadiene	87-68-3	0.0414	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Hexane	110-54-3	55.6	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Isobutyl alcohol	78-83-1	21	N/A	N/A	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Isopropyl Alcohol	67-63-0	1.676	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Isopropylbenzene	98-82-8	11.38	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	m,p-Xylenes	179601-23-1	N/A	0.01	0.01	--
Volatile Organic Compounds	8260B	Methacrylonitrile	126-98-7	0.00742	N/A	N/A	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Methyl acetate	79-20-9	71	N/A	N/A	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Methyl methacrylate	80-62-6	5.22	N/A	N/A	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Methyl Tert-Butyl Ether	1634-04-4	0.554	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Methylcyclohexane	108-87-2	316	N/A	N/A	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Methylene Chloride	75-09-2	0.47	***0.025***	0.025	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Naphthalene	91-20-3	0.0822	***0.01***	0.01	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	n-Butyl alcohol	71-36-3	8.14	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	n-Butylbenzene	104-51-8	64.6	0.005	0.005	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	n-Propylbenzene	103-65-1	2.4	0.005	0.005	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	o-Xylene	95-47-6	2.98	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Pentachloroethane	76-01-7	0.062	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	sec-Butylbenzene	135-98-8	117.4	0.005	0.005	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Styrene	100-42-5	20.6	0.005	0.005	NMED Risk-based SSL, DAF 20

Table 4
NMED Approved Soil Screening Levels When DAF 20 Soil Screening Levels Are Required
Kinder Morgan, Inc.
3 Saints Release
Anthony, New Mexico

Constituent Type	Method	Constituent	CAS Number	DAF 20 Screenig Level (mg/kg)	Test America RL (mg/kg)	NMED Approved Screening Level When DAF 20 SSLs are Required (mg/kg)[1]	Notes
Volatile Organic Compounds	8260B	tert-Butylbenzene	98-06-6	31	0.005	0.005	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Tetrachloroethene	127-18-4	0.32	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Tetrahydrofuran	109-99-9	1.5	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Toluene	108-88-3	12.14	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	trans-1,2-Dichloroethene	156-60-5	0.47	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	trans-1,4-Dichloro-2-butene	110-57-6	0.0001244	N/A	N/A	USEPA Risk-based SSL
Volatile Organic Compounds	8260B	Trichloroethene	79-01-6	0.01608	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Trichlorofluoromethane	75-69-4	15.68	0.005	0.005	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Vinyl acetate	108-05-4	1.504	0.01	0.01	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B	Vinyl chloride	75-01-4	0.00216	***0.005***	0.005	Test America RL
Volatile Organic Compounds	8260B	Xylenes, Total	1330-20-7	2.98	0.01	0.01	NMED Risk-based SSL, DAF 20
Volatile Organic Compounds	8260B-SIM	1,4-Dioxane	123-91-1	0.01628	***0.005***	0.005	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	1-Methylnaphthalene	90-12-0	0.894	***0.17***	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	2-Methylnaphthalene	91-57-6	2.76	***0.17***	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Acenaphthene	83-32-9	82.4	0.17	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Anthracene	120-12-7	850	0.17	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Benzo[a]anthracene	56-55-3	0.636	***0.17***	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Benzo[a]pyrene	50-32-8	4.42	0.17	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Benzo[b]fluoranthene	205-99-2	6.18	0.17	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Benzo[k]fluoranthene	207-08-9	60.4	0.17	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Chrysene	218-01-9	186	0.17	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Dibenz(a,h)anthracene	53-70-3	1.968	***0.17***	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Fluoranthene	206-44-0	1338	0.17	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Fluorene	86-73-7	80	0.17	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Indeno[1,2,3-cd]pyrene	193-39-5	20	0.17	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Naphthalene	91-20-3	0.0822	***0.17***	0.17	Use EPA Method 8260B Analysis
Semi-Volatile Organic Compounds	8270-SIM	Phenanthrene	85-01-8	86	0.17	0.17	NMED Risk-based SSL, DAF 20
Semi-Volatile Organic Compounds	8270-SIM	Pyrene	129-00-0	191.8	0.17	0.17	NMED Risk-based SSL, DAF 20
Metals	6010B	Arsenic	7440-38-2	0.5	***2.0***	2.0	Test America RL
Metals	6010B	Barium	7440-39-3	2700	1.0	1.0	NMED Risk-based SSL, DAF 20
Metals	6010B	Cadmium	7440-43-9	9.38	***0.5***	0.5	NMED Risk-based SSL, DAF 20
Metals	6010B	Chromium	7440-47-3	206000	1.0	1.0	NMED Risk-based SSL, DAF 20
Metals	6010B	Lead	7439-92-1	270	***0.5***	0.5	Test America RL
Metals	6010B	Selenium	7782-49-2	10.22	***1.0***	1.0	NMED Risk-based SSL, DAF 20
Metals	6010B	Silver	7440-22-4	13.76	0.5	0.5	NMED Risk-based SSL, DAF 20
Metals	6020	Uranium	7440-61-1	534	0.25	0.25	NMED Risk-based SSL, DAF 20
Metals	7471A	Mercury	7439-97-6	0.654	***0.2***	0.2	NMED Risk-based SSL, DAF 20

Table 4
NMED Approved Soil Screening Levels When DAF 20 Soil Screening Levels Are Required
Kinder Morgan, Inc.
3 Saints Release
Anthony, New Mexico

Constituent Type	Method	Constituent	CAS Number	DAF 20 Screenig Level (mg/kg)	Test America RL (mg/kg)	NMED Approved Screening Level When DAF 20 SSLs are Required (mg/kg)[1]	Notes

Notes:
1. NMED letter Approval of *Resubmittal of Revised Response to Conditional Approval, Santa Fe Pacific Pipeline (SFPP) Fuel Spill, Anthony, New Mexico* , Dated June 13, 2019 Which Proposes to Use Laboratory Reporting Limits When Laboratory Cannot Attain New Mexico DAF 1 Soil Screening Levels
· mg/kg = milligram per kilogram

Legend

- Lab method detection meets NMED and/or EPA screening levels
- Lab method detection exceeds NMED and/or EPA screening levels
- Laboratory analytical data unavailable

Table 5
Test America Water RL and MDL Comparison
Kinder Morgan, Inc.
3 Saints Release Site
Anthony, New Mexico

Constituent Type	Method	Constituent	CAS Number	Screening Level (µg/L)	Test America RL (µg/L)	Test America MDL (µg/L)	Reference
Volatile Organic Compounds	8260B	1,1,1,2-Tetrachloroethane	630-20-6	5.74	0.5	0.35	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	1,1,1-Trichloroethane	71-55-6	200	0.5	0.15	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	1,1,2,2-Tetrachloroethane	79-34-5	10	0.5	0.33	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	1,1,2-Trichloroethane	79-00-5	5	0.5	0.31	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	1,1,2-Trichlorotrifluoroethane	76-13-1	55000	N/A	N/A	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	1,1-Dichloroethane	75-34-3	25	0.5	0.14	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	1,1-Dichloroethene	75-35-4	7	0.5	0.23	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	1,2,3-Trichlorobenzene	87-61-6	7	1	0.45	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	1,2,3-Trichloropropane	96-18-4	0.00835	***2***	***0.78***	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	1,2,3-Trimethylbenzene	526-73-8	130	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	1,2,4-Trichlorobenzene	120-82-1	70	1	0.32	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	1,2,4-Trimethylbenzene	95-63-6	56	0.5	0.25	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	1,2-Dibromo-3-Chloropropane	96-12-8	0.00334	***5***	***0.82***	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	1,2-Dibromoethane (EDB)	106-93-4	0.05	***0.5***	***0.3***	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	1,2-Dichlorobenzene	95-50-1	600	0.5	0.22	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	1,2-Dichloroethane	107-06-2	5	0.5	0.31	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	1,2-Dichloropropane	78-87-5	5	0.5	0.23	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	1,3,5-Trimethylbenzene	108-67-8	60	0.5	0.21	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	1,3-Butadiene	106-99-0	0.181	***2***	***1.69***	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	1,3-Dichloropropane	142-28-9	370	0.5	0.23	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	1,3-Dichloropropene	542-75-6	4.71	N/A	N/A	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	1,4-Dichlorobenzene	106-46-7	75	0.5	0.17	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	1,4-Dioxane	123-91-1	4.59	N/A	N/A	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	2-Butanone	78-93-3	5560	5	2.22	NMED Tapwater Screen Level
Volatile Organic Compounds	8260B	2-Chloro-1,3-butadiene	126-99-8	0.187	N/A	N/A	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	2-Chlorotoluene	95-49-8	233	0.5	0.17	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	2-Hexanone	591-78-6	38	5	1.52	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	2-Nitropropane	79-46-9	0.0021	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	4-Chlorotoluene	106-43-4	250	0.5	0.2	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	4-Methyl-2-Pentanone (MIBK)	108-10-1	1240	2.5	1.32	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	Acetone	67-64-1	14100	10	7.31	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Acetonitrile	75-05-8	130	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Acrolein	107-02-8	0.0415	N/A	N/A	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	Acrylonitrile	107-13-1	0.523	N/A	N/A	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	Allyl chloride	107-05-1	0.73	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Benzene	71-43-2	5.0	0.5	0.12	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	Benzyl chloride	100-44-7	0.089	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Bromobenzene	108-86-1	62	0.5	0.14	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Bromochloromethane	74-97-5	83	0.5	0.27	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Bromodichloromethane	75-27-4	1.34	0.5	0.23	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	Bromofluorobenzene	460-00-4	4.6	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Bromoform	75-25-2	32.9	1	0.37	NMAC 20.6.2.3103.A.(2) & Table A-1

Table 5
Test America Water RL and MDL Comparison
Kinder Morgan, Inc.
3 Saints Release Site
Anthony, New Mexico

Constituent Type	Method	Constituent	CAS Number	Screening Level (µg/L)	Test America RL (µg/L)	Test America MDL (µg/L)	Reference
Volatile Organic Compounds	8260B	Bromomethane	74-83-9	7.54	1	0.67	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	Carbon disulfide	75-15-0	810	1	0.86	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Carbon tetrachloride	56-23-5	4.55	0.5	0.15	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	Chlorobenzene	108-90-7	78	0.5	0.17	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Chloroethane	75-00-3	21000	1	0.25	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Chloroform	67-66-3	100	0.5	0.13	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	Chloromethane	74-87-3	190	1	0.21	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	cis-1,2-Dichloroethene	156-59-2	70	0.5	0.21	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	cis-1,4-Dichloro-2-butene	1476-11-5	0.0013	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Cyclohexane	110-82-7	13000	10	10	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Cyclohexanone	108-94-1	14000	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Cyclohexene	110-83-8	70	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Dibromochloromethane	124-48-1	1.68	0.5	0.22	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Dibromomethane	74-95-3	8	0.5	0.26	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Dichlorodifluoromethane	75-71-8	197	0.5	0.15	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	Di-Isopropyl Ehter	108-20-3	1500	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Ethyl acetate	141-78-6	145	N/A	N/A	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Ethyl ether	60-29-7	3900	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Ethyl methacrylate	97-63-2	455	N/A	N/A	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Ethylbenzene	100-41-4	700	0.5	0.32	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	Hexachlorobutadiene	87-68-3	1.39	1	0.28	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	Hexane	110-54-3	319	2.0	1.64	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Isobutyl alcohol	78-83-1	5910	N/A	N/A	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Isopropyl Alcohol	67-63-0	410	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Cumene (Isopropylbenzene)	98-82-8	447	0.5	0.26	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	m,p-Xylene	179601-23-1	193	1.0	0.44	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Methacrylonitrile	126-98-7	1.91	N/A	N/A	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Methyl acetate	79-20-9	19900	N/A	N/A	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Methyl methacrylate	80-62-6	1390	N/A	N/A	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Methyl Tert-Butyl Ether	1634-04-4	143	0.5	0.22	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	Methylcyclohexane	108-87-2	6260	10	10	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Methylene Chloride	75-09-2	11	1	0.67	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Naphthalene	91-20-3	30	2.5	0.51	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	n-Butyl alcohol	71-36-3	2000	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	n-Butylbenzene	104-51-8	1000	0.5	0.21	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	n-Propylbenzene	103-65-1	660	0.5	0.21	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	o-Xylene	95-47-6	193	0.5	0.42	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	Pentachloroethane	76-01-7	0.65	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	p-Xylene	106-42-3	193	N/A	N/A	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	sec-Butylbenzene	135-98-8	2000	0.5	0.23	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Styrene	100-42-5	100	0.5	0.17	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	tert-Butylbenzene	98-06-6	690	0.5	0.25	USEPA Tapwaer RSL

Table 5
Test America Water RL and MDL Comparison
Kinder Morgan, Inc.
3 Saints Release Site
Anthony, New Mexico

Constituent Type	Method	Constituent	CAS Number	Screening Level (µg/L)	Test America RL (µg/L)	Test America MDL (µg/L)	Reference
Volatile Organic Compounds	8260B	Tetrachloroethene	127-18-4	5	0.5	0.18	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	Tetrahydrofuran	109-99-9	3400	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Toluene	108-88-3	1000	0.5	0.28	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	trans-1,2-Dichloroethene	156-60-5	100	0.5	0.29	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	trans-1,4-Dichloro-2-butene	110-57-6	0.0013	N/A	N/A	USEPA Tapwater RSL
Volatile Organic Compounds	8260B	Trichloroethene	79-01-6	5	0.5	0.24	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	Trichlorofluoromethane	75-69-4	1140	0.5	0.15	NMAC 20.6.2.3103.A.(2) & Table A-1
Volatile Organic Compounds	8260B	Vinyl acetate	108-05-4	409	2	0.81	NMED Tapwater Screening Level
Volatile Organic Compounds	8260B	Vinyl chloride	75-01-4	2	0.5	0.18	NMAC 20.6.2.3103.A.(1)
Volatile Organic Compounds	8260B	Xylenes, Total	1330-20-7	620	1.5	0.86	NMAC 20.6.2.3103.A.(1)
Semi-Volatile Organic Compounds	8270C	1,4-Dioxane	123-91-1	4.59	1.0	0.42	NMAC 20.6.2.3103.A.(2) & Table A-1
Semi-Volatile Organic Compounds	8270-SIM	1-Methylnaphthalene	90-12-0	30	0.1	0.05	NMAC 20.6.2.3103.A.(1)
Semi-Volatile Organic Compounds	8270-SIM	2-Methylnaphthalene	91-57-6	30	0.1	0.05	NMAC 20.6.2.3103.A.(1)
Semi-Volatile Organic Compounds	8270-SIM	Acenaphthene	83-32-9	535	0.05	0.026	NMED Tapwater Screening Level
Semi-Volatile Organic Compounds	8270-SIM	Anthracene	120-12-7	1720	0.05	0.022	NMAC 20.6.2.3103.A.(2) & Table A-1
Semi-Volatile Organic Compounds	8270-SIM	Benzo[a]anthracene	56-55-3	0.12	0.05	0.021	NMED Tapwater Screening Level
Semi-Volatile Organic Compounds	8270-SIM	Benzo[a]pyrene	50-32-8	0.2	0.05	0.02	NMAC 20.6.2.3103.A.(1)
Semi-Volatile Organic Compounds	8270-SIM	Benzo[b]fluoranthene	205-99-2	0.343	0.05	0.022	NMAC 20.6.2.3103.A.(2) & Table A-1
Semi-Volatile Organic Compounds	8270-SIM	Benzo[k]fluoranthene	207-08-9	3.43	0.05	0.022	NMAC 20.6.2.3103.A.(2) & Table A-1
Semi-Volatile Organic Compounds	8270-SIM	Chrysene	218-01-9	34.3	0.05	0.02	NMED Tapwater Screening Level
Semi-Volatile Organic Compounds	8270-SIM	Dibenz(a,h)anthracene	53-70-3	0.0343	0.05	0.028	NMED Tapwater Screening Level
Semi-Volatile Organic Compounds	8270-SIM	Dibenzofuran	132-64-9	7.9	0.05	0.24	USEPA Tapwater RSL
Semi-Volatile Organic Compounds	8270-SIM	Fluoranthene	206-44-0	802	0.05	0.027	NMAC 20.6.2.3103.A.(2) & Table A-1
Semi-Volatile Organic Compounds	8270-SIM	Fluorene	86-73-7	288	0.05	0.028	NMAC 20.6.2.3103.A.(2) & Table A-1
Semi-Volatile Organic Compounds	8270-SIM	Indeno[1,2,3-cd]pyrene	193-39-5	0.343	0.05	0.026	NMED Tapwater Screening Level
Semi-Volatile Organic Compounds	8270-SIM	Naphthalene	91-20-3	30	0.1	0.05	NMAC 20.6.2.3103.A.(1)
Semi-Volatile Organic Compounds	8270-SIM	Phenanthrene	85-01-8	170	0.1	0.05	NMAC 20.6.2.3103.A.(2) & Table A-1
Semi-Volatile Organic Compounds	8270-SIM	Pyrene	129-00-0	117	0.05	0.025	NMAC 20.6.2.3103.A.(2) & Table A-1
Metals	6020	Arsenic	7440-38-2	10	1.0	0.5	NMAC 20.6.2.3103.A.(1)
Metals	6020	Barium	7440-39-3	2000	1.0	0.5	NMAC 20.6.2.3103.A.(1)
Metals	6020	Cadmium	7440-43-9	5	1.0	0.25	NMAC 20.6.2.3103.A.(1)
Metals	6020	Chromium	7440-47-3	50	2.0	0.5	NMAC 20.6.2.3103.A.(1)
Metals	6020	Lead	7439-92-1	15	1.0	0.5	NMAC 20.6.2.3103.A.(1)
Metals	6020	Selenium	7782-49-2	50	2.0	0.5	NMAC 20.6.2.3103.A.(1)
Metals	6020	Silver	7440-22-4	50	1.0	0.5	NMAC 20.6.2.3103.A.(1)
Metals	6020	Uranium	7440-61-1	30	1	0.5	NMAC 20.6.2.3103.A.(1)
Metals	7470A	Mercury	7439-97-6	2	0.2	0.1	NMAC 20.6.2.3103.A.(1)

Table 5
Test America Water RL and MDL Comparison
Kinder Morgan, Inc.
3 Saints Release Site
Anthony, New Mexico

Constituent Type	Method	Constituent	CAS Number	Screening Level (µg/L)	Test America RL (µg/L)	Test America MDL (µg/L)	Reference

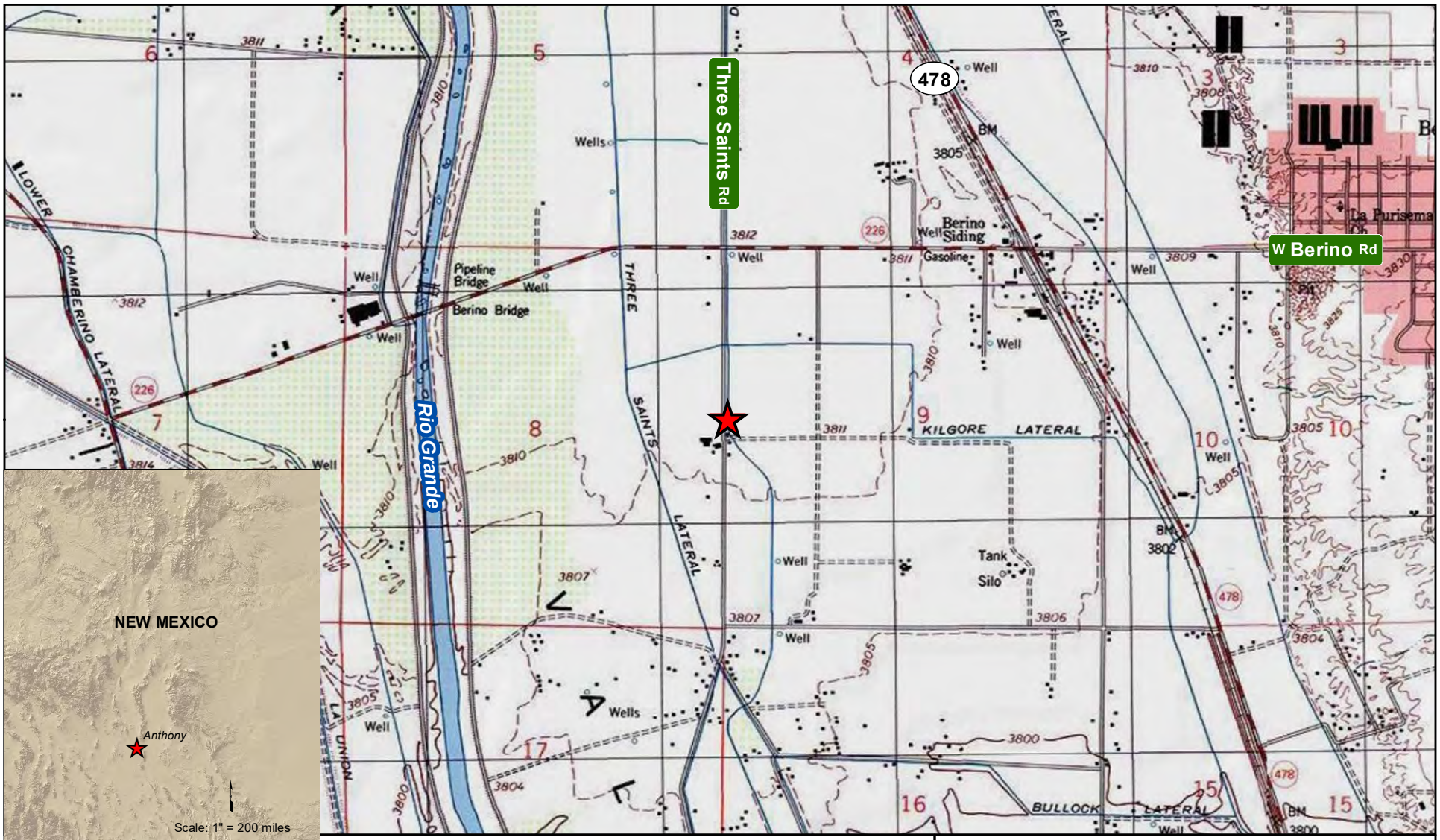
Notes:
· RL = reporting limit
· MDL = method detection limit
· µg/L = microgram per liter

Legend

- Lab method detection meets NMED and/or EPA screening levels
- Lab method detection exceeds NMED and/or EPA screening levels
- Laboratory analytical data unavailable

FIGURES

\\Scottsdale-AZ\Project\KMEP (Kinder Morgan Energy Partners)\3 Saints and Harding\GIS\Projects\Stage 1 abatement plan 11-2019\Figure 1 site vicinity.mxd 10/31/2019



LEGEND

Approximate site location

NOTES

· Topographic map source: ESRI USA Topo Maps.

N

Feet
0 1,000 2,000
Scale: 1" = 2,000'

3 SAINTS RELEASE SITE
ANTHONY, NEW MEXICO

SITE VICINITY

ARCADIS

FIGURE
1

APPENDIX A

Arcadis Quality Procedure: Field Activities Documentation

Arcadis ENV Quality Procedure	
TOPIC: FIELD ACTIVITIES DOCUMENTATION	
Revision Date: November 2016 Revision Letter: C	QP#: 3.06

STATEMENT OF POLICY:

It is Arcadis Environment Business Line (ENV) policy that field activities must be documented to facilitate the interpretation of data; show compliance with project plans, work plans, and contract terms; and to serve as evidentiary records. Documentation reflecting activities performed must be legible, organized, and complete. Applicable regulatory and client requirements should be considered when documenting field activities. Project-specific requirements for documentation typically should be described in the Work Plan, Field Sampling Plan (FSP), and/or in the Quality Assurance Project Plan (QAPP).

1. Purpose

The purpose of this Quality Procedure (QP) is to provide a standard procedure for the documentation of fieldwork activities. This documentation pertains to site-related projects, but is not limited to the collection of samples, subsurface information, and oversight of construction activities. Field documentation must include, at a minimum, project title and number, date and times of activities, the identification of the employee performing the work, and the specifics of the work being performed.

2. Responsibilities

Certified Project Manager (CPM) – is responsible for the project-related administration of this QP.

Quality Consultant – is responsible for providing quality assurance and quality control guidance to the CPM in implementing this procedure. Note that for federal projects, there are specific requirements and qualifications for the QA Officer assigned to the project.

Project Team Members – who are assigned to document field activities, are responsible for compliance with this procedure.

3. Terms and Definitions

Field Sampling Plan (FSP) – A document that describes the procedures and protocols necessary to complete field sampling and data collection activities.

Work Plan – A document that describes proposed project activities.

Quality Assurance Project Plan (QAPP) – A document that prescribes the quality assurance/quality control (QA/QC) procedures to be followed. Uniform Federal Policy (UFP) QAPPs are now frequently required for environmental projects by most federal regulatory agencies. A UFP QAPP includes Worksheets used to document the entire project plan developed following the systematic planning process. For more details on the UFP QAPP see http://www.epa.gov/fedfac/documents/qualityassurance.htm. Note that if the project QAPP is written following the UFP format, it will also contain a description of the sampling rationale and sampling locations

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as well as QA/QC requirements. The UFP QAPP format is designed to capture the entire systematic planning process. If a UFP QAPP is written for a project, a separate FSP is generally not required unless specified by the particular client or contract.

Standard Operating Procedure (SOP) and Technical Guidance Instruction (TGI) – Documents that describe a procedure and or protocol necessary to conduct a specific activity.

4. Related Forms

Forms used for documenting field activities may be included as attachments to the FSP or the QAPP and may include the following examples:

- Chain-of-custody (COC) form
- Sample data log
- Field modification form
- Sample receipt form
- Corrective action form
- Field activity log
- Calibration log
- Analysis request and chain-of-custody record
- Daily quality control reports
- Purge log
- Soil boring log.

Examples of SOPs and TGIs with field forms and check-lists can be found in the Arcadis Procedure Library at: https://arcadiso365.sharepoint.com/TEAMS/US_envsoplibrary/SitePages/Home.aspx.

DESCRIPTION OF PROCEDURE:

1. General Requirements

1.1 Documentation Format

Documentation of field activities provides an accurate and comprehensive record of the work performed sufficient for a technical peer to reconstruct the day's activities and confirm that necessary client, regulatory, contract, and work plan requirements were met. General requirements include:

- Use of field books (preferably bound) as the primary source for information collection and recording. Field books should be dedicated to the project and appropriately labeled.
- Use of personal digital assistant (PDA) to document select field sampling and data collection activities using Arcadis' electronic data gathering system (EDGE); examples include subsurface data, well/piezometer

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installation, groundwater sampling, and water-level measurements. Use of PDAs with EDGE is optional but encouraged.

- Use of a Field Activity Log is suggested to formally document activities and events as a supplement to bound field books. The Field Activity Log can be a standard or project-specific form or a bound field book. Preprinted standard forms are available for many activities and should be used whenever possible. These forms will provide prompts and request additional information that may be useful and/or needed. Project-specific field forms may be generated or existing forms may be modified to meet specific project needs. Client-supplied forms may be substituted, as required.
- Appropriate header information is documented on the first page of notes for each day of fieldwork, including project title, project number, date, time, author, and relevant setting information such as weather conditions, topography, surface water conditions, observed site activities/uses, and other persons in field team. In addition, include on every page of notes the page number and date. Project-specific information depends on the nature of work being performed and should be discussed by the project team prior to commencing fieldwork. As appropriate, dedicated field logs/journals or forms should be used. When Field Activity Log Forms are used, information fields that are not applicable should be noted as such with the symbol "N/A" or other appropriate notation.
- Field documentation entries shall be made using indelible ink.
- Data entries shall be legible. A single line should be drawn through incorrect entries and the corrected entry written next to the original strikeout. Strikeouts are to be initialed and dated by the originator.
- Units of measurement shall be specified. The level of accuracy shall be indicated (e.g., observed estimate, quantified census from direct count, and electronic data collection).
- Field records are to be maintained in project files unless otherwise specified by a client or stipulated by a contract.
- Unless addressed specifically by a client or stipulated by a contract, site photographs should be taken to document the general setting and landscape as well as site-specific issues/resources of interest. Photo locations and the compass direction of view should be recorded in the notes with the photo number.

1.2 Documentation Entries

A chronology of field events should be recorded. General entry requirements include:

- Visitors to the site, including owner and regulatory agency representatives
- Summary of pertinent project communications with the client, regulators, or other site visitors during the fieldwork
- Other contractors or entities working on site
- A description of the day's field activities, generally in chronological sequence or in order of significance, using military time notation (e.g., 9:00 a.m. as 0900, and 5:00 p.m. as 1700)
- If applicable, calibration of measuring and test equipment and identification of the calibration standard(s) (use a Calibration Log, if available, with cross-reference entered into the field book)
- Field equipment identification, including information such as the type, manufacturer, model number, or other specific information

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- If applicable sampling activities are being performed, weather information such as temperature, wind speed and direction, precipitation, time of measurement, and units
- Documentation of safety meeting (e.g., tailgates and tailboards) topics and attendees
- Verification of subsurface utility clearance in accordance with ENV ivision policy
- Safety and/or monitoring equipment readings, including time of measurements and units
- If applicable, specific forms used for collection of data are referenced in the field notebook
- Subcontractor progress and/or problems encountered
- Changes in the scope of work
- Other unusual events.

2. Specific Requirements

2.1 Sample Collection

Sample collection data are documented in a bound field book, PDA, and/or on a Field Activity Log. Where both are being used, information contained in one is cross-referenced to the other. Entries such as the following examples should be consistent with the requirements in the project-specific Work Plan, FSP, and QAPP:

- Sample identification number, location taken, depth interval, sample media, sample preservative, collection time, and date
- Sample collection method and protocol
- Physical description of the sample (using a standard classification system for soil)
- If a composite sample, include the number, location(s), and depth(s) of grab samples incorporated in the composite
- Quality-related samples (e.g., field duplicates, trip blanks, equipment rinse, blanks matrix spikes, and matrix spike duplicates)
- Container description and sample volume
- Pertinent technical data, such as pH, conductivity, temperature, and head-space readings
- Pertinent technical comments
- Identification of personnel collecting the sample.

2.2 Sample Labeling

Sample labels must be prepared and attached to sample containers. Labels are either provided by the laboratory performing the analyses or are generated internally. Labels should be indelible and securely attached to the container. The information to be provided may include:

- Sample identification number
- Sample date, initials or name of who collected the sample, and collection time
- Physical description of the sample (e.g., water, solid, gas, or other physical medium)
- Analytical parameters and method(s)

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- Preservatives, if present
- Sample location and depth, if applicable
- Client.

Although this information is typically written out, it can also be recorded in an electronic tracking system if a bar code is used.

2.3 Analysis Request and Chain-of-Custody Record

A critical component of data collection is the documentation that the samples were obtained from specific locations and received by the laboratory or archive without alteration. Evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal or archive must be properly documented. Documentation will be accomplished through a COC record that documents each sample and identifies the individuals responsible for sample collection, shipment, and receipt. A sample is considered in custody if at least one of the following criteria is met:

- The sample is in a person's actual possession
- The sample is in unobstructed view, after being in the person's actual possession
- The sample is locked and only accessible by the custodian after having been in the person's actual possession
- The sample is in a secured area, restricted to authorized personnel (e.g., laboratory).

An example COC form to be used by ENV personnel in collecting and shipping samples can be found on the corporate Intranet. A laboratory typically will not accept samples for analysis without a correctly prepared COC form. The COC must be signed by each individual who has the sample in his/her custody. Each sample shipped to a laboratory for analyses must be documented on the COC. Information on this form correlates with other supporting documentation, including the field log book, sample labels, and sample collection logs.

The COC documents the elapsed time and the custodians of the sample from the time of its collection. The individuals who have physically handled the sample(s) or witnessed initial sample collection and packaging (sample team member) must be identified on the form. A sample team member relinquishes the sample by signing the COC. Individuals who either relinquish or receive samples must include their complete names, company affiliation, and the date and time the sample(s) were relinquished. The times that the samples are relinquished and received by the next custodian should coincide, with the exception of transfer by commercial carriers. These carriers will not be required to sign the COC.

If a sample is to be stored for a period of time (e.g., overnight), measures are taken to secure the sample container in a manner that only provides access to the custodian of record. If samples are relinquished to a commercial carrier (i.e., UPS or Federal Express), the carrier waybill number is recorded, and a copy of the waybill is attached to the COC. These documents are maintained with other field documentation. The original COC is sealed inside a zip-top plastic bag and placed inside the shipping container with the samples.

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If corrections are made to the COC, the corrections should be made (single line through the error, initial, and date) by the originator of the change, and, if necessary, an explanation of the change should be provided. The documentation should be of a level of detail that clearly documents the change to a third-party reviewer.

Guidance for choosing a laboratory and completing analyses requests and COC can be found in QP 2.09-Subcontracting Laboratory Services and on the corporate Intranet for the Arcadis Laboratory Program (ALP) and should also be described in the project-specific planning documents (i.e., Work Plan, FSP. or QAPP).

2.4 Subsurface Logs

Test pits, soil borings, monitoring wells or rock coreholes wells, and piezometer installations are to be recorded in bound field books or PDA and may be supplemented with prepared forms. Personnel completing the log are to supply the following information:

- Administrative and technical information included in the header.
- Types of equipment used (e.g., drill rig type, drilling tools used [including diameter and length], or backhoe model).
- Subcontractor/driller used.
- Descriptions of subsurface materials encountered and the number and type of samples collected, if any.
- Subsurface exploration depth and units of measure.
- For drilling, length of recovery.
- Sample type and sample number for geotechnical or analytical samples collected. These data are to be also entered on the sample collection log (if used) and the sample label.
- Classification standard protocol used, if any (e.g., ASTM International Standard Penetration Test).
- Narrative description of the soil, sediment, or bedrock (using standard classification system) and other pertinent information.
- Additional data, such as background and sample vapor/gas readings, observation of sheens, non-aqueous-phase liquid, depth to water (if encountered), presence of (but generally not description of) odors, changes in drilling conditions, and other pertinent information.
- Description of the materials used to seal the boring, unless it is completed as a well or piezometer.

2.5 Monitoring Well/Piezometer Installation

In addition to requirements in Section 2.4, subsequent well or piezometer development activities may involve transcription of field data from the field book onto a computer-based boring log. The field notebook or PDA is to be used to identify the chronology and major events of the installation activity, and the computer-based boring log is to be used to correlate the geologic strata to the major elements of the monitoring well construction. Information to be collected and recorded must meet the regulatory and client requirements and may include the following:

- Location identity
- Screen and riser type, length, diameter, and location

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- Diameter
- Total depth
- Sump location and depth and diameter
- Materials of construction (e.g., stainless steel, polyvinyl chloride, or other material)
- Seal type(s) and or depth(s)
- Sand or gravel pack type, including materials (e.g., silica) and gradation
- Depth to water before and after installation.

2.6 Air Sampling Logs

At a minimum, air sampling documentation should include:

- Start and finish time of sampling
- Sampling location
- Sampling method/media
- Volume sampled.

2.7 Construction, Demolition, Abandonment, and Related Activities

Monitoring and documentation of construction and comparable activities shall be documented in bound field books and/or on appropriate company forms and should include similar information as specified above, including information such as:

- Project name and number
- Owner or client name
- Contractor or subcontractors performing the work
- Contractor or subcontractor superintendent(s) and personnel (as available) on site
- Chronological sequence and description of work activities performed, including workday start and completion times
- Reference to contract sections, work plans, or specifications describing work being performed
- Reference to relevant permit conditions and regulatory requirements and/or reference to regulatory guidance documents controlling work approach
- Listing of all trades performing work by contractor and subcontractor
- Hours worked per trade
- Work hours per day per shift, if applicable
- Equipment on site (e.g., description, model number, size, and type) and hours of use
- Listing of equipment on site being left idle
- Description and quantity of materials used or incorporated, with reference to contract or specification item number, if feasible; include simple sketch of excavation with approximate dimension, if applicable
- Calculations with dimensions for quantities of material used or incorporated

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- Delineation of the work area and access routes (e.g., fencing, flagging, or staking), confirmation that activities occurred within the work area or description of work occurring outside the delineated work area and justification (as needed), and characterization of impacts outside the designated work area
- Documentation of compliance with speed limits, dust control, erosion control best management practices, and other basic elements of construction activities as dictated by project work plans and applicable permits and regulatory criteria.

2.8 Daily Safety Meeting

A Daily Safety Meeting is to be conducted and documented each workday prior to the initiation of field activities, with on-site ENV personnel, contractors, subcontractors, and visitors if possible. Safety topics discussed are entered on the Daily Safety Meeting Form (available on the corporate Intranet). Topics discussed should include site-specific conditions, procedures to be followed that day, and protective equipment. A printed listing of the attendees at the meeting and their signatures should be included. Other required data are:

- Identification of the individual conducting the meeting and his/her signature
- Identification of the project supervisor and project manager.

2.9 Calibration

Documentation of the calibration and calibration results shall be made for field equipment requiring calibration measuring and test equipment calibration data are recorded in the field book or on the Field Activity Log. Calibration data include the following:

- Unique identification of instrument being calibrated, including type, model, and serial number
- Date and time of calibration
- Standards used in the calibration, including standard identity, concentration, lot number, and manufacturer of the standard
- Instrument reading with respect to each calibration standard
- Comments, as necessary, regarding instrument performance.

2.10 Photographs and Videos

When the client allows, photographs and videos may be used to help document pre-, active, and post-field activities. In sensitive areas (e.g., secured or confidential), the client must be contacted to evaluate security procedures concerning use of photographs or videos. Photographic and video documentation should include project title, project number, date, time, and description of conditions. The time should also be documented if time is important to a sequence of photographs.

Photographs are documented by numbering digital photographs and identifying the number and subject on the Field Activity Log. Individual prints may be marked with a stamp or preprinted self-adhesive labels, or by writing

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the project number and sequential number of each photograph and referencing the numbers in the field book, the Field Activity Log, or a dedicated photo log. Videos used for field documentation are to be identified by project title, project number, and description.

2.11 Subcontractor Preparedness Checklist

Prior to starting work, a review is to be made and documented of a subcontractor's preparedness to perform specified activities. This review may be documented on the Field Activities Log or on checklists that may be developed according to requirements for subcontracted work activities. Particular emphasis should be on site-specific issues that may require special consideration such as health and safety, access, and unique settings. These should be discussed in advance with the CPM and the client in developing and implementing the Scope of Work.

— END OF PROCEDURE —

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APPENDIX B

Arcadis Standard Operating Procedure: Sample Chain-of-Custody

ARCADIS Design & Consultancy for natural and built assets

SOP - SAMPLE CHAIN OF CUSTODY

Rev: #1

Rev Date: May 23, 2017

VERSION CONTROL

Revision No	Revision Date	Page No(s)	Description	Reviewed by
0	April 19, 2017	All	Re-write to COC only	Richard Murphy
1	May 23, 2017	4	Add: Guidance on use of previous version of SOP.	Peter Frederick
		9	Add: Info on COCs for multiple shipping containers	
		7	Modify: Move letter i. to letter m. and change to “when appropriate”	

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APPROVAL SIGNATURES

Prepared by: _____ 05/23/2017

Peter C. Frederick Date:

Technical Expert Reviewed by: _____ 05/23/2017

Richard J. Murphy Date:

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1 INTRODUCTION

This document describes general and/or specific procedures, methods, actions, steps, and considerations to be used and observed by Arcadis staff when performing work, tasks, or actions under the scope and relevancy of this document. This document may describe expectations, requirements, guidance, recommendations, and/or instructions pertinent to the service, work task, or activity it covers.

It is the responsibility of the Arcadis Certified Project Manager (CPM) to provide this document to the persons conducting services that fall under the scope and purpose of this procedure, instruction, and/or guidance. The Arcadis CPM will also ensure that the persons conducting the work falling under this document are appropriately trained and familiar with its content. The persons conducting the work under this document are required to meet the minimum competency requirements outlined herein, and inquire to the CPM regarding any questions, misunderstanding, or discrepancy related to the work under this document.

This document is not considered to be all inclusive nor does it apply to all projects. It is the CPM's responsibility to determine the proper scope and personnel required for each project. There may be project- and/or client- and/or state-specific requirements that may be more or less stringent than what is described herein. The CPM is responsible for informing Arcadis and/or Subcontractor personnel of omissions and/or deviations from this document that may be required for the project. In turn, project staff are required to inform the CPM if or when there is a deviation or omission from work performed as compared to what is described herein.

In following this document to execute the scope of work for a project, it may be necessary for staff to make professional judgment decisions to meet the project's scope of work based upon site conditions, staffing expertise, regulation-specific requirements, health and safety concerns, etc. Staff are required to consult with the CPM when or if a deviation or omission from this document is required that has not already been previously approved by the CPM. Upon approval by the CPM, the staff can perform the deviation or omission as confirmed by the CPM.

2 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the general Chain of Custody (COC) procedures and guidance instructions for samples collected from project sites that are relinquished from Arcadis' possession.

COC is defined as the maintenance of an unbroken record of possession of an item from the time of its collection through some analytical or testing procedure. COC is typically documented by a written record of the collection, possession, and handling of samples collected from a project location. Each sample will be tracked by a documented record that efficiently documents the individuals who were responsible for the sample during each successive transfer of that sample to various recipients beyond Arcadis' possession. This information can be used to legally establish the integrity of the samples and therefore the analytical results derived from the samples. This information can be used in addition to other records and documentation regarding the samples, such as field forms, field logs, and photographs.

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A sample is considered under custody if:

- It is in your possession; or
- It is in your view, after being in your possession; or
- It was in your possession and then you then locked it up to prevent tampering; or
- It is in a designated secure area.

Continued use of previous version of SOP:

Although not recommended, Arcadis program-, project-, and client-teams may be able to use the previous version of this SOP provided that it meets all of the quality expectations of Arcadis and client, and meets applicable regulatory requirements. It is up to the program, project, and/or client-team leader to determine whether it is appropriate to adopt the current SOP or to continue using the previous version.

However, all new work not associated with the previous version of this SOP must be performed with the current version of the SOP.

When adopting this new SOP, users of the previous versions must be aware that specific handling, packing, and shipping procedures and guidance has been removed and that those should be addressed within program or project plans (e.g. QAPPs, Work Plans, SAPs, etc.) or in a more detailed SOP or TGI specific to that sampling activity, whether related to media, constituent/analyte, client, state, etc.

In addition, adopting this new SOP will require users to refer to the Arcadis DOT Safety Program for procedures and guidance on the determination and handling, packing, and shipping of samples that are or may be considered hazardous materials.

3 PERSONNEL QUALIFICATIONS

Arcadis personnel performing work under the purview of this SOP will have received appropriate training and have field experience regarding the collection of samples from project locations. Arcadis personnel will have all other applicable and appropriate training relevant to the sampling work and project site.

4 EQUIPMENT LIST

The following list provides materials that may be required for each COC. Project reporting and documentation requirements must be reviewed with the CPM prior to execution of work. Additional materials, tools, equipment, etc. may be required, and project staff are required to verify with the CPM and/or Technical Expert what specific equipment is required to complete the COC.

- Indelible ink pen (preferably either black or blue ink);
- COC form https://thesourceus.arcadissource.com/TKI/Documents/COC%20Form.pdf (**Appendix A**) from either Arcadis, laboratory receiving and analyzing the samples, or other applicable and appropriate entity for the work performed;
- When appropriate, such as for litigation or expert testimony work, custody seals or tape.

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5 CAUTIONS

One way in which the law tries to ensure the integrity of evidence is by requiring proof of the chain of custody by the party who is seeking to introduce a particular piece of evidence.

A proper chain of custody requires three types of affirmations: (1) affirmation that a sample is what it purports to be (for example, soil collected from a specified location and depth); (2) affirmation of continuous possession by each individual who has had possession of the sample from the time it is collected until the time it is analyzed or held by a laboratory; and (3) affirmation by each person who has had possession that sample remained in substantially the same condition and not contaminated or affected by outside influences from the moment one person took possession until the moment that person released the evidence into the custody of another (for example, affirmation that the sample was stored in a secure location where no one but the person in custody had access to it).

Proving chain of custody is necessary to "lay a foundation" for the samples in question, by showing the absence of alteration, substitution, or change of condition.

Ensure that appropriate sample containers with applicable preservatives, coolers, and packing material are planned for and provided at the site at the time of sample collection.

Understand the offsite transfer requirements of the samples for the facility at which samples are collected.

If overnight courier service is required schedule pick-up or know where the drop-off service center is located and the hours of operation.

An Arcadis employee appropriately trained at the correct level of internal hazardous materials/DOT (Department of Transportation) shipping must complete an Arcadis shipping determination to address applicable DOT and IATA (International Air Transport Association) shipping requirements. Review the applicable Arcadis procedures and guidance instructions for sample packaging, and labeling. Prior to using air transportation, confirm air shipment is acceptable under DOT and IATA regulations.

The person relinquishing possession of the samples or other member of the project team should contact the final recipient of the samples to confirm receipt and review any special provisions on the COC or questions that they may have.

6 HEALTH AND SAFETY CONSIDERATIONS

Follow the health and safety procedures outlined in the project/site Health and Safety Plan (HASP) as well as other applicable H&S requirements, such as:

- Arcadis Hazardous Material/DOT handling, packaging, and shipping training
- Project site-specific H&S training
- Client-specific H&S training
- Constituent-specific H&S training
- Media-specific H&S training

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7 PROCEDURE

Collected samples must be uniquely identified, and properly documented, containerized, labeled with unique identifier, possessed in a secure manner during remainder of sampling event, packaged, and shipped to recipient laboratory.

Sample Identification

The method of sample identification depends on the type of measurement or analyses performed. In some cases, in-situ measurements of existing conditions and/or sample location must be made during sample collection. These data will be recorded directly on field forms, logbooks, or other project record data sheets used to permanently retain this information for the project file. Examples of location identification information includes: latitude/longitudinal measurements, compass directions, well number, building number, floor number, room name, or proximity to a site feature unique to the site. Examples of in-situ measurements are pH, temperature, conductivity, flow measurement, or physical condition of the media being sampled. Physical samples collected are identified by a unique identifying number or code on a sample tag or label. These physical samples are removed from the sample location and transported to a laboratory for analyses.

In some cases, before samples are placed into individual containers and labeled as individual samples, samples may be separated into portions depending upon the analytical methods and required duplicate or triplicate analyses to be performed.

When completing a COC for samples, personnel must complete the following:

1. Written COCs must be completed with indelible ink (preferably either black or blue colored ink).
2. Written COCs must be completed using legible printed writing, and not cursive writing.
3. All entry fields on the COC form must be completed. If information is not applicable for a specific entry field, personnel will either put “N/A” or use a strike-out line or dash like “----------“ to indicate no applicable information is needed for that field.
4. Use of quotation marks or lines/down arrows to represent repetitive/duplicative text in similar fields.
5. Regardless of the type or specific COC form, the following pertinent information must be provided on the COC form:
    a. Arcadis project number
    b. Arcadis project name
    c. Project location, including street address, city, state, building number, providing as much detail as appropriate
    d. Recipient laboratory contact and sample receiving shipping location information
    e. Entities’/persons’ contact information for who will be receiving analytical results
    f. Name of sampler, i.e. person collecting sample and relinquishing possession of samples to the next entity in the chain of custody
    g. Date of sample collection

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h. If appropriate for the sample media, contaminant/constituent of concern, or analytical method, document time of sample collection using standard military time

i. Sample analytical method(s)

j. Turnaround time required for analyses and/or reporting

k. Instructions to laboratory regarding handling, timing, analyses, etc. as applicable and appropriate

l. Printed name and signature of the individual person who collected the samples and relinquishing possession of the samples

m. If appropriate or when documentation of the specific sample collection method will influence how the laboratory handles, prepares, or analyzes the samples, document the sample collection methodology used for collecting the samples (e.g. ASTM D5755)

6. The following additional specific information will be entered on the COC form, regardless of what type of COC is being used:

   a. Unique Sample Identifier – The sample identifier (ID) must be unique to the individual sample it is applied to. The information in which the sample ID conveys is determined by the CPM, Technical Expert, and/or other project team members in advance of sample collection so that sample identification is consistently applied for the project. The sample nomenclature may be dictated by a specific client, program, or project database and require unique identification for each sample collected for the project. Consult with the CPM and/or Technical Expert for additional information regarding sample identification.

      The sample ID could convey specific information regarding the sample to aid personnel in recognizing what the sample represents, or they may be arbitrary so as to facilitate the anonymity of the sample location, media, constituent of concern, project site, etc.

      Examples of unique identifiers include:

      1. Well locations, grid points, or soil boring identification numbers (e.g., MW-3, X-20, SB-30). When the depth interval is included, the complete sample ID would be “SB-30 (0.5-1.0) where the depth interval is in feet. Please note it is very important that the use of hyphens in sample names and depth units (i.e., feet or inches) remain consistent for all samples entered on the chain of custody form. DO NOT use the apostrophe or quotes in the sample ID.

      2. Sample names may also use the abbreviations “FB,” “TB,” and “DUP” as prefixes or suffixes to indicate that the sample is a field blank, trip blank, or field duplicate, respectively.

   b. List the date of sample collection. All indicated dates must be formatted using either mm/dd/yy (e.g., 03/07/09) or mm/dd/yyyy (e.g. 03/07/2009).

   c. When appropriate for the analytical procedure used, list the local time that the sample was collected. The time value should be presented using military format. For example, 3:15 P.M. should be entered as 15:15.

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d. Samples should be indicated to be either “Grab” or “Composite”. Grab samples are collected from only one unique location at one specific point in time.

e. Composite samples are a group of individual samples that are combined for analysis in their totality. Composite samples need to be documented if they are either collected from a number of different locations over a broader area to be representative of the entire area being sampled, or if they are representative of a single location over an extended period of time.

f. If used, preservatives for the individual sample will be noted.

g. The requested analytical method(s) that the samples are being analyzed for must be indicated. As much detail, as necessary, should be presented to allow the analytical laboratory to properly analyze the samples. For example, polychlorinated biphenyl (PCB) analyses may be represented by entering “EPA Method 8082 – PCBs” or “EPA PLM 600-R93-116.” In cases where multiple analytical methods and/or analytical parameters are required for an individual sample, each method should be indicated for the sample (e.g., EPA 8082/8260/8270 or EPA PLM/400-point count).

h. If there are project-specific sample analytes to be reported, they should be specifically listed for each individual sample (e.g., 40 CFR 264 Appendix IX).

i. The total number of containers for each analytical method requested should be documented. This information may be included under the parameter or as a total for the sample.

j. When necessary, note which samples should be used for site specific matrix spikes.

k. Indicate special project-specific requirements pertinent to the handling, shipping, or analyses. These requirements may be on a per sample basis such as “extract and hold sample until notified,” or may be used to inform the laboratory of special reporting requirements for the entire sample delivery group (SDG).

l. Indicate turnaround time (TAT) required for samples on COC. If individual samples have differing TATs, the different TATs for each sample or groups of samples must be clearly indicated.

m. Provide contact name and phone number in the event that problems are encountered when samples are received at the laboratory. The person relinquishing possession of the samples or other member of the project team should contact the final recipient of the samples to confirm receipt and review any special provisions on the COC or questions that they may have.

n. If available, attach the Laboratory Task Order or Work Authorization forms.

o. The “Relinquished By” field must contain the signature of the Arcadis person who relinquished custody of the samples to the next entity in the chain of custody, which may be another person, the shipping courier, or the analytical laboratory.

p. Dates and times must be indicated using the following format:

   1) Date: either mm/dd/yy e.g., 01/01/17 <u>OR</u> mm/dd/yyyy e.g., 01/01/2017

   2) Time: use military format, e.g. 9:30 a.m. is 0930 and 9:30 p.m. is 2130

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q. The “Received By” section is signed by sample courier or laboratory representative who received the samples from the sampler or it is signed upon laboratory receipt from the overnight courier service.

4. When more than one page of the COC form is required to complete the total number of samples, use as many sheets as necessary to accurately and clearly document the samples and information. Some COCs may have a standard first page/cover page, and subsequent pages may not contain all the detailed fields as the first page/cover page. Ensure that any subsequent pages convey all of the necessary and pertinent information for each individual sample as required in this procedure document.
5. Pages of the COC must retain a page count of the total number of pages; e.g., Page 1 of 3, Page 2 of 3, Page 3 of 3.
6. Upon completing the COC forms, forward the original signed COC with the sample package. Ensure that the original COC form is secured with the sample package so that it remains with the physical samples for the duration of transport and handling to its final destination and ensure that the COC form will not be become damaged or rendered unreadable due to sample breakage/leakage if stored inside the sample shipping container or outside influences if COC is stored in an outside plastic pouch to the container.
7. If you’ve collected enough samples that would require more than one container to ship them all to the same laboratory or location, then each separate/individual container that contains any number of samples must have a separate COC representing only those samples contained within that specific container. For example, if you have 3 total shipping containers for all of your samples, you must have a total of 3 separate, individual COCs for each of the 3 containers representing only those samples in their representative container. Thus, every container holding samples must have its own, individual COC.
8. If electronic chain of custody (eCOC) forms are utilized, ensure that the requirements of this procedure and guidance instructions are followed to the extent possible. Verify that proper signature and COC procedures are maintained with the CPM and/or Technical Expert when using eCOC.

8 WASTE MANAGEMENT

Not Applicable.

9 DATA RECORDING AND MANAGEMENT

The original signed COC shall be submitted with the samples. Copies of COC records will be transmitted to the CPM or designee at the end of each day unless otherwise directed by the CPM. The sampling team leader retains copies of the chain of custody forms for filing in the project file. Record retention shall be in accordance with client- and project-specific requirements and Arcadis policies, the most stringent will apply.

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10 QUALITY ASSURANCE

COC forms will be legibly completed in accordance with this procedure and guidance instruction document, as well as other applicable and appropriate project documents such as Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP), Work Plan, or other project guidance documents.

COC records will be reviewed by the CPM or their appropriate designee for completeness and accuracy to the applicable requirements. Non-conformances will be noted and corrected in a timely manner on the copies retained by Arcadis as well as contacting the ultimate receiving entity for correction to the originally signed COC in their possession.

11 REFERENCES

Arcadis Client Document Retention Guide

Arcadis Transportation Safety Program requirements, procedures, and guidance instructions

EPA Samplers' Guide – Contract Laboratory Program Guidance for Field Samplers, EPA document EPA-540-R014-013 October 2014

EPA Region III – *Sample Submission Procedures for the Office of Analytical Services and Quality Assurance (OASQA) Laboratory Branch* revision 13.0 January 29, 2014

EPA Region I Office Environmental Measurement and Evaluation – *Standard Operating Procedures for Chain of Custody of Samples* revision 1 March 25, 2002

EPA Region IV Science and Ecosystem Support Division *Operating Procedure for Sample and Evidence Management* January 29, 2013

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APPENDIX A
Chain of Custody Form

[click image below to access form]

ARCADIS

ID#:

CHAIN OF CUSTODY & LABORATORY ANALYSIS REQUEST FORM

Page ___ of ___

Lab Work Order #

Send Results to:

Contact & Company Name: | Telephone:
Address: | Fax:
City | State | Zip | E-mail Address:
Project Name/Location (City, State): | Project #:
Sampler's Printed Name: | Sampler's Signature:

Preservative
Filtered (✓)
# of Containers
Container Information

PARAMETER ANALYSIS & METHOD

Sample ID	Collection Date	Collection Time	Type (✓) Comp	Type (✓) Grab	Matrix	REMARKS

Keys

Preservation Key:
A. H_2SO_4
B. HCL
C. HNO_3
D. NaOH
E. None
F. Other: _____
G. Other: _____
H. Other: _____

Container Information Key:
1. 40 ml Vial
2. 1 L Amber
3. 250 ml Plastic
4. 500 ml Plastic
5. Encore
6. 2 oz. Glass
7. 4 oz. Glass
8. 8 oz. Glass
9. Other: _____
10. Other: _____

Matrix Key:
SO - Soil | SE - Sediment | NL - NAPL/Oil
W - Water | SL - Sludge | SW - Sample Wipe
T - Tissue | A - Air | Other: _____

Special Instructions/Comments:

☐ Special QA/QC Instructions(✓):

Laboratory Information and Receipt		Relinquished By	Received By	Relinquished By	Laboratory Received By
Lab Name:	Cooler Custody Seal (✓)	Printed Name:	Printed Name:	Printed Name:	Printed Name:
☐ Cooler packed with Ice (✓)	☐ Intact ☐ Not Intact	Signature:	Signature:	Signature:	Signature:
Specify Turnaround Requirements:	Sample Receipt:	Firm:	Firm/Courier:	Firm/Courier:	Firm:
Shipping Tracking #:	Condition/Cooler Temp: _____	Date/Time:	Date/Time:	Date/Time:	Date/Time:

20790828 CofC AR Form 08.27.2015

Distribution: WHITE – Laboratory returns with results YELLOW – Lab copy PINK – Retained by Arcadis

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APPENDIX C

Test America Quality Assurance Manual

Quality Assurance Manual Cover Page

TestAmerica Phoenix
4625 East Cotton Center Boulevard
Suite 189
Phoenix, Arizona 85040
Phone No. 602-437-3340
Fax No. 602-454-9303

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Title Page:

Quality Assurance Manual
Approval Signatures

Laboratory Director/IH Technical Director Stephanie Stimson	6/18/2017 Date
Quality Manager - Ann Doerr	6/23/2017 Date
Department Manager- **GCMS Volatiles** Reuben Vacek	7/3/2017 Date
Department Manager - **Inorganic** Kendra Hamblin	7/3/2017 Date
Sample Receiving Supervisor - Andrea Gravlin	6/19/2017 Date
Department Manager – GCMS Semi-volatiles Cora Laurie	6/26/2017 Date

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REFERENCED CORPORATE SOPs AND POLICIES

SOP / Policy Reference	Title
CA-I-P-002	Electronic Reporting and Signature Policy
CA-L-P-002	Contract Compliance Policy
CW-L-S-004	Subcontracting Procedures
CA-Q-M-002	Corporate Quality Management Plan
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-006	Detection Limits
CA-Q-S-009	Root Cause Analysis
CA-T-P-001	Qualified Products List
CW-E-M-001	Corporate Environmental Health & Safety Manual
CW-F-P-002	Company-Wide Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CW-F-S-007	Fixed Asset Acquisition, Retention and Safeguarding
CW-L-P-004	Ethics Policy
CW-L-S-002	Internal Investigation
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CW-Q-S-003	Internal Auditing
CW-Q-S-004	Management Systems Review
CW-Q-S-005	Data Recall Process
CA-C-S-001	Work Sharing Process

REFERENCED LABORATORY SOPs

SOP Reference	Title
PE-ADM-001	Computer Security
PE-QAD-001	Control Charts and Statistical Process Control
PE-QAD-002	Dispensing Device Verification
PE-QAD-003	Sample Homogenization, Sub-sampling, & Compositing
PE-QAD-004	Thermometer Verification
PE-QAD-006	Laboratory Documentation

SOP Reference	Title
PE-QAD-007	Non Conformance & Corrective Actions
PE-QAD-008	Personnel Certification and Training
PE-QAD-010	Document Control
PE-QAD-012	Receipt Process for General Supplies and Chemicals
PE-QAD-013	Reagent and Standard Preparation, Control and Documentation
PE-QAD-014	Creation and Maintenance of SOPs
PE-QAD-015	Demonstration of Capability
PE-QAD-016	Balance Calibration Care and Use
PE-QAD-017	Record Archiving
PE-QAD-019	Determination of Method Detection Limits and Reporting Limits
PE-QAD-024	Data Review
PE-QAD-027	Client Complaint Procedures
PE-SMP-001	Sample Control
PE-PMD-004	Project Management
PE-SMP-005	Bottle Preparation
PE-SMP-006	Receiving and Waste Management of Foreign Soils
PE-SMP-007	Calibrating Sampling Pumps

SECTION 3. INTRODUCTION, SCOPE AND APPLICABILITY

3.1 Introduction and Compliance References

TestAmerica Phoenix's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with The NELAC Institute (TNI) Standard, dated 2009, Volume 1 Modules 2 and 4, AIHA-LAP, LLC and ISO/IEC Guide 17025:2005(E). In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan (CQMP) and the various accreditation and certification programs listed in Appendix 3. The CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations.

The QAM has been prepared to be consistent with the requirements of the following documents:

- ANSI/ASQC, E4-1994, "Specifications and Guidelines for Quality Management Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995, or most recent version)
- "EPA Requirements for Quality Management Programs" (QA/R-2) (EPA/240/B-01/002, May 31, 2006).
- EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991.
- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008; Final Update V, August 2015*
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005*
- APHA, *Standard Methods for* the Examination of Water and Wastewater, 18th Edition, 19th, 20th, 21st, 22nd and on-line Editions.
- Toxic Substances Control Act (TSCA).
- Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, EPA, Second Edition, 1999.
- NIOSH Manual of Analytical Methods, Fifth, Edition, 2015.

- U.S. Department of Labor, Occupational Safety & Health Administration, Index of Sampling & Analytical Methods, Revision Date: 21 November 2001.
- AIHA-LAP, LLC Policies for Laboratory Quality Assurance Programs, Current Revision

3.2 Terms and Definitions

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3 Scope / Fields of Testing

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among air, drinking water, effluent water, groundwater, hazardous waste, sludge and soils and air for industrial hygiene on varying types of media. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical and biological parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found **Appendix 4.** The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director, Account Executive and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and/or Industrial Hygiene Program Manager and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.4 Management of the Manual

3.4.1 Review Process

The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure that it remains in compliance with Section 3.1. This manual itself is reviewed annually by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to the Document Control & Updating procedures (refer to SOP PE-QAD-010 Document Control).

SECTION 4. MANAGEMENT REQUIREMENTS

4.1 Overview

TestAmerica Phoenix is a local operating unit of TestAmerica Laboratories, Inc. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., President and Chief Executive Officer (CEO), Chief Operating Officer (COO), Executive Vice President (VP) Operations, Corporate Quality, etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Phoenix is presented in Figure 4-1.

4.2 Roles and Responsibilities

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Additional Requirements for Laboratories

The responsibility for quality resides with every employee of the laboratory. All employees have access to the QAM, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for Corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Phoenix laboratory.

4.2.2 President and Chief Executive Officer (CEO)

The President /CEO is a member of the Board of Directors and is ultimately responsible for the quality and performance of all TestAmerica facilities. The President/CEO establishes the overall quality standard and data integrity program for the Analytical Business, providing the necessary leadership and resources to assure that the standard and integrity program are met.

~~4.2.3~~ Chief Operating Officer (COO)

The COO reports directly to the President and CEO of TestAmerica. The COO oversees the operations of all TestAmerica laboratories and the EMLab P&K business unit. The VP's of Operations report directly to COO.

~~4.2.4~~ Vice President of Operations

Each VP of Operations reports directly to the Executive VP of Operations and is a part of the Executive Committee. Each VP of Operations is responsible for the overall administrative and operational management of their respective laboratories. The VP's responsibilities include allocation of personnel and resources, long-term planning, goal setting, and achieving the financial, business, and quality objectives of TestAmerica. The VP's ensure timely compliance with Corporate Management directives, policies, and management systems reviews. The VP's are also responsible for restricting any laboratory from performing analyses that cannot be consistently and successfully performed to meet the standards set forth in this manual.

~~4.2.5~~ Vice President of Quality and Environmental Health and Safety (VP-QA/EHS)

The Vice President (VP) of QA/EHS reports directly to the President and CEO. With the aid of the Executive Committee, Laboratory Directors, Quality Directors, Safety Manager, EH&S Coordinators and QA Managers, the VP-QA/EHS has the responsibility for the establishment, general overview and Corporate maintenance of the Quality Assurance and EH&S Programs within TestAmerica. Additional responsibilities include:

- Review of QA/QC and EHS aspects of Corporate SOPs, national projects and expansions or changes in services.
- Work with various organizations outside of TestAmerica to further the development of quality standards and represent TestAmerica at various trade meetings.
- Preparation of a monthly report that includes quality metrics across the analytical laboratories and a summary of any quality related initiatives and issues.
- Preparation of a monthly report that includes EH&S metrics across the analytical laboratories and a summary of any EH&S related initiatives and issues.
- With the assistance of the Corporate Senior Management Teams and the EHS Director~~s~~, development and implementation of the TestAmerica Environmental, Health and Safety Program.

4.2.6 Vice President of Client Service

The VP of Client Services leads the Client Service Organization (CSO) and is responsible for client satisfaction, driving operational excellence and improving client responsiveness. The VP provides direction to the Client Service Directors, Programs Managers and Project Managers.

4.2.7 Quality Assessment Director

The Quality Assessment Director reports to the VP-QA/EHS. The Quality Assessment Director has QA oversight of laboratories; responsible for the internal audit system, schedule and procedure; monitors laboratory internal audit findings; identifies common laboratory weaknesses; and monitors corrective action closures. Together with the Quality Compliance

Director, the Quality Systems Director, and the VP-QA/EHS, the Quality Assessment Director has the responsibility for the establishment, general overview and maintenance of the Analytical Quality Assurance Program within TestAmerica.

4.2.8 Quality Compliance Director

The Quality Compliance Director reports to the VP-QA/EHS. The Quality Compliance Director has QA oversight of laboratories; monitors and communicates DoD / DoE requirements; develops corporate tools for ensuring and improving compliance; develops corporate assessment tools; identifies common laboratory weaknesses; and monitors corrective action closures. Together with the Quality Assessment Director, Quality Systems Director and the VP-QA/EHS, the Quality Compliance Director has the responsibility for the establishment, general overview and maintenance of the Analytical Quality Assurance Program within TestAmerica.

4.2.9 Quality Systems Director

The Quality Systems Director reports to the VP-QA/EHS. The Quality Systems Director has QA oversight of laboratories; develops quality policies, procedures and management tools; monitors and communicates regulatory and certification requirements; identifies common laboratory weaknesses; and monitors corrective action closures. Together with the Quality Assessment Director, Quality Compliance Director and the VP-QA/EHS, the Quality Systems Director has the responsibility for the establishment, general overview and maintenance of the Analytical Quality Assurance Program within TestAmerica.

4.2.10 Quality Information Manager

The Quality Information Manager is responsible for managing all company official documents (e.g., Policies, Procedures, Work Instructions), the company's accreditation database, intranet websites, external laboratory subcontracting, regulatory limits for clients on the company's TotalAccess website; internal and external client support for various company groups (e.g., Client Services, EH&S, Legal, IT, Sales) for both quality and operational functions. The Quality Information Manager reports to the VP-QA/EHS; and works alongside the Quality Assessment, Quality Compliance and Quality System Directors and EHS Managers to support both the Analytical Quality Assurance and EHS Programs within TestAmerica.

4.2.11 Technical Services Director

The Technical Services Director is responsible for establishing, implementing and communicating TestAmerica's Analytical Business's Technical Policies, SOPs, and Manuals. Other responsibilities include conducting technical assessments as required, acting as a technical resource in national contracts review, coordinating new technologies, establishing best practices, advising staff on technology advances, innovations, and applications.

4.2.12 Ethics and Compliance Officers (ECOs)

TestAmerica has designated two senior members of the Corporate staff to fulfill the role of Ethics and Compliance Officer (ECO) – Corporate Counsel and VP of Human Resources and the VP-QA/EHS. Each ECO acts as a back-up to the other ECO and both are involved when data investigations occur. Each ECO has a direct line of communication to the entire senior Corporate and lab management staff.

The ECOs ensure that the organization distributes the data integrity and ethical practices policies to all employees and ensures annual trainings and orientation of new hires to the ethics program and its policies. The ECO is responsible for establishing a mechanism to foster employee reporting of incidents of illegal, unethical, or improper practices in a safe and confidential environment.

The ECOs monitor and audit procedures to determine compliance with policies and to make recommendations for policy enhancements to the President and CEO~~s~~, VPOs, Laboratory Director or other appropriate individuals within the laboratory. The ECO will assist the laboratory QA Manager in the coordination of internal auditing of ethical policy related activities and processes within the laboratory, in conjunction with the laboratories regular internal auditing function.

The ECOs will also participate in investigations of alleged violations of policies and work with the appropriate internal departments to investigate misconduct, remedy the situation, and prevent recurrence of any such activity.

4.2.13 Chief Information Officer (CIO)

The CIO is responsible for establishing, implementing and communicating TestAmerica's Information Technology (IT) Policies, SOPs and Manuals. Other responsibilities include coordinating new technologies, development of electronic communication tools such as TestAmerica's intranet and internet sites, ensuring data security and documentation of software, ensuring compliance with the NELAC standard, and assistance in establishing, updating, and maintaining Laboratory Information Management Systems (LIMS) at the various TestAmerica facilities.

4.2.14 Environmental Health and Safety Managers (Corporate)

The EHS Managers report directly to the VP-QA/EHS. The EHS Managers are responsible for the development and implementation of the TestAmerica Environmental, Health and Safety program. Responsibilities include:

- Consolidation and tracking all safety and health-related information and reports for the company, and managing compliance activities for TestAmerica locations.
- Coordination/preparation of the corporate Environmental, Health and Safety Manual Template that is used by each laboratory to prepare its own laboratory-specific Safety Manual/ CHP.
- Preparation of information and training materials for laboratory EHS Coordinators.
- Assistance in the internal and external coordination of employee exposure and medical monitoring programs to insure compliance with applicable safety and health regulations.
- Serving as Department of Transportation (D.O.T.) focal point and providing technical assistance to location management.
- Serving as Hazardous Waste Management main contact and providing technical assistance to location management.

4.2.15 Laboratory Director

Phoenix's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective VPO. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- Provides one or more technical managers for the appropriate fields of testing. If the Technical Manager is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Manager to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements and AIHA-LAP, LLC.
- Ensures client specific reporting and quality control requirements are met.
- Captains the management team, consisting of the QA Manager, the Technical Manager(s), and the Operations Manager as direct reports.

4.2.16 Quality Assurance (QA) Manager or Designee

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system.

The QA Manager reports directly to the Laboratory Director and their Corporate Quality Director. This position is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Manager directs

the activities of the QA Specialist to accomplish specific responsibilities, which include, but are not limited to:

- Serves as the focal point for QA/QC in the laboratory.
- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Maintaining and updating the QAM.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Have documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems and the technical operation.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
- Maintain, improve, and evaluate the corrective action database and the corrective and preventive action systems.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs shall be investigated following procedures outlined in Section 12 and if deemed necessary may be temporarily suspended during the investigation.
- Objectively monitor standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Review a percentage of all final data reports for internal consistency. Review of Chain of Custody (COC), correspondence with the analytical request, batch QC status, and completeness of any corrective action statements, evaluate manual calculations, format, holding time, sensibility and completeness of the project file contents.
- Review of external audit reports and data validation requests.
- Follow-up with audits to ensure client QAPP requirements are met.
- Establishment of reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Development of suggestions and recommendations to improve quality systems.
- Research of current state and federal requirements and guidelines.

- Captains the QA team to enable communication and to distribute duties and responsibilities.
- Ensuring Communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 12.
- Evaluation of the thoroughness and effectiveness of training.
- Compliance with ISO 17025 and AIHA-LAP, LLC**.** (where applicable)

4.2.17 Industrial Hygiene Program/Technical Manager

The Industrial Hygiene Program/Technical Manager reports directly to the Laboratory Director and shall posses the qualifications and assumes the responsibilities listed below in addition to the responsibilities listed under the department/program manager title.

- The laboratory shall provide day to day supervision of its technical operations by designating at least one Technical Manager (TM) per program.
- The Industrial Hygiene Program/Technical Manager shall be an employee of the laboratory.
- The Industrial Hygiene Program/Technical Manager shall be present on site at least 20 hours per week or 50 percent of the laboratory operating hours (whichever is less) to address technical issues for laboratory staff and customers.
- The Industrial Hygiene Program/Technical Manager shall authorize and document that all analyses for which the laboratory is accredited are completed by personnel with appropriate education and/or technical background in the Industrial Hygiene department. The Laboratory Director shall have the responsibility to ensure that personnel in other departments, performing industrial hygiene analyses, have appropriate education and/or technical background.
- The Industrial Hygiene Program/Technical Manager shall ensure that adequate supervision is provided for all laboratory technical personnel.
- The Industrial Hygiene Program/Technical Manager or their designee shall function as the approved signatory. The IH Program/Technical Manager/Laboratory Director/Customer Service Manager shall designate those individuals that may function as approved signatories using the Demonstration of Capability form for IH, PX-QAD-005.
- The Industrial Hygiene Program/Technical Manager/Laboratory Director/Customer Service Manager shall designate those individuals that may direct projects from setup through data interpretation and reporting.
- The Industrial Hygiene Program/Technical Manager shall in conjunction with the QA Department Manager ensure on-going proficiency for analysts and technicians that perform analyses that fall under the Industrial Hygiene Program: Every six months a chemist/tech

must demonstrate ongoing proficiency. This can be accomplished through the analysis of PAT samples, at least 2 pairs of LCS/LCSD during the six month period, or by repeating the IDC as described in this SOP studies (every six months).

- The Industrial Hygiene Program/Technical Manager shall in conjunction with the QA Department Manager ensure initial/annual reporting level verification spikes are completed as appropriate for each analyte by analysts and technicians that perform analyses that fall under the Industrial Hygiene Program.

- The Industrial Hygiene Program/Technical Manager shall ensure method validation/desorption efficiency studies are performed as appropriate by for analysts and technicians that perform analyses that fall under the Industrial Hygiene Program.

- The Industrial Hygiene Program/Technical Manager shall research and development of new analytical procedures and improvements to current procedures.

- The Industrial Hygiene Program/Technical Manager or their designee, during an absence, shall perform secondary review of all data produced for analyses that fall under the Industrial Hygiene Program.

- The Industrial Hygiene Program/Technical Manager shall posses the following authority:

  Stop work on analytical methods that fall under the Industrial Hygiene Program.

  Hold or stop issuance of reports that fall under the Industrial Hygiene Program.

Any changes in laboratory ownership, location (except for mobile and field operations laboratories), management, quality control personnel, or any other change that significantly affects the laboratory's capability, scope of accreditation, or ability to meet the policy requirements, shall be reported in writing to AIHA-LAP, LLC within twenty (20) business days of the change. Any absence of personnel for a period in excess of twenty (20) consecutive working days, that impacts the laboratory's ability to perform its scope of testing, shall be reported to AIHA-LAP, LLC within twenty (20) business days. This notification requirement shall be in effect if the Technical Manager, the Quality Manager, or an analyst who is the only staff member that performs a given test, are absent for reasons of extended family leave, illness, temporary disability, etc.

Qualifications of the Industrial Hygiene Program/Technical Manager: Minimum of three (3) years relevant nonacademic analytical experience. A minimum of two (2) years experience shall be in industrial hygiene analyses within the scope of accreditation. The remaining one (1) year may be from other laboratory analytical procedures. Relevant academic experience may be substituted for the remaining one (1) year work experience. A relevant post-graduate degree (MS or Ph.D.) shall also be considered equivalent to one (1) year of work experience. Academic experience and post-graduate degrees may not be substituted for the two (2) years industrial hygiene experience. (Environmental, forensic, or similar micro analytical experience shall be reviewed to determine if the specific experience is a reasonable substitute.) The Industrial Hygiene Program/Technical Manager shall possess a bachelor's degree in an applicable physical or biological science.

4.2.18 Technical Manager or Designee (Department Managers)

The Technical Manager(s) report(s) directly to the Laboratory Director. He/she is accountable for all analyses and analysts under their experienced supervision **and for compliance with the ISO 17025 Standard and AIHA-LAP, LLC**. The Department Manager acts as a designee for the Technical Director(s). The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and new instrumentation. Specific responsibilities include, but are not limited to:

- Exercises day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Coordinating, writing, reviewing preparation of all test methods, i. e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she insures that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.
- Reviews and approves, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.
- Monitors the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.
- Provides training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.
- Enhances efficiency and improves quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Coordinates sample management from "cradle to grave," insuring that no time is lost in locating samples.
- Schedules all QA/QC-related requirements for compliance, e.g., MDLs, etc...

- Captains department personnel to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.
- Coordinates audit responses with the QA Manager.

4.2.19 EHS Coordinator

The EHS Coordinator (EHSC) reports to the Laboratory Director and ensures that systems are maintained for the safe operation of the laboratory. The EHSC is responsible to:

- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administer dispersal of all Safety Data Sheet (SDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is “reasonable” and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica’s medical consultants.

4.2.20 Hazardous Waste Coordinator

The Hazardous Waste Coordinator reports directly to the Laboratory Director. The duties consist of:

- Staying current with the hazardous waste regulations.
- Continuing training on hazardous waste issues.
- Reviewing and updating annually the Hazardous Waste Contingency Plan in the Environmental Health & Safety Manual.
- Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.
- Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste.
- Ensures proper collection and disposal of all hazardous waste.

4.2.21 Industrial Hygiene Laboratory Analysts/Technicians

The industrial hygiene program distinguishes two titles for those conducting analytical procedures within the laboratory. An analyst is one who has a bachelor's degree in chemistry or a related science. A technician is one who does not have a degree in chemistry or a related science.

Analysts and Technicians that perform analyses which fall under the Industrial Hygiene Program shall report directly to the Industrial Hygiene Program/Technical Manager information regarding any analysis that fall under the Industrial Hygiene Program. Analysts and technicians may in addition to the IH Program/Technical Manager report to the designated department manager regarding other non-industrial Hygiene analyses and personnel issues.

Analysts and Technicians that perform analyses which fall under the Industrial Hygiene Program shall posses the qualifications and assume the responsibilities listed below in addition to the responsibilities listed under the Laboratory Analyst title.

This position is responsible for a variety of routine analyses or preparation procedures to determine and evaluate chemical and physical properties. Responsible for interpretation, organization, coordination and completion of routine and/or complex assignments as well as preparation of sampling equipment and materials.

- Successful training (in-house courses are acceptable) in specific methodologies used in the laboratory shall be documented. In house training to be provided on sample preparation and instrument analysis prior to performing independent analysis of laboratory samples. All analysts and technicians shall have a minimum of twenty (20) business days of hands-on experience conducting analyses in an industrial hygiene laboratory before initiation of independent work on customer samples. The criteria and training requirements for laboratory personnel shall be clearly defined, documented and maintained on file in the Quality Assurance office.
- Training Program content, duration, qualifications of the trainer, and objective evidence that the analyst/technician has successfully analyzed unknown reference samples of the matrices/analytes of concern within specified criteria. The dates of authorization to perform specific tasks shall be recorded on the DOC form, PX-QAD-005 and a copy be placed on file in the Quality Assurance office.
- Analysts and Technicians shall have demonstrated ability to produce reliable results through accurate analysis of certified reference materials (CRMs), proficiency testing samples, or in-house quality control samples. Their performance must be documented.
- Analysts and Technicians shall be responsible for complying with all quality assurance and quality control requirements pertaining to their technical functions.
- Analysts and Technicians shall be responsible to perform on-going proficiency for analyses that fall under the Industrial Hygiene Program: Every six months a chemist/tech must demonstrate ongoing proficiency. This can be accomplished through the analysis of PAT samples, at least 2 pairs of LCS/LCSD during the six month period, or by repeating the IDC as described in the SOP studies (every six months).
- Analysts and Technicians shall be responsible to ensure initial and/or annual reporting level

verification spikes are completed as appropriate for each analyte for each method as appropriate, that fall under the Industrial Hygiene Program.

- Analysts and Technicians shall ensure method validation/desorption efficiency studies are performed as appropriate by for analysts and technicians that perform analyses that fall under the Industrial Hygiene Program.
- Analysts and Technicians may assist in research and development of new analytical procedures and improvements to current procedures.
- Analysts and Technicians shall perform preparation and analyses on a variety of samples according to the associated SOP.
- Analysts and Technicians shall train new analysts and technicians in proper use of equipment, maintenance, setup and procedures, as appropriate.
- Analysts and Technicians shall operate, maintain, and trouble shoot as applicable various analytical instrumentation including but not limited to GC-MS, GC, ICP, ICP-MS, cold vapor AA, IC, HPLC UV/VIS, etc.
- Analysts and Technicians shall be responsible to prepare data, review data, perform routine calculations, prepare graphs, tables, and control charts, maintain appropriate organization and cleanliness in lab areas and keep inventory of supplies.

4.2.22 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the Department Manager or designee. The responsibilities of the analysts are listed below:

- Performs analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Documents standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on logbooks, bench sheets, lab notebooks and/or the Non-Conformance Database.
- Reports all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their Department or Program Manager as applicable, and/or the QA Manager or member of QA staff.
- Performs 100% review of the data generated prior to entering and submitting for secondary level review by another qualified analyst.
- Suggests method improvements to their Department/Program Manager, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.

- Works cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.
- Lead analyst additional responsibilities - In addition to the responsibilities listed above supports the Technical/Department Manager by monitoring sample throughput, supports adherence to QA and safety protocols, and helps with the daily functions of the department.

4.2.23 Manager of Project Management (MPM)

The Manager of Project Management manages the Project Management Team to ensure total client satisfaction through timely communication and customer service. With the overall goal of total client satisfaction, specific responsibilities include, but are not limited to:

- Technical training and growth of the Project Management team.
- Technical liaison for the Project Management team.
- Human resource management of the Project Management team.
- Manages the assignments of accounts.

4.2.24 Project Managers

The PM reports to the Manager of Project Management (MPM) and serves as the interface between the laboratory's technical departments and the laboratory's clients. There is an entire staff of Project Managers that makes up the Project Management team. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team.
- Technical liaison for the Project Management team.
- Human resource management of the Project Management team.
- Responsible to ensure that clients receive the proper sampling supplies.
- Accountable for response to client inquiries concerning sample status.
- Responsible for assistance to clients regarding the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the supervisors of incoming projects and sample delivery schedules.
- Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates.
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Inform clients of data package-related problems and resolve service issues.

- Coordinate requests for sample containers and other services (data packages).

4.2.25 Sample Receiving

The Sample Receiving Department Manager oversees the Sample Receiving Department. He/She or designee is responsible for ensuring the timely and correct shipment of sample containers, including proper preservatives and instructions, to clients. :

- Directs the logging of incoming samples into the LIMS.
- Maintains accurate records of sample shipments
- Ensures the verification of data entry from login.
- Supervises the organized storage and appropriate climate control of samples.
- Oversees the area of bottle kit preparations
- Manages the shipment of sub-contracted samples to designated laboratories
- Maintains bottle and cooler inventory
- Supervises the disposal of samples in accordance with the Waste Disposal SOP, the corporate Environmental Health and Safety Manual, the Hazardous Waste Contingency Plan in the facility addendum to the corporate safety manual, and the U. S. Department of Agriculture requirements.

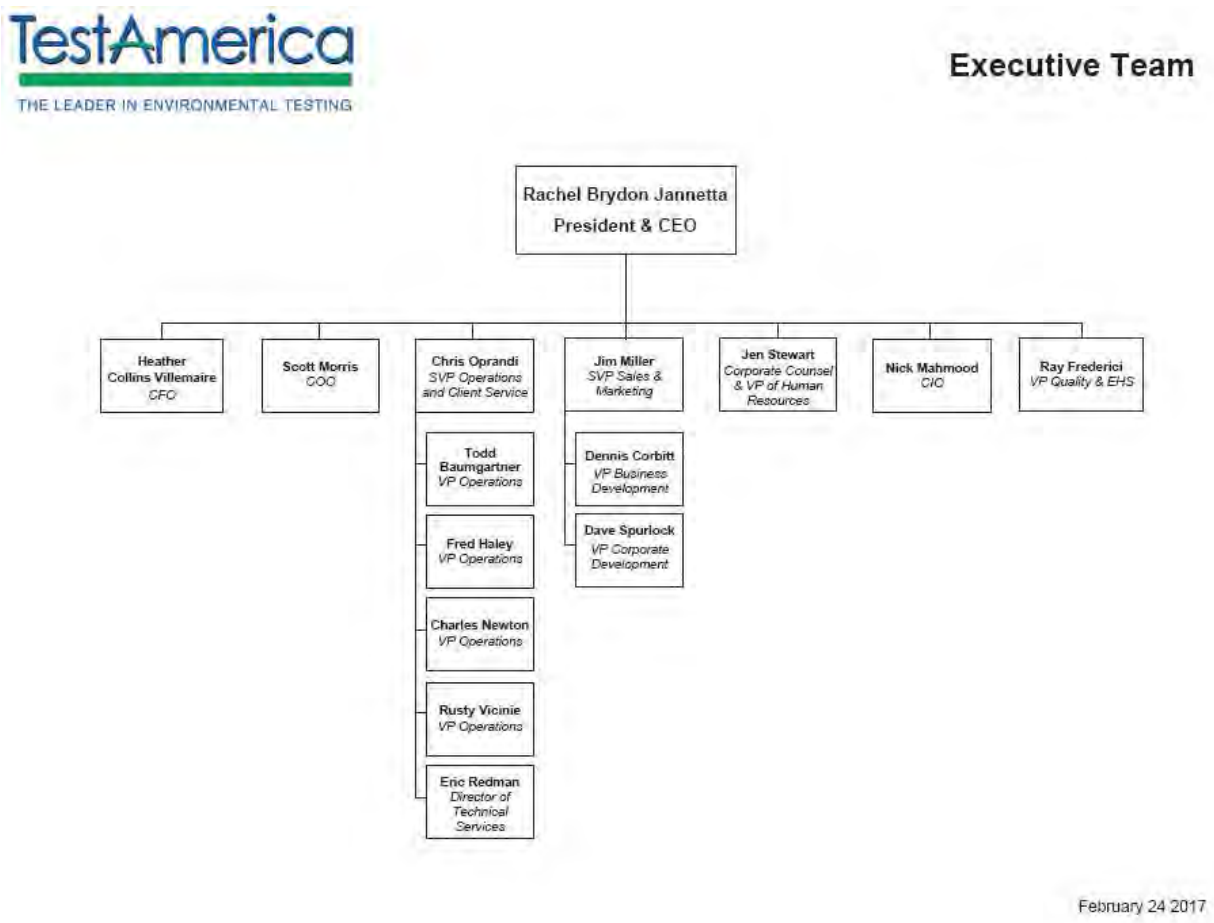
4.3 Deputies

The following table defines who assumes the responsibilities of key personnel in their absence:

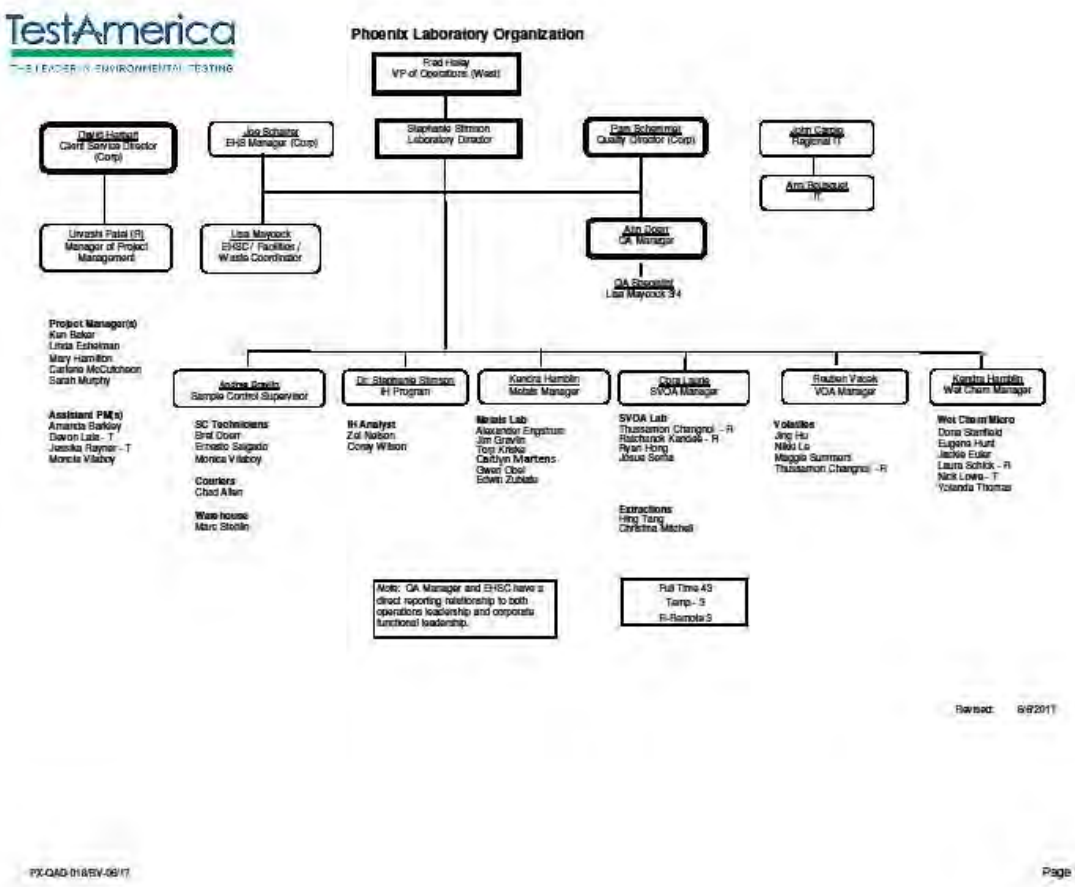
Key Personnel	Deputy
Laboratory Director	Quality Assurance Manager
Quality Manager	Laboratory Director or QA Specialist
GCMS VOA Department Manager	SVOA / Extractions Department Manager or Laboratory Director or VOA Lead Analyst
Industrial Hygiene Program / Technical Manager	Industrial Hygiene Lead Analyst
SVOA / Extractions Department Manager	GCMS VOA Department or Laboratory Director or SVOA Lead Analyst
Inorganic Department Manager	Laboratory Director or Metals Lead Analyst or Wet Chemistry Lead Analyst
EHS Coordinator	Industrial Hygiene Program / Technical Manager
Hazardous Waste Coordinator	EHS Coordinator or Industrial Hygiene Program / Technical Manager

Key Personnel	Deputy
Sample Receiving Supervisor	Laboratory Director

Figure 4-1. Corporate and Laboratory Organization Charts



PHOENIX LABORATORY ORGANIZATION



SECTION 5. QUALITY SYSTEM

5.1 Quality Policy Statement

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.
- To comply with the ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard, AIHA-LAP, LLC and to continually improve the effectiveness of the management system.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 Ethics and Data Integrity

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy No. CW-L-P-004) and Employee Ethics Statements.
- Ethics and Compliance Officers (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A Confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (Corporate SOP No. CW-L-S-002).
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CA-Q-S-005).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).
- Produce results, which are accurate and include QA/QC information that meets client, pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.

- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 Quality System Documentation

The laboratory's Quality System is communicated through a variety of documents.

- Quality Assurance Manual – Each laboratory has a lab-specific quality assurance manual.
- Corporate SOPs and Policies – Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions – A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Laboratory QA/QC Policy Memorandums

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory QA/QC Policy Memorandum
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction or accrediting body shall hold primacy. The laboratory's QAM shall take precedence over the CQMP in those cases.

5.4 QA/QC Objectives for the Measurement of Data

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the

procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), inter-element corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 Criteria for Quality Indicators

The laboratory maintains a *Quality Control Limit Summary* that summarizes the precision and accuracy acceptability limits for performed analyses. This summary includes an effective date, is updated each time new limits are generated and are managed by the laboratory's QA department. Unless otherwise noted, limits within these tables are laboratory generated. This is also maintained with the LIMS. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits are contained in SOP QAD-001 Control Charts and Statistical Process Control and/or Section 24.

5.6 Statistical Quality Control

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs [such as the Arizona Department of Health Services (ADHS), ISO: 17025 or AIHA-LAP, LLC]. The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical / Department Manager and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory. The test's limits associated with data are archived in LIMS. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project. These will be evaluated on a case by case basis.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

QC charts are generated as part of statistical control (see SOP PE-QAD-001). The QA Manager evaluates these to determine if adjustments need to be made or for corrective actions to methods. All findings are documented and kept on file.

5.7 Quality System Metrics

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6. DOCUMENT CONTROL

6.1 Overview

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving Corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in SOP PE-QAD-010 Document Control

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action reports. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 Document Approval and Issue

The pertinent elements of a document control system for each document include a unique document title and number, pagination, the total number of pages of the item or an 'end of document' page, the effective date, revision number and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department. In order to develop a new document, a technical / department manager submits an electronic draft to the QA Department for suggestions and approval before use. Spreadsheets used for calculations and data evaluation must be verified to be accurate and locked down prior to approval. Upon approval, QA personnel add the identifying version information to the document and retain that document as the official document on file. That document is then provided to all applicable operational units (may include electronic access). Controlled documents are identified as such and records

of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of every two years and every year for drinking water and AIHA-LAP, LLC methods and revised as appropriate. Changes to documents occur when a procedural change warrants.

6.3 Procedures for Document Control Policy

For changes to the QA Manual, refer to SOP PE-QAD-010 Document Control. Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. Electronic copies are stored on the Public server in the QA folder (or define location) for the applicable revision.

For changes to SOPs, refer to SOP PE-QAD-014 Creation and Maintenance of SOPs. The SOP identified above also defines the process of changes to SOPs.

Forms, worksheets, work instructions and information are organized and maintained by the QA department. There is a table of contents. Electronic versions are kept on a hard drive in the QA department; hard copies are kept in QA files. The procedure for the care of these documents is in SOP PE-QAD-010 Document Control.

6.4 Obsolete Documents

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived according to SOP PE-QAD-010 Document Control.

SECTION 7. SERVICE TO THE CLIENT

7.1 Overview

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed

by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 Review Sequence and Key Personnel

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the Client Relationship Manager or Proposal Team, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below).

- Contract Administrator
- VP of Operations
- Manager of Project Management
- Laboratory Project Manager
- Laboratory and/or Corporate Technical Managers
- Laboratory and/or Corporate Information Technology Managers/Directors
- Account Executives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The ***Sales Director, Contract Administrator Account Executive or Proposal Coordinator*** then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Contracts Department maintains copies of all signed contracts. The Account Executive, Manager of Project Management or the Project Manager maintains the local copies of the contracts.

7.3 Documentation

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. Those records are maintained locally as needed.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Account Executive. A copy of the contract and formal quote will be filed with the laboratory PM and the Laboratory Director.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log of conversations with the client. Client correspondence and internal communications regarding projects are kept in the project file or stored electronically.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, a PM is assigned to each client. It is the PM's responsibility to ensure that project-specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated verbally to the laboratory during status meetings or via email. Such changes are updated to the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Department Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 Special Services

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 15 and 25).

Note: ISO/IEC 17025 states that a laboratory "shall afford clients or their representatives' cooperation to clarify the client's request".

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 Client Communication

Project managers are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Technical Managers / Department Managers are available to discuss any technical questions or concerns that the client may have.

7.6 Reporting

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 Client Surveys

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service. TestAmerica's Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8. SUBCONTRACTING OF TESTS

8.1 Overview

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase "work sharing" refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we

have made to the client. Refer to TestAmerica's Corporate SOP's on Subcontracting Procedures (CW-L-S-004) and the Work Sharing Process (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-TNI accredited work where required.

Project Managers (PMs), Manager of Project Management (MPM), Client Relationship Managers or Account Executives (AE) (or others as defined by the lab) for the Export Lab (TestAmerica laboratory that transfers samples to another laboratory) are responsible for obtaining client approval prior to subcontracting any samples. The laboratory will advise the client of a subcontract arrangement in writing and when possible approval from the client shall be retained in the project folder. Standard TestAmerica Terms & Conditions include the flexibility to subcontract samples within the TestAmerica laboratories. Therefore, additional advance notification to clients for intra-laboratory subcontracting is not necessary unless specifically required by a client contract.

Note: In addition to the client, some regulating agencies (e.g., USDA) or contracts (e.g., certain USACE projects) may require notification prior to placing such work

8.2 Qualifying and Monitoring Subcontractors

Whenever a PM or Account Executive (AE), Client Relationship Manager or Manager of Project Management (MPM), etc. becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- Subcontractors specified by the client - In these circumstances, the client assumes responsibility for the quality of the data generated from the use of a subcontractor.
- Subcontractors reviewed by TestAmerica – Firms which have been reviewed by the company and are known to meet standards for accreditations (e.g., State, TNI and DoD/DOE); technical specifications; legal and financial information.

A listing of vendors is available on the TestAmerica intranet site.

All TestAmerica laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process).

- Unless otherwise directed by the customer or regulatory agency, a laboratory accredited by AIHA-LAP, LLC or other ILAC MRA signatory shall be used for subcontract work for Fields of Testing covered by the scope of accreditation of the primary facility.
- Work submitted under the AIHA ELLAP program shall only be performed by another NLLAP recognized laboratory (EPA National Lead Laboratory Accreditation Program.)

When the potential sub-contract laboratory has not been previously approved, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director. The Laboratory Director requests that the QA Manager or PM begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CA-L-S-002, Subcontracting Procedures.

8.2.1 When the potential sub-contract laboratory has not been previously approved, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Client Relations Manager (CRM) or Laboratory Director. The CRM or Laboratory Director requests that the QA Manager or PM begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CW-L-S-004, Subcontracting Procedures.

Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to the Corporate Quality Information Manager (QIM) for review. After the Corporate QIM reviews the documents for completeness, the information is forwarded to the Finance Department for formal signature and contracting with the laboratory. The approved vendor will be added to the approved subcontractor list on the intranet site and the finance group is concurrently notified for JD Edwards.

The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractors on our approved list can only be recommended to the extent that we would use them.

8.3 Oversight and Reporting

8.3.1 The status and performance of qualified subcontractors will be monitored by the Corporate Quality department. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance, Legal and Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report.
- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.

- Subcontractors in good standing will be retained on the intranet listing. CSO personnel will notify all TestAmerica laboratories, Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all CSO Personnel, Laboratory Directors, QA Managers and Sales Personnel.

Prior to initially sending samples to the subcontracted laboratory, the PM confirms their accreditation / certification / recognition status to determine if it's current and scope-inclusive. The information is documented within the project records.

8.3.2 For continued use of a subcontractor, verification of accreditation / certification / recognition is placed upon the subcontractor for the defined project. Samples are subcontracted under Chain of Custody with the program defined as 'Accreditation Required' and the following statement for verification upon sample receipt:

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon our subcontract laboratories. This sample shipment is forwarded under Chain of Custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analytes/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said compliance to TestAmerica Laboratories, Inc.

For TestAmerica laboratories, accreditations / certifications can be viewed on the company's TotalAccess Database.

8.3.3 All subcontracted samples must be accompanied by a TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must be available in TALS for all samples workshared within TestAmerica. Client COCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client COCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor's report as appropriate. If TNI accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods

and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 Contingency Planning

The full qualification of a subcontractor may be waived to meet emergency needs; however, this decision & justification must be documented in the project files, and the 'Purchase Order Terms And Conditions For Subcontracted Laboratory Services' must be sent with the samples and Chain-of-Custody.

In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time.

The use of any emergency subcontractor will require the PM to complete a JDE New Vendor Add Form in order to process payment to the vendor and add them to TALS. This form requires the user to define the subcontractor's categories of testing and the reason for testing.

SECTION 9. PURCHASING SERVICES AND SUPPLIES

9.1 Overview

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica's Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica's Company-Wide Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 Glassware

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 Reagents, Standards & Supplies

Purchasing guidelines for equipment, consumables, and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001. Approval information for the solvents and acids tested under SOP CA-Q-S-001 is stored on the TestAmerica SharePoint, under Solvent Approvals. A master list of all tested materials, as well as the certificates of analysis for the materials, is stored in the same location.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP.

The requisitioning department employee will complete an ordering template found on the shared server. Once completed the template should be saved in the proper folder with the employee's initials and date. This will be forwarded to the Administrative personnel in charge of ordering who will complete a General Requisition in JD Edwards. Alternatively, some departments complete the General Requisition in JD Edwards directly. The Lab Director will approve the requisition via the orders awaiting approval application in JDE. Properly approved requisitions are generated into purchase orders and are procured by the Corporate Purchasing Coordinator.

9.3.2 Receiving

It is the responsibility of the warehouse personnel to receive the shipment. They must also document date the material when received and compare the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. A unique tracking identifier is assigned at this time. The laboratory department receiving the item confirms that the quality of the item received meets the level specified. This is documented through the addition of the received date and initials to the information present on the daily order log.

The warehouse personnel verifies the lot numbers of received solvents and acids against the pre-approval lists. If a received material is listed as unapproved, or is not listed, it is sequestered and returned to the vendor. Alternatively, the laboratory may test the material for the intended use, and if it is acceptable, document the approval on the approval list. Records of any testing performed locally are maintained on the shared "public: folder on the computer network.

Materials may not be released for use in the laboratory until they have been inspected, verified as suitable for use, and the inspection / verification has been documented.

Safety Data Sheets (SDSs) are available online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

Methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, analytical reagent grade will be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals and solvents unless noted otherwise by the manufacturer or by the reference source method. Chemicals/solvents should not be used past the manufacturers or SOPs expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date **cannot** be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded, the dry chemical/solvent must be discarded.
- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).
- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical/solvent meets CCV limits. The comparison studies are maintained by the QA department.

Note: The five year expiration date applies to all Industrial Hygiene standards that are considered 'neat'.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. To prevent a tank from going to dryness, or introducing potential impurities, the pressure should be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1- µmho/cm (or specific resistivity of greater than 1.0 megohm-cm) at 25°C. The specific conductivity is checked and recorded daily. If the water's specific conductivity is greater than the specified limit, the Facility Manager and appropriate Technical Managers must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased bottle ware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottle ware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer's certification and traceability statements are maintained in files and are entered into LIMS. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Manager or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. Doc. No. CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 Purchase of Equipment / Instruments / Software

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Technical Director or Department Manager and/or the Laboratory Director. If they agree with the request, the procedures outlined in TestAmerica's Corporate Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department or QA Department. Software certificates supplied by the vendors are filed IT Department. The manufacturer's operation manual is retained at the bench.

9.5 Services

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is

determined by analysts and/or Technical Managers. The service providers that perform the services are approved by the Technical Manager /Department Manager.

Analytical balances are serviced and calibrated annually in accordance with SOP PE-QAD-016 Balance Calibration Care and Use. The calibration and maintenance services are performed on-site, and the balances are returned to use immediately following successful calibration. When the calibration certificates are received (usually within two weeks of the service), they are reviewed, and documentation of the review is filed with the certificates. If the calibration was unsuccessful, the balance is immediately removed from service and segregated pending either further maintenance or disposal.

Calibration services for support equipment such as thermometers, weight sets, autopipettors, etc., are obtained from vendors with current and valid ISO 17025 accreditation for calibration of the specific piece of equipment. Prior to utilizing the vendor's services, the vendor's accreditation status is verified. Once the equipment has been calibrated, the calibration certificates are reviewed by the QA department, and documentation of the review is filed with the calibration certificates. The equipment is then returned to service within the laboratory

9.6 Suppliers

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Procurement & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Laboratory Director are consulted with vendor and product selection that have an impact on quality.

SECTION 10. COMPLAINTS

10.1 Overview

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented following SOP PE-QAD-027 Customer Complaint Procedures.

10.2 External Complaints

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to SOPs PE-QAD-027, Customer Complaints Procedures.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data

was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

Any complaint about the quality of the reported results that fall under AIHA-LAP, LLC may be referred to the accrediting body if such complaints cannot be resolved directly with the customer.

10.3 Internal Complaints

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 12. In addition, Corporate Management, Sales and Marketing and IT may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 Management Review

The number and nature of client complaints is reported by the QA Manager to the laboratory and Quality Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16).

SECTION 11. CONTROL OF NON-CONFORMING WORK

11.1 Overview

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the supervisor for resolution. The supervisor may elect to discuss it

with the Laboratory Director and/or QA Manager or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in Section 12. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Department Manager and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with TNI (or the analytical method) requirements and the reason. Data being reported to a non-TNI state would need to note the change made to how the method is normally run. This practice is not permissible under the AIHA-LAP, LLC accreditation.

11.2 Responsibilities and Authorities

Under certain circumstances, the Laboratory Director, a Department Manager, or a member of the QA team may authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures. This information may also be documented in logbooks and/or data review checklists as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, and the Department Managers. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO) (e.g. the VP-QA/EHS) and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, VP of Operations and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 Evaluation of Significance and Actions Taken

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

Corporate SOP entitled Data Recalls (CW-Q-S-005) is the procedure to be followed when it is discovered that erroneous or biased data may have been reported to clients or regulatory agencies.

Corporate SOP entitled Internal Investigations (CW-L-S-002) is the procedure to be followed for investigation and correction of situations involved alleged incidents of misconduct or violation of the company's ethics policy.

Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in TestAmerica's Corporate SOP No. CW-Q-S-005.

11.4 Prevention of Nonconforming Work

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. Periodically as defined by the laboratory's preventive action schedule, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process must be followed.

11.5 Method Suspension / Restriction (Stop Work Procedures)

In some cases, it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line. The QA Manager will also initiate a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps should be e-mailed by the laboratory to the appropriate VP of Operations and member of Corporate QA. This e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (e.g., Project Management, Log-in, etc.). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical/ Department Manager, QA Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12. CORRECTIVE ACTION

12.1 Overview

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memos (NCMs) and Corrective Action Reports (CAR) (refer to Figure 12-1).

12.2 General

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility(s) for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track client complaints and provide resolution.

12.2.1 Non-Conformance Memo (NCM) - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP

- QC outside of limits (non-matrix related)
- Isolated reporting / calculation errors
- Client complaints
- Discrepancies in materials / goods received vs. manufacturer packing slips.

12.2.2 Corrective Action Report (CAR) - is used to document the following types of corrective actions:

- Questionable trends that are found in the review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Internal and external audit findings.
- Failed or unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic reporting / calculation errors
- Client complaints
- Data recall investigations
- Identified poor process or method performance trends
- Excessive revised reports

This will provide background documentation to enable root cause analysis and preventive action.

12.3 Closed Loop Corrective Action Process

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An NCM or CAR must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Technical / Department Manager, Laboratory Director, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.

- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or CAR is used for this documentation.

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness. Corporate SOP Root Cause Analysis (No. CA-Q-S-009) describes the procedure.

Systematically analyze and document the root causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the Root Cause data from these incidents to identify Root Causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with the problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred 5 consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- The Laboratory Director, Technical / Department Manager and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Technical Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCM and CAR is entered into a database for tracking purposes and a monthly summary of all corrective actions is printed out for review to aid in ensuring that the corrective actions have taken effect.
- TestAmerica laboratories began using the Incident/Corrective Action Tracker (iCAT) database developed by the company in 2015. (Previously, a local database, Non-Conformances, served this purpose.) An incident is an event triggering the need for one or more corrective actions as distinct from a corrective action, a potential deficiency stemming from an incident that requires investigation and possibly fixing. The database is independent of TALS, available to all local and corporate managers, and capable of

notifying and tracking multiple corrective actions per event, dates, and personnel. iCAT allows associated document upload, categorization (such as, external/internal audit, client service concerns, data quality issues, proficiency testing, etc.), and trend analysis. Refer to Figure 12-1.

- The QA Manager reviews monthly NCMs and CARs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to Section 15.1.4, Special Audits.)

12.4 Technical Corrective Actions

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11). The documentation of these procedures is through the use of an NCM.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs. The laboratory may also maintain Work Instructions on these items that are available upon request.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, Work Instructions, QAM Sections 19 and 20. All corrective actions are reviewed monthly, at a minimum, by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCM and appropriate corrective action (e.g., reanalysis) is taken and documented.

12.5 Basic Corrections

When mistakes occur in records, each mistake shall be crossed-out, [not obliterated (e.g. no white-out)], and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original "uncorrected" file must be maintained intact and a second "corrected" file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.
Example - Corrective Action Report

Table 12-1. Example – General Corrective Action Procedures

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Initial Instrument Blank *(Analyst)*	- Instrument response < MDL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc.
Initial Calibration Standards *(Analyst, Technical Manager(s))*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument. -Perform instrument maintenance if necessary
Independent Calibration Verification (Second Source) *(Analyst, Technical Manager(s))*	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Reporting Limit Verification Standards *(Analyst, Data Reviewer*	- % Recovery within acceptance criteria	- Reanalyze standard. - If still unacceptable, batch must be re-prepared and re-analyzed.
Duplicate *(Analyst, Data Reviewer)*	- % RPD within acceptance criteria	- Reanalyze once, evaluate. Flag data if reanalysis remains out of control outside of limit.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within acceptance limits. - % RPD within acceptance criteria	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set. - For matrix spike or duplicate results outside criteria the data for that sample shall be reported with qualifiers.

QC Activity *(Individual Responsible for Initiation/Assessment)*	**Acceptance Criteria**	**Recommended Corrective Action**
Laboratory Control Sample / Laboratory Control Sample Duplicate (LCS/LCSD) *(Analyst, Data Reviewer)*	- % Recovery within acceptance limits. - % RPD within acceptance criteria	- Batch must be re-prepared and re-analyzed. This includes any allowable marginal exceedance. When not using marginal exceedances, the following exceptions apply: 1) when the acceptance criteria for the positive control are exceeded high (i.e., high bias) and there are associated samples that are non-detects, then those non-detects may be reported with data qualifying codes; 2) when the acceptance criteria for the positive control are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level with data qualifying codes. **Note:** If there is insufficient sample or the holding time cannot be met, contact client and report with flags.
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits of method or within three standard deviations of the historical mean.	- Individual sample must be repeated. Place comment in LIMS. - Surrogate results outside criteria shall be reported with qualifiers.
Method Blank (MB) *(Analyst, Data Reviewer)*	< Reporting Limit [1]	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results. - Qualify the result(s) if the concentration of a targeted analyte in the MB is at or above the reporting limit AND is > 1/10 of the amount measured in the sample.
Proficiency Testing (PT) Samples *(QA Manager, Technical Manager(s))*	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Internal / External Audits *(QA Manager, Technical Manager(s), Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc.	- Non-conformances must be investigated through CAR system and necessary corrections must be made.

QC Activity *(Individual Responsible for Initiation/Assessment)*	**Acceptance Criteria**	**Recommended Corrective Action**
Reporting / Calculation Errors (Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Technical Managers, QA Manager, Corporate QA, Corporate Management)	- SOP CW-Q-S-005, Data Recall	- Corrective action is determined by type of error. Follow the procedures in SOP CW-L-S-002 or your lab's CA SOP.
Client Complaints *(Project Managers, Lab Director/Manager, Sales and Marketing)*	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (Refer to Section 16 for an example) (QA Manager, Lab Director/Manager, *Technical Manager(s)*)	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.
Health and Safety Violation (EHSC, Lab Director/Manager, *Technical Manager(s)*)	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through VelocityEHS database

Note:

1. These tables provide general corrective action procedures. Not all QC samples are listed in the table. Frequency, acceptance criteria and corrective actions may vary. Standard Operating Procedures (SOPs) provide detailed information on corrective action for each method or procedure.
2. For Instrument and analytical QC, the acceptance criteria are that listed in the applicable method or program (e.g. AIHA) requirements). If no criteria are listed the laboratory may utilize Arizona Department of Health Services default limits or generates control limits using historical laboratory data.

3. QC acceptance criteria is listed in SOPs. QC limits can be found in LIMS.

SECTION 13. PREVENTIVE ACTION / IMPROVEMENT

13.1 Overview

The laboratory's preventive action programs improve or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process of improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, the laboratory continually strives to improve customer service and client satisfaction through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered through any of the following:

- Review of the monthly QA Metrics Report,
- Trending NCMs,
- Review of control charts and QC results
- Trending proficiency testing (PT) results,
- Performance of management systems reviews,
- Trending client complaints,
- Review of processing operations, or
- Staff observations

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. The metrics report is reviewed monthly by the laboratory management, Corporate QA and TestAmerica's Executive Committee. These metrics are used in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

Items identified as continuous improvement opportunities to the management system may be issued as goals from the annual management systems review, recommendations from internal audits, white papers, Lesson Learned, Technical Services audit report, Technical Best Practices, or as Corporate or management initiatives.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action and non-conformances provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action/process improvement system:

- Identification of an opportunity for preventive action or process improvement.
- Process for the preventive action or improvement.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action or improvement.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action or improvement.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action/Process Improvement. Documentation of Preventive Action/Process improvement is incorporated into the monthly QA reports, corrective action process and management review.

13.1.2 Any Preventive Actions undertaken or attempted shall be taken into account during the annual Management Systems Review (Section 16). A highly detailed report is not required; however, a summary of successes and failures within the preventive action program is sufficient to provide management with a measurement for evaluation.

SECTION 14. CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued. Exceptions for programs with longer retention requirements are discussed in Section 14.1.2.

14.1 Overview

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. More detailed information on retention of specific records is provided in CW-L-P-001 Records Retention Policy and CW-L-WI-001, TestAmerica Records Retention/Storage Schedule. Quality records are maintained by the QA department, which is backed up as part of the regular laboratory backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by QA Department and Corporate IT Department.

Table 14-1. Record Index[1]

	Record Types [1]:	**Retention Time:**
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Policy Memorandums - Manuals - Published Methods	Indefinitely
QA Records	- Certifications - Method and Software Validation / Verification Data	Indefinitely
QA Records	- Internal & External Audits/Responses - Corrective/Preventive Actions - Management Reviews - - Data Investigation	5 Years from archival* **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)
Project Records	- Sample Receipt & COC Documents - Contracts and Amendments - Correspondence - QAPP - SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*
Administrative Records	Financial and Business Operations	Refer to CW-L-WI-001
	EH&S Manual, Permits	Indefinitely
	Disposal Records	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	Refer to HR Manual
	Administrative Policies	Indefinitely
	Technical Training Records	7 years
	Legal Records	Indefinitely
	HR Records	Refer to CW-L-WI-001
	IT Records	Refer to CW-L-WI-001
	Corporate Governance Records	Refer to CW-L-WI-001
	Sales & Marketing	5 years
	Real Estate	Indefinitely

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Verification, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility that provides a suitable environment to prevent damage or deterioration and to prevent loss. All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees and shall be documented with an access log. Logs are maintained in to note removal and return of records. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 14-2. Example: Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	10 years (lab reports and raw data) 10 years - Radiochemistry (project records)
Drinking Water Lead and Copper Rule	12 years (project records)
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement
OSHA	30 years

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to Section 19.14.1 for more information. See SOPs PE-ADM-002 Data Back-up Procedures and PE-QAD-017 Record Archiving.

14.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data. The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the COC is stored with the invoice and the work order sheet generated by the LIMS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set. Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method; a copy of each day's run log or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data. Standard and reagent information is recorded in logbooks or entered into the LIMS for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as "sampled by," "prepared by," "reviewed by", or "analyzed by".

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory's ability to retrieve the information prior to the destruction of the hard copy that was scanned. The procedure for this verification can be found in SOP PE-PMD-004 Project Management.

- Also refer to Section 19.14.1 'Computer and Electronic Data Related Requirements'.

14.2 Technical and Analytical Records

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the sampling, performance of each analysis and reviewing results.

14.2.2 Observations, data and calculations are recorded real-time and are identifiable to the specific task.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- laboratory sample ID code;
- Date of analysis; Time of Analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook or on a bench sheet.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs where available or indicated in SOPs.
- analysis type;
- all manual calculations and manual integrations;
- analyst's or operator's initials/signature;
- sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;
- test results;
- standard and reagent origin, receipt, preparation, and use;
- calibration criteria, frequency and acceptance criteria;
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;
- quality control protocols and assessment;
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats.

14.2.4 All logbooks used during receipt, preparation, storage, analysis, and reporting of samples or monitoring of support equipment shall undergo a documented supervisory or peer review on a periodic basis typically every 15-25 pages.

14.3 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;
- copies of final reports;
- archived SOPs;
- correspondence relating to laboratory activities for a specific project;
- all corrective action reports, audits and audit responses;
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 Administrative Records

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 14-1.

14.5 Records Management, Storage and Disposal

All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access.

The laboratory has a record management system (a.k.a., document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued on a per analysis basis, and are numbered sequentially. All data are recorded sequentially within a series of sequential notebooks. Bench sheets are filed sequentially. Standards are maintained in the LIMS – no logbooks are used to record that data. Records are considered archived when moved from current storage.

14.5.1 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.2 Records Disposal

Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2).

Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required.

SECTION 15. AUDITS

15.1 Internal Audits

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and, when requested, to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Auditing, SOP No. CW-Q-S-003. The types and frequency of routine internal audits are described in Table 15-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems Audits	QA Department, QA approved designee, or Corporate QA	All areas of the laboratory annually
Method Audits QA Technical Audits	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	QA Technical Audits Frequency: 50% of methods annually
SOP Method Compliance	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	SOP Compliance Review Frequency: • Every 2 years • Annually for all AIHA-LAP, LLC Fields of Testing, Drinking Water methods.
Special	QA Department or Designee	Surveillance or spot checks performed as needed, e.g., to confirm corrective actions from other audits.
Performance Testing	Analysts with QA oversight	Two successful per year for each TNI-field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, TestAmerica's Data Integrity and Ethics Policies, TNI quality systems, AIHA-LAP Quality Systems, client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed for effectiveness & sustainability. The audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be

performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

15.1.2 QA Technical Audits

QA technical audits assess data authenticity and analyst integrity. These audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, electronic audit miner programs (e.g., Chrom, AuditMiner) are used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period. All analysts should be reviewed over the course of a two year period through at least on QA Technical audit.

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical/Department Manager or qualified designee at least every two years. ***(Annually for drinking water methods and AIHA-LAP, LLC Fields of Testing.)*** It is also recommended that the work of each newly hired analyst is assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Water Supply, Water Pollution, Underground Storage Tank, Hazardous Waste, Air, AIHA- PATP, and ELPAT, and other Round Robin studies.

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 External Audits

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2009 TNI standards.

15.3 Audit Findings

Audit findings are documented using the corrective action process and database. The laboratory's corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must be set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Technical / Department Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16. MANAGEMENT REVIEWS

16.1 Quality Assurance Report

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director, Technical / Department Managers, their Quality Director as well as the VP of Operations. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, VP of Operations or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and VPs of Operations.

16.2 Annual Management Review

The senior lab management team (Laboratory Director, Technical / Department Managers, QA Manager) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals, objectives and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel is be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that cannot be solved by the lab and report them to Corporate IT.

This management systems review (Corporate SOP CW-Q-S-004 & Work Instruction No. CW-Q-WI-003) uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective; therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.

- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:
  - Adequacy of staff, equipment and facility resources.
  - Adequacy of policies and procedures.
  - Future plans for resources and testing capability and capacity.
- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate VP of Operations and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 Potential Integrity Related Managerial Reviews

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica's Corporate Internal Investigations SOP shall be followed (SOP No. CW-L-S-002). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's President and CEO, Executive VP of Operations, VP of Client & Technical Services, VPs of Operations and Quality Directors receive a monthly report from the VP-QA/EHS summarizing any current data integrity or data recall investigations. The VPs of Operations are also made aware of progress on these issues for their specific labs.

SECTION 17. PERSONNEL

17.1 Overview

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 Education and Experience Requirements for Technical Personnel

The laboratory makes every effort to hire analytical staffs that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located on the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, colony counting, aseptic or quantitation techniques, etc., are also considered).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
GFAA, CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience
Technical Managers – **General**	Bachelor's Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee
Technical Managers – **Wet Chem** only (no advanced instrumentation)	Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry	And 2 years relevant experience
Technical Managers - **Microbiology**	Bachelor's degree in applied science with at least 16 semester hours in general microbiology and biology An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years of relevant experience

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Technical / Department Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 Training

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All
Ethics – New Hires	1 week of hire	All
Ethics – Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics violations). This information is maintained in the employee's secured personnel file.

Evidence of successful training could include such items as:

- Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.
- Analysts knowledge to refer to QA Manual for quality issues.
- Analysts following SOPs, i.e., practice matches SOPs.
- Analysts regularly communicate to supervisors and QA if SOPs need revision, rather than waiting for auditors to find problems.

Further details of the laboratory's training program are described in the Laboratory Training SOP PE-QAD-008 Personnel Certification and Training.

17.4 Data Integrity and Ethics Training Program

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire followed by technical data integrity training within 30 days, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy (Policy No. CW-L-P-004) and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics Statement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.
Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18. ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

18.1 Overview

The laboratory is a 24,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc., OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, microbiological sample analysis, and administrative functions.

18.2 Environment

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity, voltage, temperature, and vibration levels in the laboratory.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 Work Areas

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Microbiological culture handling and sample incubation areas.
- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory. Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

Refer to the following documents and procedures for specific requirements for microbiological laboratory facility requirements.

- Standard Methods, 20th Ed., 9020B, Sec. 2
- TNI V1M5, 1.7.3.7.a
- EPA Manual for the Certification of Laboratories Analyzing Drinking Water, 5th Edition

18.4 Floor Plan

A floor plan can be found in Appendix 1.

18.5 Building Security

Magnetic building keys and alarm codes are distributed to employees as necessary.

Visitors to the laboratory sign in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contain requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed. Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19. TEST METHODS AND METHOD VALIDATION

19.1 Overview

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 Standard Operating Procedures (SOPS)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to TestAmerica's Corporate SOP entitled 'Writing a Standard Operating Procedure', No. CW-Q-S-002 or the laboratory's SOP PE-QAD-014 Creation and Maintenance of SOPs.
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water, AIHA-LAP, LLC Fields of Testing/Methods and DoD SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 Laboratory Methods Manual

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 Selection of Methods

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology, NIOSH and OSHA methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA, NIOSH, OSHA and the state or territory from which the samples were collected. Reference methods include:

- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Analysis and Sampling Procedures; 40CFR Part 136 as amended by Method Update Rule; May 18, 2012*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*
- *Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992. Supplement III EPA/600/R-95/131 - August 1995 (EPA 500 Series) (EPA 500 Series methods)*
- *Handbook for Analytical Quality Control in Water and Wastewater Laboratories, EPA 600/4-79-019, EPA, March 1979.*
- *Technical Notes on Drinking Water Methods, EPA-600/R94-173, October 1994*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th 22nd and online edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*

- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008;Final Update V, August 2015 .*
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005)*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*
- *NIOSH Manual of Analytical Methods (NMAM®), 4th ed.*
- *DHHS (NIOSH) Publication 94-113 (August, 1994), 1st Supplement Publication 96-135, 2nd Supplement Publication 98-119,3rd Supplement 2003-154 Schlecht, P.C. & O'Connor, P.F. (**pfo1@cdc.gov**), Eds.*
- *Index of Sampling & Analytical Methods, U.S. Department of Labor, Occupational Safety & Health Administration, Revision Date: 21 November 2001.*
- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, EPA-625/R96/010b, January 1999.*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

A demonstration of capability (DOC, Lab SOP PE-QAD-015 Demonstration of Capability is performed whenever there is a change in instrument type (e.g., new instrumentation), matrix, method or personnel (e.g., analyst hasn't performed the test within the last 12 months).

Note: The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for

all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.

The initial demonstration of capability must be thoroughly documented and approved by the Technical / Department Manager and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures.

The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct an MDL study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*

19.4.3 <u>Initial Demonstration of Capability (IDOC) Procedures</u>

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or the laboratory SOP.

19.4.3.3 At least four aliquots shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (refer to Figure 19-1) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

Methods on line prior to the effective date of this Section shall be updated to the procedures outlined above as new analysts perform their demonstration of capability. A copy of the new record will replace that which was used for documentation in the past. At a minimum, the precision and accuracy of four mid-level laboratory control samples must have been compared to the laboratory's quality control acceptance limits.

19.5 Laboratory Developed Methods and Non-Standard Methods

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 Validation of Methods

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 .Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range

Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 Method Detection Limits (MDL) / Limits of Detection (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value can be differentiated from blanks. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements. Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. Drinking Water method MDLs must be analyzed over a period of 3 or more days.

Refer to the Corporate SOP No. CA-Q-S-006 or the laboratory's SOP PE-QAD-019 Determination of Method Detection Limits and Reporting Limits.

19.8 Instrument Detection Limits (IDL)

The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

If IDL is > than the MDL, it may be used as the reported MDL.

19.9 Verification of Detection and Reporting Limits

Once an MDL is established, it must be verified, on each instrument, by analyzing a quality control sample (prepared as a sample) at no more than 3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, Atomic Absorption, etc.) and no more than 4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL does not verify, then the lab will not report to the MDL, or redevelop their MDL or use the level where qualitative identification is established. MDLs must be verified at least annually

When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 times the reporting limit and annually thereafter. The annual requirement is waived for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirements.

19.10 Retention Time Windows

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specific in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analytes retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes. Complete details are available in the laboratory SOPs.

19.11 Evaluation of Selectivity

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, spectrochemical, atomic absorption or fluorescence profiles, co-precipitation evaluations and specific electrode response factors.

19.12 Estimation of Uncertainty of Measurement

19.12.1 Uncertainty is “a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand” (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result’s validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an “expanded uncertainty”: the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent uncertainties at approximately the 95% confidence level with a coverage factor of k = 2. As an example, for a reported result of 1.0 mg/L with an LCS recovery range of 50 to 150%, the estimated uncertainty in the result would be 1.0 ± 0.5 mg/L.

19.12.5 In the case where a well-recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g., 524.2, 525, etc.) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 Sample Reanalysis Guidelines

Because there is a certain level of uncertainty with any analytical measurement, a sample re-preparation (where appropriate) and subsequent analysis (hereafter referred to as 'reanalysis') may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. **Client specific Contractual Terms & Conditions for reanalysis protocols may supersede the following items.**

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Area Supervisor or Laboratory Director if unsure.

19.14 Control of Data

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. More detail is outlined in SOP PE-ADM-001 Computer Security**.** The laboratory is currently running TALS which is a custom in-house developed LIMS system that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS for the remainder of this section. The LIMS utilizes SQL Server which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 Maintain the Database Integrity: Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.14.1.2 Ensure Information Availability: Protection against loss of information or service is **Computer and Electronic Data Related Requirements**

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.14.1.3 Maintain Confidentiality: Ensure data confidentiality through physical access controls such as password protection or website access approval when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS. The spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP No. CA-Q-S-002, *Acceptable Manual Integration Practices.*

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained in the worklist folder, computer file (if appropriate), and/or run log. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1**%.** Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, results are reported to 2 significant figures on the final report.

19.14.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-

matched compounds. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument's printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained with the data file. The data file is stored in a monthly folder on the instrument computer; periodically, this file is transferred to the server and, eventually, to a tape file.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.).

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be "Z"'d out, signed and dated.
- Worksheets are created with the approval of the Technical /Department Manager and QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

Review procedures are outlined in the following SOPs to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported:

- PE-QAD-024 Data Review
- PE-SMP-001 Sample Control
- PE-QAD-006 Laboratory Documentation
- PE-QAD-007 Non-Conformance and Corrective Actions
- PE-QAD-022 Good Calibration Practices

The laboratory also has an SOP discussing Manual Integrations to ensure the authenticity of the data (SOP PE-QAD-009 Manual Integration / Data Integrity). The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 Login Review - The data review process starts at the sample receipt stage. Sample control personnel review chain-of-custody forms and project instructions from the project management group. This is the basis of the sample information and analytical instructions entered into the LIMS. The log-in instructions are reviewed by the personnel entering the information, and a second level review is conducted by the project management staff

19.14.4.2 First Level Data Review - The next level of data review occurs with the analysts. As data are generated, analysts review their work to ensure that the results meet project and SOP requirements. First level reviews include inspection of all raw data (e.g., instrument output for continuous analyzers, chromatograms, spectra, and manual

integrations), evaluation of calibration/calibration verification data in the day's analytical run, evaluation of QC data, and reliability of sample results. The analyst transfers data into LIMS, data qualifiers are added as needed. All first level reviews are documented.

19.14.4.3 Second Level Data Review – All analytical data are subject to review by a second qualified analyst or supervisor. Second level reviews include inspection of all raw data (e.g., instrument output, chromatograms, and spectra) including 100% of data associated with any changes made by the primary analyst, such as manual integrations or reassignment of peaks to different analytes, or elimination of false negative analytes. The second review also includes evaluation of initial calibration/calibration verification data in the day's analytical run, evaluation of QC data, reliability of sample results, qualifiers and NCM narratives. Manual calculations are checked in second level review. All second level reviews are documented.

Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.4.4 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Director/Manager, Department Manager for further investigation. Corrective action is initiated whenever necessary.

19.14.4.5 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.4.6 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met. The Project Manager may also evaluate the validity of results for different test methods given expected chemical relationships

19.14.4.7 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project

Manager then signs the final report. The Project Manager is the designee for the Technical Manager for all Industrial Hygiene reports. The accounting personnel also check the report for any clerical or invoicing errors. When complete, the report is sent out to the client.

19.14.4.8 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 19-2.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica's Corporate SOP (CA-Q-S-002) as the guideline.

19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principles and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale "after" chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale "before" chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1. Example - Demonstration of Capability Documentation

TestAmerica Laboratories, Inc.
Demonstration of Capability
Authorization/Certification Statement

Date:

Laboratory Name/Address: TestAmerica Laboratories, Inc., 4625 East Cotton Center Boulevard, Suite 189, Phoenix, AZ 85040

Analyst Name: Matrix: Media Type:

Method Number: SOP / Rev No.:

Analyte, or Class of Analytes or Measured Parameters:

We, the undersigned, CERTIFY that:

1. The analyst identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program and/or the American Industrial Hygiene Association (AIHA) Accreditation Program, has met the Demonstration of Capability and is authorized to perform the above named analysis on the date listed.
2. The test method(s) was performed by the analyst identified on this certification.
3. A copy of the test method(s) and the SOP(s) are available for all personnel on-site.
4. The data associated with the demonstration of capability are true, accurate, and complete.
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well-organized and available for review by authorized assessors.

ORELAP - Demonstrated by (Select one):

- ☐ **IDOC**
- ☐ 4 consecutive LCS / LCSD
- ☐ 4 Consecutive QCS
- ☐ **CDOC** (NELAC annually)
- ☐ 2 batches (LCS / LCSD)
- ☐ Acceptable PT/Work Order ID: ____
- ☐ Side by Side Analysis/Supervisor Approval – no spike is available

IHLAP - Demonstrated by (Select one):

- ☐ **IDOC**
- ☐ 4 consecutive LCS / LCSD
- ☐ Desorption Efficiency Study
- ☐ **CDOC** (every 6 months)
- ☐ 4 consecutive LCS / LCSD
- ☐ 2 batches (LCS / LCSD)
- ☐ Desorption Efficiency Study
- ☐ Acceptable PT/Work Order ID:

ELLAP - Demonstrated by (Select one):

- ☐ **IDOC**
- ☐ 4 sets of 5 varied amts per matrix
- ☐ **CDOC** (every 6 months)
- ☐ 2 batches (LCS / LCSD)
- ☐ Acceptable PT/Work Order ID: ____

IHLAP/ORELAP/ELLAP Annual Requirements

- ☐ RLV (Annual IH Requirement)
- ☐ MDL / MDLV (Circle one)

Analyst Supervisor Name and Title	Signature	Date
Quality Assurance Officer's Name	Signature	Date

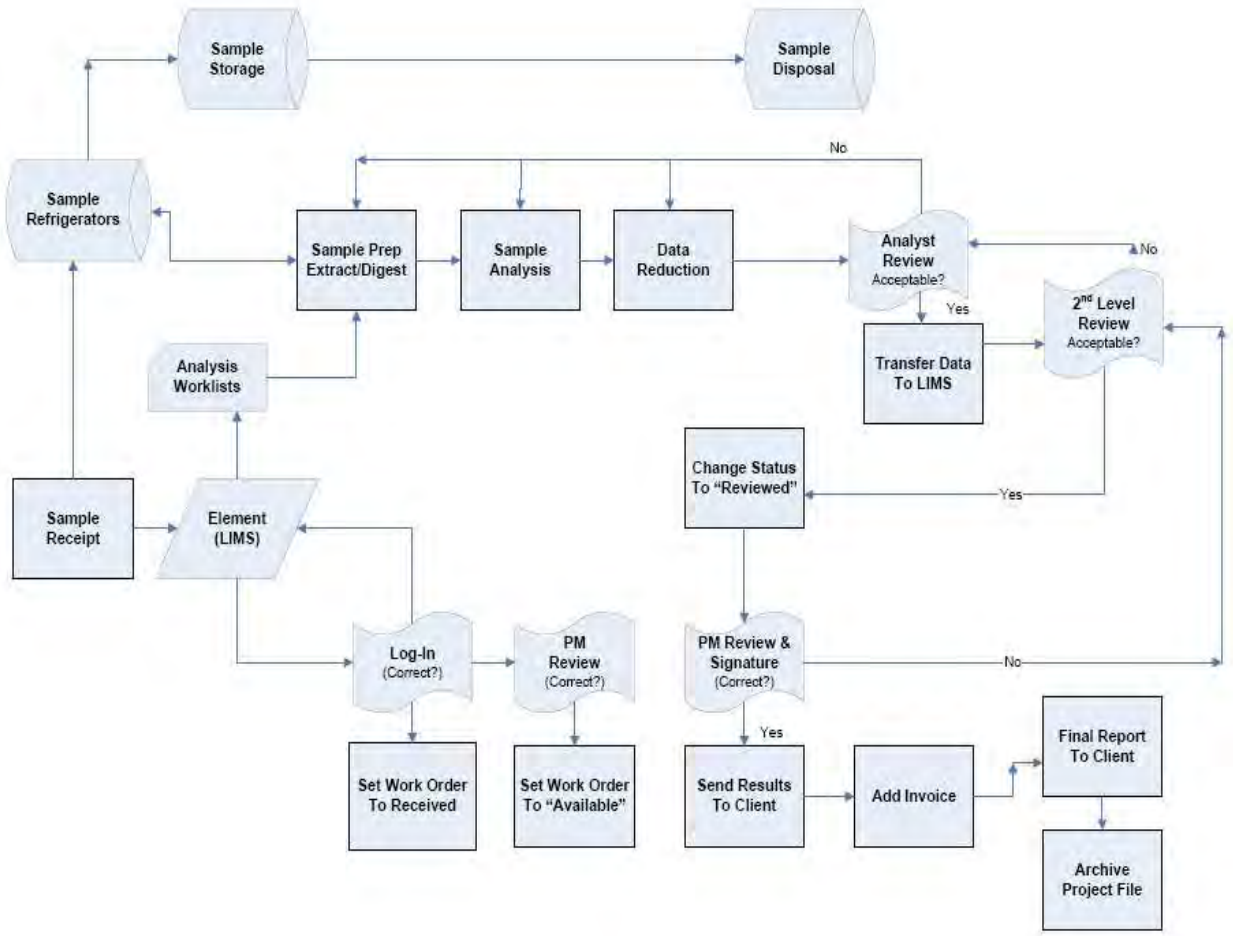
This certification form must be completed each time a NELAC and/or AIHA demonstration of capability study is completed.

True: Consistent with supporting data.
Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.
Complete: Includes the results of all performance testing.

Comments:

PX-QAD-005H-01/15

Figure 19-2. Example: Work Flow



SECTION 20. EQUIPMENT and CALIBRATIONS

20.1 Overview

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in the Corporate SOP CA-Q-S-005 Calibration Curves (General), laboratory SOPs and in SOP PE-QAD-022 Good Calibration Procedures.. A list of laboratory instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturer's instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 Preventive Maintenance

The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

Routine preventive maintenance procedures and frequency, such as cleaning and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

Table 20-2 lists examples of scheduled routine maintenance. It is the responsibility of each Technical / Department Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may be / are also outlined in analytical SOPs or instrument manuals. (Note: for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

- Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.
- Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or

instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrument records.

- When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out-of-service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Transportation and packaging will be based on manufacturers' recommendations. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back-up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

At a minimum, if an instrument is sent out for service or transferred to another facility, it must be recalibrated and the laboratory MDL verified (using an MDLV) prior to return to lab operations.

20.3 Support Equipment

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, field sampling devices, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or

other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains “calibration only” ASTM type 1 weights).
All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file. For additional information, reference laboratory SOP PE-QAD-016 Balance Calibration and Documentation.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one µmhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer.

- If the temperature measuring device is used over a range of 10℃ or less, then a single point verification within the range of use is acceptable;
- If the temperature measuring device is used over a range of greater than 10℃, then the verification must bracket the range of use.

IR thermometers, digital probes and thermocouples are calibrated quarterly. IR Thermometers should be calibrated over the full range of use, including ambient, iced (4°C) and frozen (0°C to -5°C), per the Drinking Water Manual.

The mercury and digital NIST thermometer is recalibrated every five years (mercury) and one year (digital) (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer(s) have increments of 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories), and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in log sheets. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in LIMS, instrument or method-specific logbooks or log sheets. More information on this subject can be found in the SOP PE-QAD-004 Thermometer Verification.

20.3.4 Refrigerators/Freezer Units, Water baths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day. All of this information is documented in Daily Temperature Log sheets located in the QA office or in the Microbiology laboratory

Ovens, water baths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens water baths, and incubators can be found in method specific SOPs.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware and Glass microliter syringes) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis.

For those dispensers that are not used for analytical measurements, a label is / can be applied to the device stating that it is not calibrated. Any device not regularly verified cannot be used for any quantitative measurements.

Refer to SOP PE-QAD-002 Dispensing Device Verification for more information.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy.

20.3.6 Field Sampling Devices (Auto Samplers)

Each Auto Sampler is assigned a unique identification number in order to keep track of the calibration. This number is also recorded on the sampling documentation.

The Auto Sampler is calibrated monthly by setting the sample volume to 100ml and recording the volume received. The results are filed in a logbook/binder. The Auto Sampler is programmed to run three (3) cycles and each of the three cycles is measured into a graduated cylinder to verify 100ml are received.

If the RSD (Relative Standard Deviation) between the 3 cycles is greater than 10%, the procedure is repeated and if the result is still greater than 10%, then the Auto Sampler is taken out of service

until it is repaired and calibration verification criteria can be met. The results of this check are kept in a logbook/binder.

20.4 Instrument Calibrations

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12).

Note: Instruments are calibrated initially and as needed after that and at least annually ***(the annual requirement does not apply to Isotope dilution).***

20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points will be used.

Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exceptions to these

rules are ICP and ICPMS methods which define the working range with periodic linear dynamic range studies, rather than through the range of concentrations of daily calibration standards.
Per AIHA-LAP,LLC calibration or working quantification ranges shall encompass the concentration reported by the laboratory. Continuing calibration verification standards and continuing calibration blanks shall be analyzed in accordance with the specified test methods. Acceptance criteria shall be documented.

All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst at a different time or a different preparation would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.1.1 Calibration Verification

The calibration relationship established during the initial calibration must be verified initially and at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and in the 2009 TNI Standard and AIHA-LAP Industrial Hygiene Laboratory Accreditation Program (IHLAP). The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

Note: The process of calibration verification referred to here is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met, i.e., RPD, per 2009 TNI Std. EL-V1M4 Sec. 1.7.2.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Note: If an internal standard calibration is being used then bracketing calibration verification standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the

analysis of the last sample, QC, or standard that can be injected within 12-hours of the beginning of the shift.

A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements see specific SOPs. Most Inorganic methods require the CCV to be analyzed after ever 10 samples or injections, including matrix or batch QC samples.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed & documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable calibration verification may be fully useable under the following special conditions: **and reported based upon discussion and approval of the client:**

a). when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a footnote or case narrative explaining the high bias. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b). when the acceptance criteria for the CCV are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.

Samples reported by the 2 conditions identified above will be appropriately flagged.

20.4.1.2 Verification of Linear and Non-Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs. Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been

verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.

20.5 Tentatively Identified Compounds (TICs) – GC/MS Analysis

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

20.6 GC/MS Tuning

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1. Example: Instrumentation List

Equipment/ Instrument	Manufacturer	Model Number	Serial Number	Year Put into Service	Condition When Received
GCMS 1					
Gas Chromatograph	Hewlett Packard	6890	US00007754		
Mass Spectrometer	Agilent	5973	US70810388	1997	-
P&T Concentrator	OI	4560	K709460895		
Autosampler	Varian	Archon	13624		
GCMS 2					
Gas Chromatograph	Hewlett Packard	5890	3033A30276		
Mass Spectrometer	Hewlett Packard	5971	2950A00789	2001	-
P&T Concentrator	OI	4560	224071		
Autosampler	OI	Archon	13559		
GCMS 4					
Gas Chromatograph	Hewlett Packard	5890	3240G18320		
Mass Spectrometer	Hewlett Packard	5971	3234A04143	2001	-
P&T Concentrator	OI	4560	N124460502		
Autosampler	OI	Archon	13025		
GCMS 7					
Gas Chromatograph	Agilent	5890	3133A37877		
Mass Spectrometer	Agilent	5972	3307A00428	--	-
P&T Concentrator	OI	4560	H405460197		
Autosampler	Varian	Archon	13472		
GCMS 9					
Gas Chromatograph	Hewlett Packard	5890			
Mass Spectrometer	Hewlett Packard	5972	3459A03207	--	-
P&T Concentrator	OI Analytical	4560	J619460894		
Autosampler	OI	Archon 4552	14623		
GCMS12					
Gas Chromatograph	Agilent	G1530A	US00040094		
Mass Spectrometer	Agilent	G2578A	US21853018	2000	--
ALS Tower	Agilent	G2613A	US93909504		
ALS Tray	Agilent	G2614A	US92905661		
GCMS 13					
Gas Chromatograph	Hewlett Packard	5890	3336A60504		
Mass Spectrometer	Hewlett Packard	5972	3524A03129	--	-
P&T Concentrator	OI	4660	D611466185P		
Autosampler	EST	Centurion	CENTS120100709		
GCMS15					
Gas Chromatograph	Agilent	6890	US00036050		
Mass Spectrometer	Agilent	5973	US01140157	2013	Used
P&T Concentrator	OI	4660	D546466949P		
Autosampler	OI	Archon 4552	13818		
GCMS16					
Gas Chromatograph	Hewlett Packard	G1530A	US00008316		
Mass Spectrometer	Agilent	G1099A	US82322366		
342 Gauge Controller	Granville-Phillips	342022	1861	2013	Used
Injector	Hewlett Packard	18593B	3304A33716		
Tray Module	Hewlett Packard	18593B	3315A21827		
Controller Box	Agilent	G1512A	US70600901		
GCMS 17					
Gas Chromatograph	Agilent	6890	US00028232		
Mass Spectrometer	Agilent	5973	US91422448		
P&T Concentrator	OI	4660 Eclipse	OIC4660PnT2003-34		
Autosampler	Varian	Archon	12276		

Equipment/ Instrument	Manufacturer	Model Number	Serial Number	Year Put into Service	Condition When Received
GC 3 Gas Chromatograph 3 Linkbox ALS Concentrator PID Lam Power Source ECD/PID	 Agilent OI Analytical EST Analytical EST Analytical OI Analytical OI Analytical	 5890 Series II 600 Series CentWS Encon EV 4430 NA	 3336A51039 5192110120 CENTS138022210 EV239012910 B348430309 NA	 1995 2010 1995 	
GC 4 Gas Chromatograph 4 Concentrator ALS PID Lamp Power Source ECD/PID	 Agilent OI Analytical OI Analytical OI Analytical OI Analytical	 5890 Series II 4560 MPM16 4430 NA	 2950A26451 D309335 91-369 91-171 NA	1995	
GC 5 Gas Chromatograph 5 ALS Tower ALS Tray Controller Box FID MACH MACH Power Box	 Agilent Agilent Agilent Agilent Agilent Agilent (former RVM Scientific Agilent	 5890 18593B 18596M 18594B NA NA LTMA58/A68PS	 2643A9891 3042A23537 3251A30857 3239A30053 NA NA G E-01	 1990 2005	 --
GC 7 *(shared with IH)* Gas Chromatograph 7 ALS Tower ALS Tray u-ECD1 u-ECD2	 Agilent Agilent Agilent Agilent Agilent	 6890 G2613 G2614A G2397A G2397A	 US00000197 CN33832614 US91605057 U1290 U6313	2003	--
GC 9 Controller Autosampler Injector GC w/ FID Detector	 Agilent	 7673 18596 B 7673 5890 Series II	 3251A30932 3334A32981 3120A26800 3118A35369	--	--
GC 12 Gas Chromatograph 12 ALS Tower ALS Tray Controller Box u-ECD1 u-ECD2	 Agilent Agilent Agilent Agilent Agilent Agilent	 6890 G1513A 18596M G1512A G2397A G2397A	 US00001438 US05012072 US30608322 3530A02441 U2666 U0495	1997	
GC 13 Controller Injector GC w/ FID and TCD Detectors	 Agilent	 7673 7673 5890 Series II	 3113A25897 3048A24489 3140A38303	--	--
GC 14 Controller Autosampler Injector GC w/ dual FID Detectors	 Agilent	 7673 18596 B 7673 5890 Series II	 3007A20952 3201A27340 3237A32148 3140A39271	--	--

Equipment/ Instrument	Manufacturer	Model Number	Serial Number	Year Put into Service	Condition When Received
HPLC 2 HPLC 1100 ALS DEGASSER QUAD PUMP COL COM FLD Dual-DAD	Agilent	G1313A G1322A G1311A G1316A G1321A G1315B	DE91610196 JP73020320 DE11114347 DE91612722 DE92001665 DE11112225	--	--
HPLC 3 ALS COL COM FLD Dual-DAD DEGASSER QUAD PUMP	Agilent Agilent Agilent Agilent Agilent Agilent	G131A G1316A G1321A G1315B G1379A G1311A	DE23922078 DE23930798 DE92001260 DE30518838 JP13205067 DE23920683	2004 2009 2004	New
HPLC 4 HPLC 1100 ALS LCQ Advantage MS w/ DAD Fluorescence Detectors	Agilent Thermo – Finnigan Thermo - Finnigan	G1313A G1322A G1311A G1316A G1321A G1315A LCQADV	DE11115352 JP05029135 DE91608229 DE11120753 DE11103117 DE91607422 LAD00192	--	--
ICP 02 *(Shared with IH)*	Perkin Elmer	5300DV	077N6041401	2006	New
ICP 03 *(Shared with IH)*	Perkin Elmer	5300DV	077C7070202	2006	New
ICP/MS 03 *(Shared with IH)*	Agilent	G8403A	USH2943259	2014	New
Mercury Analyzer 03 *(Shared with IH)*	Perkin Elmer	FIMS 100	101S4080502	2004	New
Mercury Analyzer 02	Perkin Elmer	FIMS 400	135951	2000	--
AA1 Flame AA	Varian	Spectra AA/Spectrometer 220FS	E10307666	2012	Used
IC 2 Ion Chromatograph Interface AS-40 Autosampler	Dionex PE Nelson Dionex	DX-120 900 AS-40	97070800 1036512763 94120305	-- -- --	Used
IC 3 Ion Chromatograph 3 Autosampler	Dionex Dionex	ICS1000 AS40	04050018 95090256	2004 1995	New --
IC 4 Ion Chromatograph 4 Autosampler	Dionex Dionex	ICS2000 AS40	05090476 05090256	2005 2005	New New
IC 5 Ion Chromatograph 5 Autosampler	Dionex Dionex	ICS2000 AS40	04050699 94110334	2006 1994	New --
IC 6 Ion Chromatograph 6 Autosampler	Dionex Dionex	ICS2000 AS40	07020086 04040861	2007 2004	New New

Equipment/ Instrument	Manufacturer	Model Number	Serial Number	Year Put into Service	Condition When Received
IC 7					
Ion Chromatograph 7		ICS 3000	--	2008	New
Pump		ICS 3000	08050969	2008	New
TC	Dionex	ICS 3000	08041101	2008	New
VWD		ICS 3000	08050957	2008	New
Pneumatic Controller		PC-10	063334	2008	New
Autosampler		AS-40	08051080	2008	New
IC 8					
Ion Chromatograph 8	Dionex	ICS-1500	8020607	2013	New
Detector	Dionex	DS6	8020456		New
Autosampler	Dionex	AS40-1	94110334		
PC Titrator 1					
PC Titrate Interface Module	ManTech	PC-1000-102/4	MS-0A4-357	2003	New
Titra-Sip Titration Module	ManTech	PC-1300-475	MS-0D4-634	2003	New
Burivar I/2 Buret Module	ManTech	PC-1104-00	MS-9B9-399	2003	New
Titra-Rinse/A Module	ManTech	PC-1000-408	MS-0J3-167	2003	New
Conductivity Meter	Jenway	4510	1106	2003	New
Autosampler	ManTech	--	270J3XB590	2003	New
PC Titrator 2					
Titra-Sip SA Interface Module	ManTech	PC-1075-00	MS-1H0-105	2010	New
Titra-Sip Titration Module	ManTech	PC-1300-475	MS-1F0-817	2010	New
Titra-Rinse/A Module	ManTech	PCM-1000-470	MS-0F4-191	2010	New
Titra-Rinse/A Module	ManTech	PCM-1000-400	MS-0J2-535	2010	New
Autosampler	ManTech	PC-1000-681	190A3032	2010	New
BOD Auto-Analyzer					
Interface Module	ManTech	PC-1085-00	MS-1B0-136	2010	New
Titra-Rinse/A Module	ManTech	PC-1000-480	MS-0F5-243	2010	New
Titra-Rinse/A Module	ManTech	PC-1000-443	MS-1A0-111	2010	New
Sensor &Stirrer Control	ManTech	PB-10030	MS-1B0-106	2010	New
Inhibitor Pump	ManTech	PC-1000-475	MS-1B0-118	2010	New
Rinse Pump	ManTech	PC-1000-470	MS-1B0-113	2010	New
Dissolved Oxygen Meter 2	YSI	52CE	03J0616	2003	New
Autosampler	ManTech	PBM-1000-688	260A8N025	2010	New
Total Organic Carbon Analyzer	Shimadzu	TOC-V-CSH	40D91227	2002	--
Autosampler	Shimadzu	ASI-V	H52104100104	2002	--
UV-Vis Spectrophotometer 02 *(IH)*	Turner	830	1102980604474	2003	New
UV-Vis Spectrophotometer 06	Varian	Cary-50	EL0702-3401	2013	New
UV-Vis Spectrophotometer 06	Hach	DR 2800	1342969	8/19/13	New
Turbidimeter 04	HF Scientific	Micro-100	200702190	2007	New
Turbidimeter 05	HACH	2100AN	08080C21392	2015	Used
Dissolved Oxygen Meter	YSI	5000	99D0533	--	--
pH / ISE Meter 3	Thermo/Orion	710	060237	--	--
pH / ISE Meter 5	Orion	420A	24440	--	--
pH / ISE Meter 6	Orion	410A	060724	--	--
pH / ISE Meter 11	Thermo Orion	Orion Star A211	X04323	2012	New
TKN Digestion System 1					
Block	Aim Lab	AIM600	4904A14055	2008	New
Controller	Aim Lab	AIM 600	4906A14087	2008	New

Equipment/ Instrument	Manufacturer	Model Number	Serial Number	Year Put into Service	Condition When Received
TKN Digestion System 2 Block Controller	 Aim Lab Aim Lab	 AIM600 AIM 600	 5146U00552 5146U00553	 2015 2015	 New New
FS3100 Automated Chemistry Analyzer 3090 Auto Sampler Multichannel High Precision Peristaltic Pump	 OI Analytical OI Analytical OI Analytical	 322689 ASX 1360 IPC-16 Channel	 243831263 091203A130 338769-2	 2012 2012 2012	 New New New

Table 20-2. Example: Schedule of Routine Maintenance

Instrument	Procedure	Frequency
Mercury Analyzer	Check tubing for wear Fill rinse tank with 10% HCl Insert clean drying tube filled with Magnesium Perchlorate Fill reductant bottle with 10% Stannous Chloride	Daily Daily Daily Daily
ICP	Check pump tubing Check liquid argon supply Check fluid level in waste container Check filters Clean or replace filters Check torch Check sample spray chamber for debris Clean and align nebulizer Check entrance slit for debris Change printer ribbon Replace pump tubing	Daily Daily Daily Weekly As required Daily Monthly Monthly Monthly As required As required
ICP MS	Change pump tubing Clean torch Check / clean nebulizer Clean cones Check air filters Check multiplier voltages & do cross calibration Replace sample uptake tubing Check rotary pump oil Check oil mist filters Check chiller water level	Weekly Weekly Weekly Daily Weekly Weekly Monthly Monthly Monthly Monthly
UV-Vis Spectrophotometer	Clean ambient flow cell Precision check/alignment of flow cell Wavelength verification check	As required As required Semi-annually
Auto Analyzers	Clean sampler Check all tubing Clean inside of colorimeter Clean pump well and pump rollers Clean wash fluid receptacle Oil rollers/chains/side rails Clean optics and cells	Daily Daily Daily Quarterly Weekly Weekly Quarterly

Instrument	Procedure	Frequency
Hewlett Packard GC/MS	Ion gauge tube degassing Pump oil-level check Pump oil changing Analyzer bake-out Analyzer cleaning Resolution adjustment COMPUTER SYSTEM AND PRINTER: Air filter cleaning Change data system air filter Printer head carriage lubrication Paper sprocket cleaning Drive belt lubrication	As required Monthly Annually As required As required As required As required As required As required As required As required
Gas Chromatograph	Compare standard response to previous day or since last initial calibration Check carrier gas flow rate in column Check temp. of detector, inlet, column oven Septum replacement Check system for gas leaks with SNOOP Check for loose/frayed wires and insulation ½"Bake injector/column Change/remove sections of guard column Replace connectors/liners Change/replace column(s)	Daily Daily via use of known compound retention Daily As required W/cylinder change as required Monthly As Required As Required As Required As Required
Electron Capture Detector (ECD)	Detector wipe test (Ni-63) Detector cleaning	Semi-annually As required
Flame Ionization Detector (FID)	Detector cleaning	As required
Flame Photoionization Detector (FPD)	Clean and/or Replace Lamp	As required
Photoionization Detector (PID)	Change O-rings Clean lamp window	As required As required
HPLC	Change guard columns Change lamps Change pump seals Replace tubing Change fuses in power supply Filter all samples Change autosampler rotor/stator	As required As required Semi-annually or as required As required As required Daily As required
Balances	Class "S" traceable weight check Clean pan and check if level Field service	Daily, when used Daily At least Annually
Conductivity Meter	0.01M KCl calibration Conductivity cell cleaning	Daily As required
Turbidimeter	Check light bulb	Daily, when used

Instrument	Procedure	Frequency
Deionized/Distilled Water	Conductivity Point Sources Daily conductivity check Check deionizer light Monitor for VOA's System cleaning Replace cartridge & large mixed bed resins	Water Quality Daily Daily As required As required
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As required
Refrigerators/ Freezers	Temperature monitoring Temperature adjustment Defrosting/cleaning	Daily As required As required
Vacuum Pumps/ Air Compressor	Drained Belts checked Lubricated	As required As required Semi-annually
pH/Specific Ion Meter	Calibration/check slope Clean electrode	Daily As required
BOD Incubator	Temperature monitoring Coil and incubator cleaning	Daily Monthly
Water baths	Temperature monitoring Water replaced	Daily Monthly or as needed

SECTION 21. MEASUREMENT TRACEABILITY

21.1 Overview

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware and Glass microliter syringes, quarterly accuracy checks are performed for all mechanical volumetric devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware and Glass microliter syringes should be routinely inspected for chips, acid etching or deformity (e.g., bent needle). If the Class A glassware or syringe is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-Traceable Weights and Thermometers

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), or another accreditation organization that is a signatory to a

MRA (Mutual Recognition Arrangement) of one or more of the following cooperations – ILAC (International Laboratory Accreditation Cooperation) or APLAC (Asia–Pacific Laboratory Accreditation Cooperation). A calibration certificate and scope of accreditation is kept on file at the laboratory.

21.3 Reference Standards / Materials

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared reference standards, to the extent available, are purchased from vendors that are accredited to ISO Guide 34 and / or ISO/IEC Guide 17025. All reference standards from commercial vendors shall be accompanied with a certificate that includes at least the following information:

- Manufacturer
- Analytes or parameters calibrated
- Identification or lot number
- Calibration method
- Concentration with associated uncertainties
- Purity

If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health & Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

21.4 Documentation and Labeling of Standards, Reagents, and Reference Materials

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company-wide purchase. [Refer to TestAmerica's Corporate SOP (CA-Q-S-001), Solvent and Acid Lot Testing and Approval.]

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained ***in LIMS.*** Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on receipt, documentation and labeling of laboratory standards, reagents, and reference materials; please refer to SOPs PE-QAD-012 Receipt Process for General Supplies and Chemicals and PE-QAD-013 Reagent and Standard Preparation, Control and Documentation.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material. Blended gas standard cylinders use a nominal concentration if the certified value is within +/-15%, otherwise the certified values is used for the canister concentration.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS system, and are assigned a unique identification number. The following information is typically recorded in the electronic database within the LIMS.

- Standard ID
- Description of Standard
- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID (generated from LIMS)
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be available to the analyst. This information is maintained as part of the applicable method SOP.

21.4.3 In addition, the following information may be helpful:

- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Recommended Storage Conditions
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include an expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and preparation/analytical batch records.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOP.

SECTION 22. SAMPLING

22.1 Overview

The laboratory provides sampling services. Sampling procedures are described in SOP PE-SMP-004 Field Sampling for:

- Groundwater Sampling
- Wastewater Sampling
- Soil Sampling

22.2 Sampling Containers

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Any certificates of cleanliness for bottles and preservatives are provided by the supplier are maintained at the laboratory. Alternatively, the certificates may be maintained by the supplier and available to the laboratory on-line. Additional information is available in SOP PE-SMP-005 Bottle Preparation.

For Industrial Hygiene, at the client's request, sample media and sampling instructions can be provided. Sample media is shipped to the client via a commercial courier service. Sampling instructions, if requested, are shipped to the client with the sample media.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Ammonium Chloride – ACS Grade or equivalent
- Ascorbic Acid – ACS Grade or equivalent
- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- MCAA (Chloroacetic Acid) = ACS Grade or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Sulfite – ACS Grade or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent
- Zinc Acetate – ACS Grade or equivalent

22.2.2 Industrial Hygiene Sampling Equipment

In addition to providing clients with sample media and sampling instructions, the laboratory offers sampling equipment for client loan or rental. Loan and rental equipment includes air sampling pumps, impingers, and cyclones. The air sampling pumps are calibrated according to the procedures outlined in SOP PE-SMP-007 – Calibrating Sampling Pumps.

22.3 Definition of Holding Time

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in "days" (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in "hours" (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. Holding times for analysis include any necessary reanalysis. However, there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is.

22.4 Sampling Containers, Preservation Requirements, Holding Times

The preservation and holding time criteria specified in the laboratory SOPs are derived from the source documents for the methods. If method required holding times or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.4.1 Semi-Volatiles - Holding times for sample preparation for semi-volatile organics are measured from the sampling date (and time where applicable) until the day of (and time where applicable) extraction. If a sample is to be extracted on the day of expiration, the actual time of extraction must be recorded on the sample preparation worksheet. Holding times for analysis are measured from the date (and time where applicable) of initiation of extraction to the time of injection into the instrument.

22.4.2 Volatiles - Holding times for volatile organics are measured from the date (and time where applicable) of sampling to the date and time of injection into the Instrument. The data systems record the start of the analytical run. Extractions, e.g., for high-level soils, must be completed in time to allow for analysis to be initiated within the maximum allowable holding time. Holding time is regulatory program driven.

22.4.3 Inorganics - For inorganic and metals analysis, the preparation/digestion/distillation must be started within the maximum holding time as measured from the sampling date (and time where applicable).

22.5 Sample Aliquots / Subsampling

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines on taking sample aliquots & subsampling are located SOP PE-QAD-003 Sample Homogenization, Sub-sampling and Compositing.

SECTION 23. HANDLING OF SAMPLES

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 Chain of Custody (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to TestAmerica personnel, the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory personnel. The sample collector must assure that each container is in his/her physical possession or in his/her

view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. When sampling personnel deliver the samples through a common carrier (Fed-Ex, UPS), the COC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by lab when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The receipt from the courier is stored in the project folder.

23.1.2 Legal / Evidentiary Chain-of-Custody

If samples are identified for legal/evidentiary purposes, the Project Manager or Sample Control will enter “Legal ICOC” or “LCOC” into the comments section of LIMS. Sample control signs the samples into the secure walk-in refrigerator or freezer. Each time the sample is removed or returned to secure storage it is recorded in LIMS for that sample. Refer to SOP PE-QAD-026 Internal Chain of Custody Procedures for more detailed information.

23.2 Sample Receipt

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

SOP No. PE-SMP-001, Sample Control describes these procedures.

23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on a Notification of Discrepancy form and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):

Example: 550 - 9608 - A - 1

Location ID (3-digit # for your lab) | Login ID | Container Occurrence | Sample Number

The above example states that TestAmerica Phoenix Laboratory (Location 550). Login ID is 9608 (unique to a particular client/job occurrence). The container code indicates it is the first container ("A") of Sample #1.

If the primary container goes through a prep step that creates a "new" container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: 550 - 9608 - A - 1 - **A** ← **Secondary Container Occurrence**

Example: 550-9608-A-1-A, would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.

23.3 Sample Acceptance Policy

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis (Sampling Guide) and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method (Sampling Guide);
- sample holding times must be adhered to (Sampling Guide);
- All samples submitted for water Volatile Organic analyses must have a Trip Blank submitted at the same time;
- the project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

23.3.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.3.2 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or

- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according SOP PE-SMP-001 Sample Control.

23.4 Sample Storage

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators, freezers or protected locations suitable for the sample matrix Aqueous Metal samples and some IH samples are stored unrefrigerated. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. All unused portions of samples, including empty sample containers, are returned to the secure sample control area. All samples are kept in the refrigerators for two to four weeks after analysis, which meets or exceeds most sample holding times. After two to four weeks the samples are moved to dry room temperature, sample archive area where they are stored for an additional four weeks before they are disposed of. This eight week holding period allows samples to be checked if a discrepancy or question arises. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only.

Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 Hazardous Samples and Foreign Soils

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples are stored in an isolated area designated for hazardous waste only. For any sample that is known to be hazardous at the time of receipt or, if after completion of analysis the result exceeds the acceptable regulatory levels, a Hazardous Sample Notice must be completed by the analyst. This form may be completed by Sample Control, Project Managers, or analysts and must be attached to the report. The sample itself is clearly marked with a red stamp, stamped on the sample label reading “HAZARDOUS” or “FOREIGN SOIL” and placed in a colored and/or marked bag to easily identify the sample. The date, log number, lab sample number, and the result or brief description of the hazard are all written on the Hazardous & Foreign Soil Sample Notice. A copy of the form must be included with the original COC and Work Order and the original must be given to the Sample Control Custodian. Analysts will notify Sample Control of any sample determined to be hazardous after completion of analysis by completing a Hazardous Sample Notice. All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm that lab-packs all hazardous samples and removes them from the laboratory. Foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility.

23.6 Sample Shipping

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses (see Note). The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will not analyze the trip blanks that were supplied. However, in the interest of good client service, the laboratory will advise the client at the time of sample receipt that it was noted that they did not request analysis of the trip blank; and, that the laboratory is providing the notification to verify that they are not inadvertently omitting a key part of regulatory compliance testing.

23.7 Sample Disposal

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several

possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP PE-SFT-001 Sample Disposal and Waste Management). All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than two months from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record should be completed.

Figure 23-1. Example: Chain of Custody (COC)

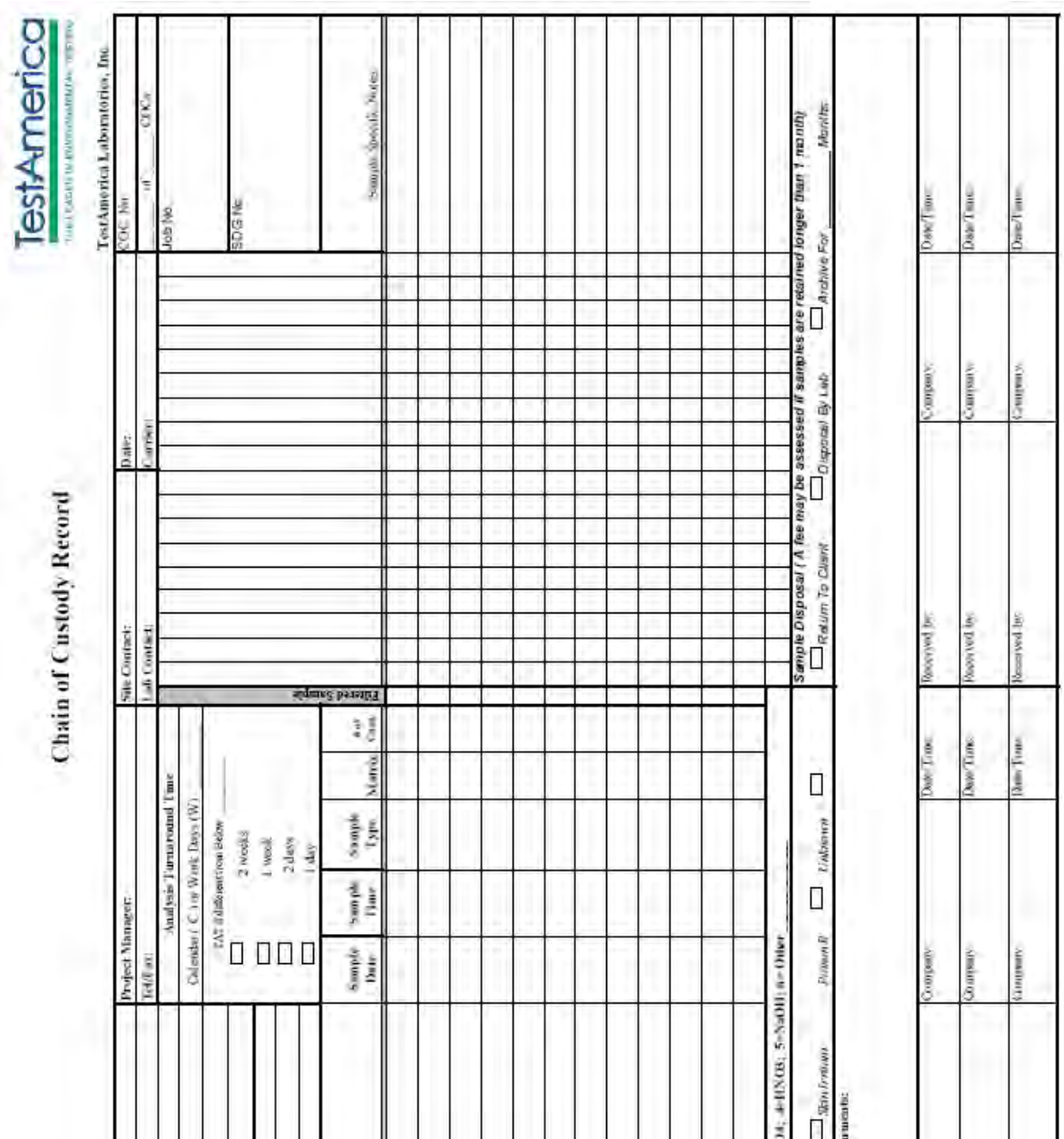


Figure 23-2. Example: Sample Acceptance Policy

All incoming work will be evaluated against the below criteria. Any exceptions will require client authorization for the laboratory to proceed. Where applicable, data from samples that do not meet the criterial will be noted on the laboratory report. Alternatively, sample re-submittal may be required. All information on the Chain of Custody (COC) and sample labels must be legible.

CHAIN OF CUSTODY (COC)

Samples must be accompanies by a completed COC. COCs should contain the following:

- Client name / Project name/number
- Sample ID / Collection Date and Time
- Container / Preservatives
- Matrix (WW, DW etc.)
- Analysis requested
- Requested Turn-around-time (TAT)
- Relinquish Date / Time
- TestAmerica lab project number, if known

SAMPLE LABEL REQUIRMENTS

- Durable label (waterproof) with indelible link
- Unique ID
- Sample collection date and time
- Preservatives

SAMPLE CONTAINER REQUIRMENTS

- Container must include appropriate preservative.
- Sample containers must be intact.
- Sample container must be of adequate size to perform the analysis including any QC requirements.

SAMPLE PRESERVATION REQUIRMENTS

- Samples must be preserved according to the requested method requirements.
- Samples must be within 0-6℃, unless otherwise sti pulated in the method. If samples are hand delivered, they may be considered acceptable if the chilling process has started, but not yet within acceptance criteria. Some exceptions may apply. Contact the appropriate regulatory agency for details.

SAMPLE HOLDING TIME REQUIRMENTS

- Samples must be received within the regulatory holding time and with enough time for sample analysis.
- Field analyses (pH, Dissolved Oxygen, Residual Chlorine) will be analyzed within 24-72 hours of receipt.

TestAmerica may refuse any sample if the sample may pose a health or safety risk during handling or analysis.

SECTION 24. ASSURING THE QUALITY OF TEST RESULTS

24.1 Overview

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. Quality control samples are to be treated in the exact same manner as the associated field samples being tested. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 Controls

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 Negative Controls

Table 24-1. Example – Negative Controls

Control Type	Details
Method Blank (MB)	Are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample.

Table 24-1. Example – Negative Controls

Control Type	Details
Calibration Blanks	Are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.
Instrument Blanks	Are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.
Trip Blank [1]	Are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan). Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	Are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	Are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)
Holding Blanks	Also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.3.1 **Negative Controls for Microbiological Methods** – Microbiological Methods utilize a variety of negative controls throughout the process to ensure that false positive results are not obtained. These controls are critical to the validity of the microbiological analyses. Some of these negative controls are*:*

Table 24-2. Negative Controls for Microbiology

Control Type	Details
Sterility Checks (Media)	Are analyzed for each lot of pre-prepared media, ready-to-use media and for each batch of medium prepared by the laboratory.
Filtration Blanks	Blanks are run at the beginning and end for each sterilized filtration unit used in a filtration series. For pre-sterilized single use funnels a sterility check is performed on at least one funnel per lot.
Sterility checks (Sample Containers)	Are performed on at least one container per lot of purchased, pre-sterilized containers. If containers are prepared and sterilized by the laboratory, one container per sterilization batch is checked. Container sterility checks are performed using non-selective growth media.

Sterility Checks (Dilution Water)	Are performed on each batch of dilution water prepared by the laboratory and on each batch of pre-prepared dilution water. All checks are performed using non-selective growth media.
Sterility Checks (Filters)	Are also performed on at least one filter from each new lot of membrane filters using non-selective growth media.

Negative culture controls demonstrate that a media does not support the growth of non-target organisms and ensures that there is not an atypical positive reaction from the target organisms. Prior to the first use of the media, each lot of pre-prepared selective media or batch of laboratory prepared selective media is analyzed with at least one known negative culture control as appropriate to the method.

24.4 Positive Controls

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) , which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) (Matrix spikes are not applicable to air) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples. For IH Samples, it is generally 1 for each analysis day

If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

- Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.
- Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

24.4.2 Positive Controls for Microbiological Methods *[Remove this section if not doing micro analyses]*

- Each lot of pre-prepared media (including chromofluorogenic reagent) and each batch of laboratory prepared media is tested with a pure culture of known positive reaction.
- In addition, every analytical batch also contains a pure culture of known positive reaction.
- A pure culture of known negative reaction is also tested with each analytical batch to ensure specificity of the procedure.

24.5 Sample Matrix Controls

Table 24-3. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	Used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects. If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	Essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).

Table 24-3. Sample Matrix Control

Control Type	Details	
	Typical Frequency [1]	Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.
[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 Acceptance Criteria (Control Limits)

As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

Laboratory generated % Recovery acceptance (control) limits are generally established by taking ± 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

The following items are for environmental work only. They do not apply to any AIHA-LAP, LLC Field of Testing.

- Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

- In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

- The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.

- The maximum acceptable recovery limit will be 150%.

- The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

- If either the high or low end of the control limit changes by $\leq$ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.1 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. Refer to SOP PE-QAD-001 Control Limits and Statistical Process Control for additional information

24.6.2 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

- The analyte results are below the reporting limit and the LCS is above the upper control limit.

- If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

Or, for TNI work, there are an allowable number of Marginal Exceedances (ME):

<11 analytes	0 marginal exceedances are allowed.
11 – 30 Analytes	1 marginal exceedance is allowed

31-50 Analytes	2 marginal exceedances are allowed
51-70 Analytes	3 marginal exceedances are allowed
71-90 Analytes	4 marginal exceedances are allowed
> 90 Analytes	5 marginal exceedances are allowed

- Marginal exceedances are recovery exceedances between 3 SD and 4 SD from the mean recovery limit (TNI).

- Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken. The laboratory has a system to monitor marginal exceedances to ensure that they are random.

Though marginal exceedances may be allowed, the data must still be qualified to indicate it is outside of the normal limits.

24.6.3 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.4 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 Additional Procedures to Assure Quality Control

The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 15).

A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

- Use of formulae to reduce data is discussed in the method SOPs and in Section 20.
- Selection of appropriate reagents and standards is included in Section 9 and 21.
- A discussion on selectivity of the test is included in Section 5.
- Constant and consistent test conditions are discussed in Section 18.
- The laboratories sample acceptance policy is included in Section 23.

SECTION 25. REPORTING RESULTS

25.1 Overview

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client. Review of reported data is included in Section 19.

25.2 Test Reports

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report) with a "sample results" column header.

25.2.2 Each report cover page printed on company letterhead, which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. work order number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as page # of ##. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.

- Any additional addenda to the report must be treated in a similar fashion so it is a recognizable part of the report and cannot accidentally get separated from the report (e.g., Sampling information).

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc.).

25.2.11 Reporting limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results. Measurement below the reporting limit are reported as < the reporting limit or ND. Results are not reported as"0".

25.2.15 For AIHA-LAP projects, the final report includes the measured quantitative result of the analysis of any blank samples submitted to the laboratory. Additionally, a statement is included that discloses whether on not the sample results have been corrected for contamination based on the field blank or method blank.

25.2.16 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits.

25.2.17 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda).

25.2.18 A statement expressing the validity of the results, that the source methodology was followed and all results were reviewed for error.

25.2.19 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.20 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

25.2.21 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Authorized signatories are appointed by the Manager of Project Managers.

25.2.22 When TNI accreditation is required, the lab shall certify that the test results meet all requirements of TNI or provide reasons and/or justification if they do not.

25.2.23 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.24 When soil samples are analyzed, a specific identification as to whether soils are reported on a “wet weight” or “dry weight” basis.

25.2.25 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.26 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., preliminary report). A complete report must be sent once all of the work has been completed.

25.2.27 Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.28 A Certification Summary Report, where required, will document that, unless otherwise noted, all analytes tested and reported by the laboratory were covered by the noted certifications.

Note: Refer to the Corporate SOP on Electronic Reporting and Signature Policy (No. CA-I-P-002) for details on internally applying electronic signatures of approval.

25.3 Reporting Level or Report Type

The laboratory offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level I is a report with the features described in Section 25.2 above.
- Level II is a Level I report plus summary information, including results for the method blank reported to the laboratory MDL, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. Procedures used to ensure client confidentiality are outlined in Section 25.6.

25.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services in addition to the test report as described in Section 25.2. When NELAP accreditation is required and both a test result and EDD are provided to the client, the official version of the test report will be the combined information of the report and the EDD. TestAmerica Phoenix offers a variety of EDD formats including Excel, ASCII, Dbase, and Access.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 Supplemental Information for Test

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet TNI sample acceptance requirements such as improper container, holding time, or temperature.

Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.5 Environmental Testing Obtained From Subcontractors

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the Corporate SOP on Subcontracting (SOP No. CA-L-S-002).

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of TestAmerica are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

25.6 Client Confidentiality

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore,

information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

This material is intended only for the use of the individual(s) or entity to whom it is addressed and may contain information that is privileged and confidential. It is our policy that facsimiles are intended for and should be used for business purposes only. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this facsimile is strictly prohibited. If you have received this communication in error, please notify the sender. Thank you for your professional consideration and cooperation.

25.7 Format of Reports

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.8 Amendments to Test Reports

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

The revised report is retained on the Archive data server, as is the original report. The revised report is stored in the Archive data server under the sample number followed by "REVISION". The revised report will have the word "revised" or "amended" next to the date rather than the word "Issued" or "Reported".

When the report is re-issued, a notation of "report reissued" is placed on the case narrative/signature page of the report in the Comments or Additional Information section of the Case Narrative with a brief explanation of reason for the re-issue and a reference back to the last final report generated. *For Example*: *Report was revised on 11/3/08 to include toluene in sample NQA1504 per client's request. This final report replaces the final report generated on 10/27/08 at 10:47am.*

25.9 Policies on Client Requests for Amendments

25.9.1 Policy on Data Omissions or Reporting Limit Increases

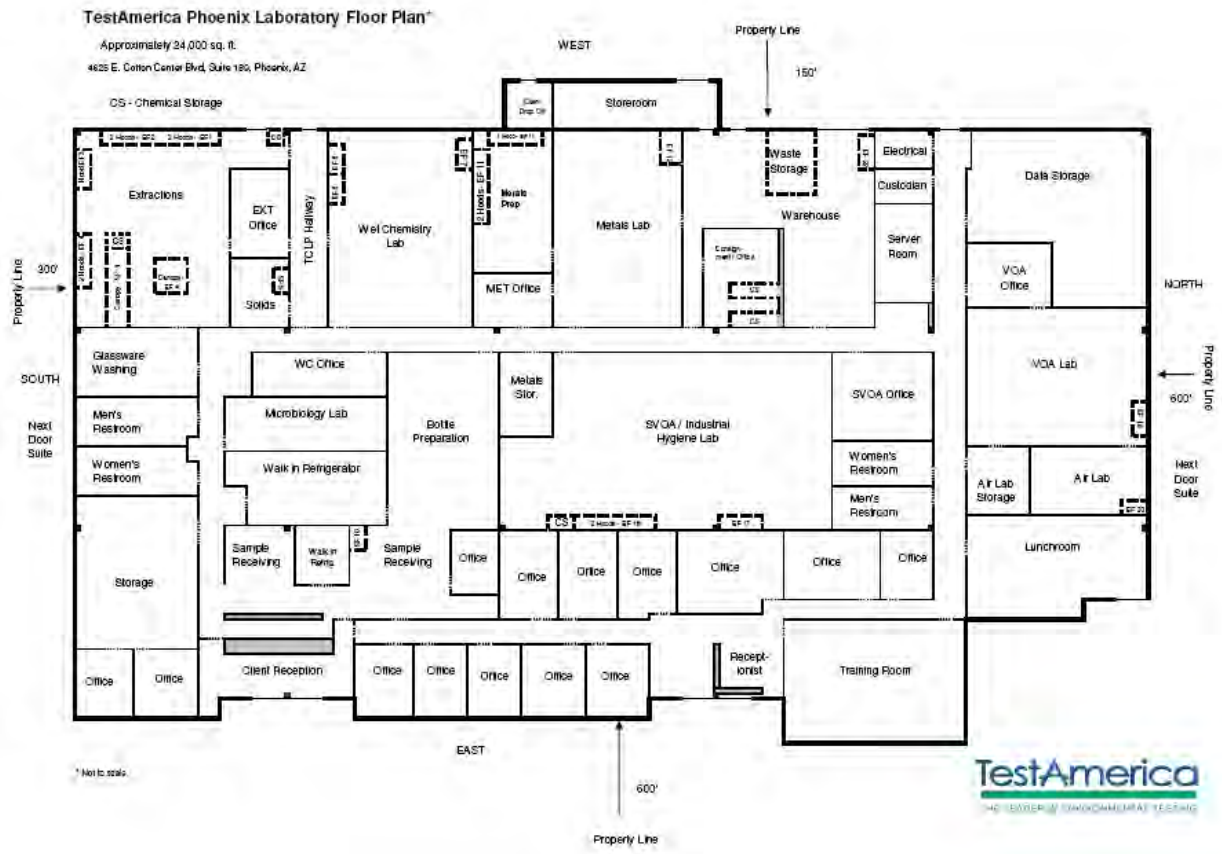
Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

25.9.2 Multiple Reports

TestAmerica does not issue multiple reports for the same work order where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1. Laboratory Floor Plan



Appendix 2. Glossary/Acronyms (EL-V1M2 Sec. 3.1)

Glossary:

Acceptance Criteria: Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation: The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory

Accuracy: The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst: The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Anomaly: A condition or event, other than a deficiency, that may affect the quality of the data, whether in the laboratory's control or not.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI)

Batch: Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one (1) to twenty (20) environmental samples of the same quality systems matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be twenty-four (24) hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed twenty (20) samples. (TNI)

Bias: The systematic or persistent distortion of a measurement process, which causes errors in one direction (i.e., the expected sample measurement is different from the sample's true value). (TNI)

Blank: A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).

2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve: The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Standard: A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM): A reference material accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI)

Chain of Custody (COC) Form: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. (TNI)

Compromised Samples: Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified.

Confidential Business Information (CBI): Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. TNI and its representatives agree to safeguard identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation: Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to Second Column Confirmation; Alternate wavelength; Derivatization; Mass spectral interpretation; Alternative detectors or Additional Cleanup procedures. (TNI)

Conformance: An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Correction: Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis**.** No significant action is taken to change behavior, process or procedure.

Corrective Action: The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria).

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, and concentration factors, and collation into a more useable form. (TNI)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC), whether in the laboratory's control or not.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

Document Control: The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses: The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Equipment Blank: Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures.

External Standard Calibration: Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Field Blank: Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Holding Times: The maximum time that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard: A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

Internal Standard Calibration: Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank: A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is $\pm$ 100%. The IDL represents a <u>range</u> where <u>qualitative</u> detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps of the procedure unless otherwise noted in a reference method. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Least Squares Regression (1st Order Curve): The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit(s) of Detection (LOD) [a.k.a., Method Detection Limit (MDL)]: A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. (TNI)

LOD Verification [a.k.a., MDL Verification]: A processed QC sample in the matrix of interest, spiked with the analyte at no more than 3X the LOD for single analyte tests and 4X the LOD for multiple analyte tests and processed through the entire analytical procedure.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (TNI)

(QS) Matrix: The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine. Includes surface water, groundwater effluents, and TCLP or other extracts.

Drinking Water: Any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: Any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-Aqueous Liquid: Any organic liquid with <15% settleable solids.

Biological Tissue: Any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: Includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: A product or by-product of an industrial process that results in a matrix not previously defined.

Air & Emissions: Whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (TNI)

Matrix Spike (spiked sample or fortified sample): A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which an independent test result of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): A replicate matrix spike prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank: A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit: The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control: Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results.

Non-conformance: An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Observation: A record of phenomena that (1) may assist in evaluation of the sample data; (2) may be of importance to the project manager and/or the client, and yet not at the time of the observation have any known effect on quality.

Performance Audit: The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Positive Control: Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects.

Precision: The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (TNI)

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

Proficiency Testing: A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (TNI)

Proficiency Testing Program: The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (TNI)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the laboratory and is provided to test whether the laboratory can produce analytical results within specified acceptance criteria. (TNI)

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item or service is of the type of quality needed and expected by the client. (TNI)

Quality Assurance [Project] Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control: The overall system of technical activities that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against “out of control” conditions and ensuring that the results are of acceptable quality. (TNI)

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. (TNI)

Quality Manual: A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (TNI)

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC activities. (TNI)

Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions.

Reference Material: Material or substance one or more properties of which are sufficiently homogeneous and well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (TNI)

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a

standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (TNI)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

Spike: A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs): A written document which details the method for an operation, analysis, or action, with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or repetitive tasks. (TNI)

Storage Blank: A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

Surrogate: A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit): A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Manager: A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

Trip Blank: A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

Uncertainty: A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms:

CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP/MS – ICP/Mass Spectrometry
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
LOD – Limit of Detection
LOQ – Limit of Quantitation
MDL – Method Detection Limit
MDLCK – MDL Check Standard
MDLV – MDL Verification Check Standard
MRL – Method Reporting Limit Check Standard
MS – Matrix Spike
MSD – Matrix Spike Duplicate
SDS - Safety Data Sheet
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
TNI – The NELAC Institute
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP – Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3. Laboratory Certifications, Accreditations, Validations

TestAmerica **Phoenix** maintains accreditations, certifications, and approvals with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

Organization	Certificate Number
AIHA-LAP	154268
Arizona Department of Health Services	AZ0728
California ELAP	2941
Nevada	AZ010302009
Oregon (ORELAP)	AZ100001
US Department of Agriculture	P330-10-00310

The certificates and accredited parameter lists are available, for each State/Program at **www.testamericainc.com** under Analytical Services Search – Certifications.

Appendix 4 - Methodology

Preparation Only Methods

Method	Aqueous	Solid	Waste	Air
Organics				
EPA 1311	X	X	X	
EPA 1312	X	X	X	
EPA 3500B	X		X	
EPA 3510C	X		X	
EPA 3600C	X	X	X	
EPA 3665A H2SO4/Per manganate	X	X	X	
EPA 3546 Microwave		X		
EPA 3580A	X		X	
EPA 5000	X	X	X	
EPA 5030 B & C	X	X	X	
EPA 5035 & 5035A		X	X	
Inorganics				
EPA 1311	X	X	X	
EPA 1312	X	X	X	
EPA 3005A	X			
EPA 3010A	X		X	
EPA 3020A	X		X	
EPA 3050B		X	X	

Organics Methods Performed

Parameter	Method	Aqueous	Solid	Waste	Air
Volatile Organics (VOC)	EPA 8260B	X	X	X	X
	EPA 524.2	X			
	EPA 624	X		X	
Base Neutrals and Acids (BNAs)	EPA 8270C	X	X	X	
	EPA 625	X			
Organochlorine Pesticides	EPA 8081A /8081B	X	X	X	
	EPA 608	X			
PCBs	EPA 8082 /8082A	X	X	X	
Petroleum Hydrocarbons	ADHS 8015AZ R1		X		
Diesel Range Organics	EPA 8015B/8015D	X	X	X	
Gasoline Range Organics	EPA 8015B/8015D	X	X	X	X

Organics Methods Performed

Parameter	Method	Aqueous	Solid	Waste	Air
PAHs	EPA 8310 / 8270C SIM	X	X	X	
Formaldehyde	EPA TO-11A				X

Metals Methods Performed

Parameter	Methods	Aqueous	Solid	Waste	Air
Trace Metals	EPA 200.7	X			
	EPA 200.8	X			
	EPA 6010B/6010C	X	X	X	
	EPA 6020/6020B	X	X	X	
Hardness	SM 2340B	X			
	EPA 200.7	X			
Mercury	EPA 245.1	X			
	EPA 7470A	X		X	
	EPA 7471A /7471B		X	X	

Microbiology Methods Performed

Parameter	Method	Aqueous	Solid	Waste	Air
Fecal Coliform by Mtf	SM 9221E	X	X	X	
Fecal Coliform by Membrane Filtration	SM 9222D	X			
Fecal Coliform Quanti-Tray (WW only)	SM 9223B	X			
Heterotrophic Bacteria	SIMPLATE	X			
Total Coliforms & E. Coli by Colilert	SM 9223B	X			
Total Coliform by Mf	SM 9221B & C	X	X		
E. Coli (not for NPDES)	SM9221F	X	X		

Inorganics Methods Performed

Parameter	Method	Aqueous	Solid	Waste	Air
Alkalinity (Carbonate, Bicarbonate, Total)	SM 2320B	X			
Ammonia	SM 4500 NH3 D	X	X		
	EPA 350.1	X			
Bromide	EPA 300.0	X			
	EPA 9056/9056A	X	X	X	

Inorganics Methods Performed

Parameter	Method	Aqueous	Solid	Waste	Air
Carbon, Total Organic	SM 5310B	X			
Carbon, Dissolved Organic	SM 5310B	X			
Chloride	EPA 300.0	X			
	EPA 9056/9056A	X	X	X	
Chlorine, Total Residual	SM 4500 Cl	X			
Chromium, Hexavalent	SM 3500 CR B D	X			
Corrosivity	SM 2330B	X			
Conductivity	SM 2510B	X			
	EPA 9050A	X		X	
Cyanide, Total	SM 4500 CN E	X	X	X	
	SM 4500CN B C	X	X	X	
	EPA 9010C		X	X	
	EPA 9013		X	X	
	EPA 9014	X	X	X	
Cyanide, Amenable	SM 4500 CN G	X			
Demand, Biological Oxygen	SM 5210B	X		X	
Demand, Carbonaceous (CBOD)	SM 5210B	X		X	
Demand, Chemical Oxygen	SM 5220D	X		X	
Fluoride	EPA 300.0	X	X		
	EPA 9056	X	X	X	
Ignitability	EPA 1030		X		
Nitrate	EPA 300.0	X			
	EPA 9056/9056A	X	X	X	
Nitrate & Nitrite	EPA 300.0	X			
	EPA 9056	X	X	X	
Nitrite	EPA 300.0	X			
	EPA 9056/9056A	X	X		
	SM 4500 NO2 B	X			
Total Kjeldahl Nitrogen	351.2	X			
Total Kjeldahl Nitrogen (NV Only)	351.2	X			
Orthophosphate	EPA 300.0	X			
	EPA 9056/9056A	X	X	X	
Paint Filter Liquids Test	EPA 9095B	X		X	X
Perchlorate	EPA 314.0	X			
pH	SM 4500 H+ B	X			
	EPA 9040B	X			
	EPA 9041A	X			
	EPA 9045D		X	X	

Inorganics Methods Performed

Parameter	Method	Aqueous	Solid	Waste	Air
Phosphorus, Total	SM 4500 P B E	X	X	X	
Solids, Total	SM 2540B	X		X	
Solids, Total Dissolved	SM 2540C	X		X	
Solids, Total Suspended	SM 2540D	X		X	
Solids, Total Volatile	EPA 160.4	X		X	
Settleable Solids	SM 2540F	X			
Solids, Total, Fixed and Volatile	SM 2540G	X	X		
Sulfate	EPA 300.0	X			
	EPA 9056/9056A	X	X	X	
Temperature	SM 2550	X			
Turbidity	EPA 180.1	X			

APPENDIX D

Corrective Action Form

CORRECTIVE ACTION REPORT (CAR) FORM
QF 4.20.01

CAR No: _____/_____

Date: _____

Project: _____

Client: _____

Originator (Reviewer): _____ CPM/Quality Consultant: _____

I. Issue / Problem Identification

Field / Office Location:_____

System / Activity: _____

Date Problem Identified: _____

Nature of Problem:

Recommended Action:

Action Required: ☐ Immediately ☐ w/in 15 days ☐ w/in 30 days

Corrective Action Recommendation Received by *(to be signed by CPM)*:

_____ Date: _____

II. Problem Resolution Acknowledgement *(to be completed by the CPM and submitted to the PIC, Quality Consultant and QMS Leadership)*:

Date Corrective Action Taken: _____

Summary of Corrective Action:

Approved/Quality Consultant /QMS Leadership: _____ Date:

Distribution:

APPENDIX B

Site Specific Health and Safety Plan

Site Specific Health and Safety Plan

Revision 16c

Project Name:	3 Saints Release
Project Number:	30036536
Client Name:	Kinder Morgan Energy Partners
Date:	10/23/2019
HASP Expires	10/22/2020
Revision:	V2

Approvals:

HASP Developer: Kevin Renlund

Project Manager: Bob Forsberg

HASP Reviewer: Robin Johl, ASP

Arcadis Culture of Caring

Arcadis is committed to a Culture of Caring that ensures each Arcadis employee, part time as needed employee (PTAN), temporary agency employee under Arcadis day to day control, Inexperienced Workers and contractor (cumulatively referred to here as "field staff") goes home at the end of the day free from injury or illness. I certify that the following has been performed with all Arcadis field staff on this project either in person or by Skype:

☐ Reviewed the HASP including a discussion of hazard identification and controls.

- ☐ If conducting activities deemed by Arcadis to be "High Risk", frontline management has reviewed applicable H&S standards (Job Safety Analysis [JSA] when authorized by H&S) for these activities with field staff.
- ☐ If permit to work is required, frontline management has reviewed the permit(s) with field staff.

☐ Reviewed proactive H&S engagement expectations/injury prevention actions.

☐ Reviewed Stop Work Authority.

☐ Reviewed the incident reporting process and expectations including when WorkCare should be contacted by staff (WorkCare incident intervention for all minor, non-emergency injuries) and that the WorkCare phone number is programmed into field team cell phone.

☐ For Inexperienced Workers, a mentor has been assigned for the new task being performed.

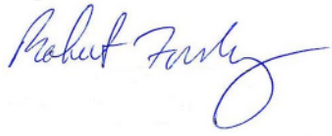
For short service employees (SSEs), PTANS* and temporary agency employees* :

☐ Provided coaching and mentoring on Arcadis H&S expectations during project work. Reviewed in detail specific hazards and controls and provided a resource who can be contacted if individual has questions regarding planned or unplanned work tasks.

Mentor/Resource # _____ _____

Name Phone Number

Signed:



_____ Project Manager

* Upon hiring/contracting for the first time.

Emergency Information

Site Address:

3 Saints Road & Harding
Approximately 4220 3 Saints Road
Anthony, NM 88021

Emergency Phone Numbers:

Emergency (fire, police, ambulance)		911
Emergency (facility specific, if applicable):		
Anthony Fire Department		575-882-2000
Anthony Police Department		575-882-2983
Emergency Other (specify):		
Primary Client Contact:		
WorkCare (non-life-threatening injury/illness):		1-888-449-7787
Project H&S:	Robin Johl	602-797-4607
Task Manager:		
Project Manager:	Bob Forsberg	480-905-9311
Corporate H&S Specialist:	Alec MacAdam	720-454-0948
Corporate H&S Director:	Denis Balcer	614-778-9171

Hospital Name and Address:

Las Palmas Del Sol West
1535 N Resler Drive
El Paso, TX 79912

Hospital Phone Number: 915-231-1600

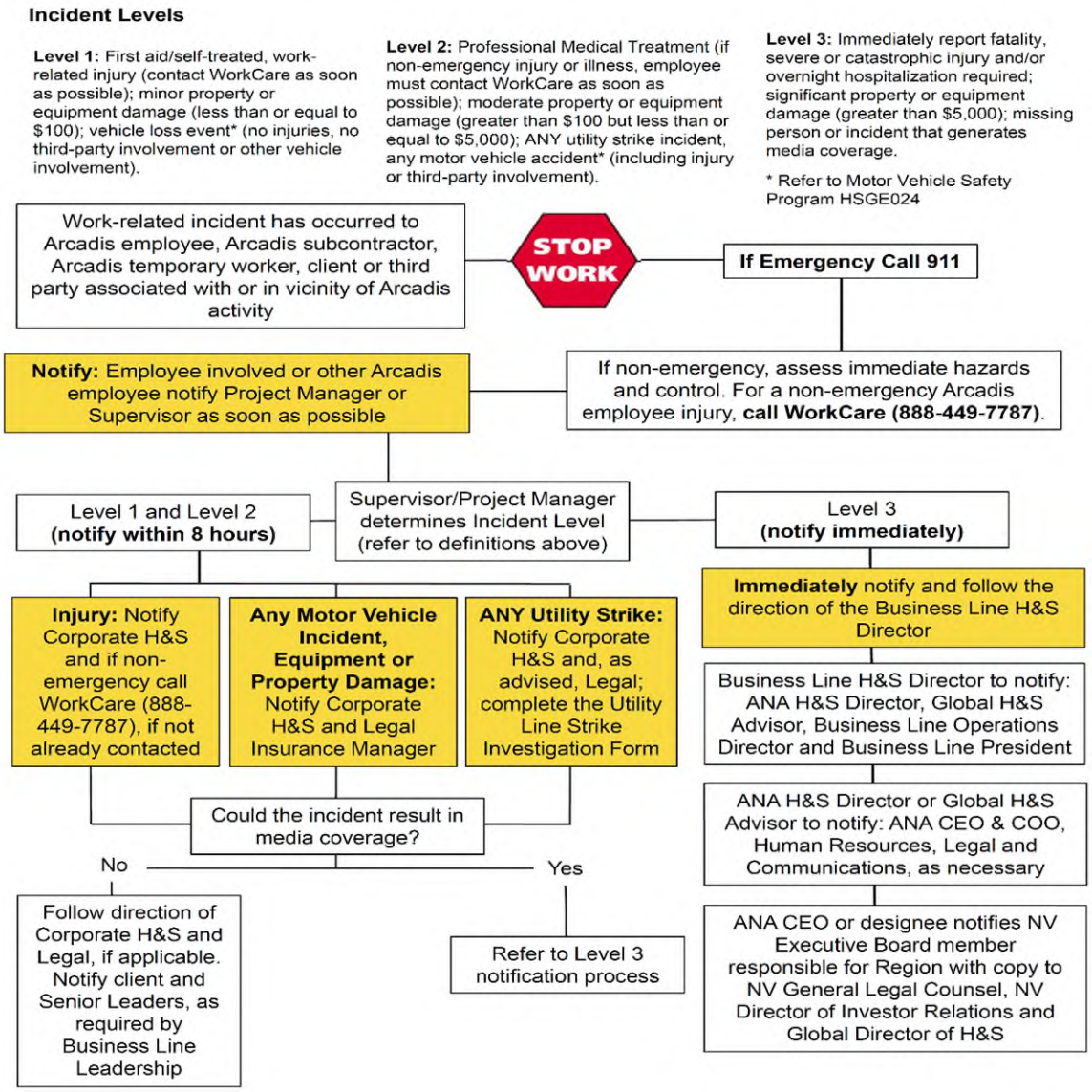
Supplemental Client Contact Information:

Scott Martin	(713) 420-2832

Other Important Phone Numbers:

Poison Control Center	1-800-222-1222
Nat. Response Ctr. (spills in reportable quantities)	1-800-424-8802
U.S. Coast Guard (spills to water)	1-800-424-8802

Incident Reporting Protocol Within Arcadis



Client Incident Reporting Protocol

See attached reporting requirements.

KINDER MORGAN

EVENT / INCIDENT INVESTIGATION SUMMARY

Instructions

1. Insert the date of the final report.
2. Address the memo to the field director, technical manager and district manager. In the last section, "Who should know of these findings," consider routing this summary across regional, departmental and entity boundaries, depending upon the applicability of lessons learned.
3. In "From:" list team members with the team leader at the top of the list. When forming the team, insure the team has access to resources required for the investigation. The team should be small but able to draw upon Operations, Engineering, EHS and other groups as needed.
4. Briefly describe what happened in the appropriate box. Include who, what, where and when.
5. Include technical details in the appropriate box. These details could include design information such as pipe attributes, purchasing specifications, equipment ratings, etc.
6. Describe what led up to the event - who said what or how a particular configuration of work occurred.
7. Describe the event that caused the loss or near miss. Include alarm logs, sketches, schematics and drawings as needed as attachments.
8. Identify the immediate causes using the "Systematic Cause Analysis Technique" (SCAT) chart from Loss Causation Training. Generally, immediate causes are substandard acts or substandard conditions.
9. Identify the basic/underlying causes using the SCAT chart.
10. Emergency Response Procedures Evaluation
    - Evaluate Emergency Response Procedures and determine if they were effective. If they were not effective or require modification then document actions taken in the next section.
11. Recommendations and Action Items:
    - Make specific recommendations to address each basic cause with action items clearly assigned to a responsible person.
    - Set a conference or response method to ascertain closure to each item.
    - Critique all emergency responses, as warranted.
    - Determine whether emergency procedures were followed and effective.
    - Determine whether ERL protocol procedures and/or response changes are necessary.
    - Modify responses as described in Company procedures, if necessary.

    The team leader should retain responsibility of closure for each recommended action item.
12. Finally, communicate the findings and distribute to appropriate personnel to prevent similar events. Identify the distribution list for the findings.

Date:

To: **From:**

Subject:

This is a summary of
The loss causation model was used to identify the immediate and basic (root) causes and to recommend several steps to prevent reoccurrence.

Date incident investigation commenced	
What happened?	
Technical details	
Prior to the event	
Event Type and description	
Immediate causes	
Basic or root causes	

Emergency Response procedures adequate?	☐ Yes ☐ No
Recommendations and action items	
Who should know of these findings?	
Contractor briefing summary (if Contractor was involved with the incident)	

SpellCheck

We will have a conference on to review progress and provide closure to this report.

CC: Those who need to know

Attachments:
Include documentation to support conclusions. This could include gate maps, schematics, purchase orders, photographs, alarm logs or any other information pertinent to the report.

Re: attachments:

- Insert photos, etc. below, adjust size
- OR create a sketch in another document, copy and paste below

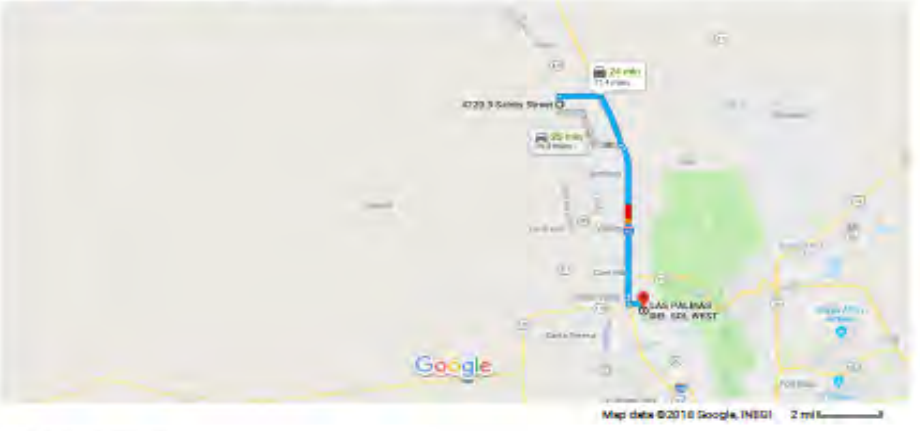
➔

Route to the Hospital

Google Maps

4220 3 Saints St, Anthony, NM 88021 to LAS PALMAS DEL SOL WEST

Drive 17.4 miles, 24 min



4220 3 Saints St
Anthony, NM 88021

Get on I-10 E in Anthony from E Berino Rd and Stern Dr

10 min (6.5 mi)

1. Head north on 3 Saints St toward NM-226 W

0.5 mi

2. Turn right at the 1st cross street onto NM-226 E/E Berino Rd
   Continue to follow E Berino Rd

2.3 mi

3. Turn right onto Anthony Dr/Stern Dr
   Continue to follow Stern Dr

3.3 mi

4. Turn left onto Ohara Rd

0.1 mi

5. Turn right to merge onto I-10 E

0.2 mi

Follow I-10 E to S Desert Blvd in El Paso. Take the exit toward TX-178/Artcraft Rd/Paseo Del Norte from I-10 E

8 min (9.3 mi)

6. Merge onto I-10 E
   Entering Texas

9.1 mi

7. Take the exit toward TX-178/Artcraft Rd/Paseo Del Norte

0.2 mi

Take Paseo del Norte to N Resler Dr

4 min (1.5 mi)

8. Merge onto S Desert Blvd

0.9 mi

9. Use the 2nd from the left lane to turn left onto Artcraft Rd

0.1 mi

10. Continue onto Paseo del Norte

0.6 mi

11. Turn right onto N Resler Dr
    Destination will be on the right

0.6 mi

LAS PALMAS DEL SOL WEST
1535 N Resler Dr, El Paso, TX 79912

Site Type

The project site is an inactive facility which historically had the following attributes:

Parking Lot/Private Drive (NON ROW)	
Remote Area	
Utility	

Work in parking lots will require preparation of a Non-ROW Traffic Safety Plan. If a lone worker is used for a remote area project, additional communication and emergency action planning (HASP supplement or JSA) is required for the lone worker.

Surrounding Land Use and Topography

Surrounding area includes cotton fields and pecan orchards. Topography is generally flat, with a ditch approximately 10 feet below surface grade. Few residences are present within the general vicinity of the release area.

Simultaneous Operations (SimOps)

Planned Arcadis site work will not be in proximity to SimOps work activities performed by non Arcadis employees or subcontractors. Arcadis will initiate stop work and evaluate the work activities through the JSA process if during the course of work a SimOps activity is identified that could reasonably affect health and safety of Arcadis employees and subcontractors.

Site Background

A gasoline release occurred at the corner of Harding and 3 Saints and flowed into the nearby irrigation ditch. Response activities included free product recovery and covering the remaining free product with soil and foam. Soil excavation and backfilling activities performed in the ditch were sucessful in removing petroleum impacted soil; however, petroleum hydrocarbons remain present in groundwater.

Project Tasks

The following tasks are identified for this project:

1	Driving - Motor vehicles
2	Inspections and audits - Nonbuilding including non-secure/non-controlled areas
3	Utilities - Clearance
4	Drilling - Using mechanical methods
5	Monitor well - Well development and purging mechanical methods including use of mechanical surge bloc
6	Sampling - Well sampling using diffusive samplers
7	Survey - Land surveying

Supplemental requirements associated with the above task(s):
Site access agreements and/or a discussion of proper procedures for accessing off-site non-client owned private property must be provided to the field team.

[X] Required Checklists/Work Forms

Tailgate Safety Briefing Form

Vehicle Inspection Checklist

[ ] Required Permits

Not Applicable

[ ] Required H&S Standards

Short Service Employees (SSEs)

SSEs (employees who are employed with Arcadis for less than 1 year or are Inexperienced Workers) have the potential to work on this project. If SSEs are utilized, the project team working in conjunction with the SSE's administrative supervisor will ensure requirements of ARC HSGE019 "Short Service Employees" are completed. SSE's will be identified on the project Tailgate Safety Meeting Form.

Roles and Responsibilities

	Name	Role	Short Service Employee
1	Bob Forsberg	Project Manager (PM)	
2		Associate Project Manager (APM)	
3	Dakota Draper	Task Manager	
4		Field Technical Lead	
5	Dakot Draper	Site Safety Officer (SSO)	
6			
7			
8			
9			
10			

Training

All Arcadis employees are required to have the following training to be on site:

Defensive Driving - Smith On-Line
DOT HazMat #1
Hazwoper 40-Hour
Hazwoper 8-Hour Annual Refresher
HAZCOM GHS/EAP (non-certificate)
None
None
None
None
None
None
None
None
None
Client specific:
ISNetworld
Other:

Selected Arcadis employees are required to have the following additional training:

	Names or Numbers from above
None	
None	
None	
None	
None	
None	
None	
None	
None	
None	
None	
None	
None	
None	
None	
None	
Other:	

The Arcadis Fundamental H&S Principles

Staff working on any of the task(s) listed above must utilize the six Arcadis Fundamental H&S Principles to ensure work is conducted safely. These principles include: 1) Use of TRACK, 2) H&S Planning, 3) Stop Work Authority, 4) "If Not Me Then Who", 5) Stewardship, and 6) Incident Reporting. Every project team member plays an important role in project health and safety. This is more than just having a HASP, training, or PPE. Proactive staff engagement with these principles is critical to a safe work environment.

General Task Hazard Assessment and Risk Control (HARC)

General:	Hazards Applicable to All Project Tasks

The 12 hazard category HARC ratings are not available in this General THA. The mitigated and unmitigated ratings for the hazards presented are based on the Risk Assessment Matrix below. Modify hazards and ratings as necessary to meet project needs.

Risk Assessment Matrix		Likelihood Ratings			
Consequences Ratings		A	B	C	D
People	Property	0 Almost Impossible	1 Possible but Unlikely	2 Likely to Happen	3 Almost Certain to Happen
1-Slight or No Health Effect	Slight or No Damage	0-Low	1-Low	2-Low	3-Low
2-Minor Health Effect	Minor Damage	0-Low	2-Low	4-Medium	6-Medium
3-Major Health Effect	Local Damage	0-Low	3-Low	6-Medium	9-High
4-Fatalities	Major Damage	0-Low	4-Medium	8-High	12-High

Hazard #1

Driving - On road - Injury or vehicle damage from motor vehicle accident or incident

Suggested FHSHB Ref: III V, W, U, AO

Overall Unmitigated Risk: HIGH

Mitigated Risk: MEDIUM

To mitigate this hazard, use TRACK and the following:
Smith System (on line)
JSAs

Comments: Use Smith System "5-Keys" when driving. See Driving JSA for details.

Hazard #2

Driving - Driver - Injury, death or property damage due to driver distraction, fatigue, etc.

Suggested FHSHB Ref: III V, AO

Overall Unmitigated Risk: HIGH

Mitigated Risk: LOW

To mitigate this hazard, use TRACK and the following:
Smith System (on line)
Driver awareness and use of stop work authority

Comments: Use route planning. Keep eyes moving while driving. See Driving JSA.

Hazard #3

Biological - skin/eye irritation or damage from poisonous plants

Suggested FHSHB Ref: III N, AE

Overall Unmitigated Risk: LOW

Mitigated Risk: LOW

To mitigate this hazard, use TRACK and the following:
Job Briefing/Site Awareness
PPE (see HASP "PPE" section)

Comments: Use skin pre-treatment lotions when available.

Hazard #4

Biological - bites or stings from exposure to insects or arachnids

Suggested FHSHB Ref: III N

Overall Unmitigated Risk: LOW

Mitigated Risk: LOW

To mitigate this hazard, use TRACK and the following:
Job Briefing/Site Awareness
PPE (see HASP "PPE" section)

Comments: Do body check daily.

Hazard #5

Biological - cuts, scrapes, skin/eye puncture from exposure to physically damaging plants

Suggested FHSHB Ref: III N, AE

Overall Unmitigated Risk: MEDIUM

Mitigated Risk: LOW

To mitigate this hazard, use TRACK and the following:
Job Briefing/Site Awareness
PPE (see HASP "PPE" section)

Comments:

General Task HARC (continued)

Hazard #6		
Environmental - Thermal stress - Injury or illness from heat or cold		
Suggested FHSHB Ref:	III M	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Field H&S Handbook (see ref. above)
Mitigated Risk:	LOW	JSAs
Comments:	Use job rotation or rest breaks. Stay hydrated and eat regularly.	
Hazard #7		
Environmental - Inclement weather -Injury or equipment damage from inclement weather		
Suggested FHSHB Ref:	III I	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Weather Monitoring
Mitigated Risk:	LOW	Cont./Emerg. Planning
Comments:	Use 30/30 rule for lightning. See FHSHB for details.	
Hazard #8		
Motion - Musculoskeletal - Injury from lifting, twisting , stooping, or awkward body positions		
Suggested FHSHB Ref:	III AF	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Engineering Controls (specify in comments)
Mitigated Risk:	LOW	Admin. Controls (specify in comments)
Comments:	Use proper lifting techniques. Use job rotation when applicable. See FHSHB for details.	
Hazard #9		
Motion - Musculoskeletal - Injury from repeated work activity or body motion		
Suggested FHSHB Ref:	III AF	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Engineering Controls (specify in comments)
Mitigated Risk:	LOW	Admin. Controls (specify in comments)
Comments:	Use proper lifting techniques. Use job rotation when applicable. See FHSHB for details.	
Hazard #10		
Sound - Noise - Injury or illness due to noise exposure		
Suggested FHSHB Ref:	III L	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Engineering Controls (specify in comments)
Mitigated Risk:	LOW	PPE (see HASP "PPE" section)
Comments:	Increase distance from source if possible. Maintain equipment.	
Hazard #11		
Gravity - Falls - Injury due to slips and trips		
Suggested FHSHB Ref:	III F	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Site Awareness
Mitigated Risk:	LOW	Housekeeping
Comments:	Use footwear appropriate for site conditions, plan routes and do not hurry while walking.	
Hazard #12		
None		
Suggested FHSHB Ref:	None	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	Not Ranked	Select
Mitigated Risk:	Not Ranked	Select
Comments:		

Task Specific HARC

Task 1:	Driving - Motor vehicles							
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):						FHSHB Ref:		III V
Biological	-	Chemical	-	Driving	H	Electrical	-	
Environmental	-	Gravity	-	Mechanical	-	Motion	-	
Personal Safety	L	Pressure	-	Radiation	-	Sound	-	

Hazard #1

Driving - Off road - Injury or vehicle damage from object impact/vehicle rollover/improper load securement

Suggested FHSHB Ref:	III V, W, U, AO	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	HIGH	Smith System (on line)
Mitigated Risk:	LOW	Select
Comments:	Use of spotter	

Hazard #2

Personal Safety - Fatigue - Injury or illness caused while working when fatigued

Suggested FHSHB Ref:	III R	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Job Briefing/Site Awareness
Mitigated Risk:	LOW	Job Rotation
Comments:		

Task Specific HARC (continued)

Task 2:	Inspections and audits - Nonbuilding including non-secure/non-controlled areas

HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): FHSHB Ref: III F

Biological	L	Chemical	L	Driving	M	Electrical	L
Environmental	L	Gravity	M	Mechanical	L	Motion	L
Personal Safety	L	Pressure	L	Radiation	L	Sound	L

Hazard #1

Radiation - Non-ionizing - Injury or illness due to exposure to non-ionizing radiation including sun exposure

Suggested FHSHB Ref: NA

Overall Unmitigated Risk: MEDIUM

Mitigated Risk: LOW

Comments: Use of proper clothing

To mitigate this hazard, use TRACK and the following:

PPE (see HASP "PPE" section)

Select

Hazard #2

Environmental - Wind -Skin injury from sun or wind exposure

Suggested FHSHB Ref: III M

Overall Unmitigated Risk: MEDIUM

Mitigated Risk: LOW

Comments: Use of proper clothing

To mitigate this hazard, use TRACK and the following:

PPE (see HASP "PPE" section)

Select

Task Specific HARC (continued)

Task 3:	Utilities - Clearance

HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): FHSHB Ref: III AN

Biological	L	Chemical	L	Driving	-	Electrical	M
Environmental	L	Gravity	L	Mechanical	M	Motion	M
Personal Safety	L	Pressure	L	Radiation	-	Sound	L

Hazard #1

Motion - Struck by - Bodily injury from impact with moving object

Suggested FHSHB Ref:	III S	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Site Awareness
Mitigated Risk:	LOW	Engineering Controls (specify in comments)
Comments:	Position vehicles to stop traffic	

Hazard #2

Electrical - Housekeeping - Injury or property damage due to frayed wiring, improperly mounted wiring, missing

Suggested FHSHB Ref:	III AB, AG	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Inspections
Mitigated Risk:	LOW	Housekeeping
Comments:		

Task Specific HARC (continued)

Task 4:	Drilling - Using mechanical methods

HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): FHSHB Ref: IV E

Biological	L	Chemical	L	Driving	-	Electrical	M
Environmental	L	Gravity	M	Mechanical	M	Motion	H
Personal Safety	L	Pressure	L	Radiation	-	Sound	M

Hazard #1

Chemical - solids/particulates, skin or eye irritation/damage/allergy

Suggested FHSHB Ref:	III C, F, G, K, S, AG	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	PPE (see HASP "PPE" section)
Mitigated Risk:	LOW	Job Briefing/Site Awareness
Comments:		

Hazard #2

Chemical- solids/particulates - injury or illness from skin absorption

Suggested FHSHB Ref:	III C, F, G, K, S, AG	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	PPE (see HASP "PPE" section)
Mitigated Risk:	LOW	Job Briefing/Site Awareness
Comments:		

Hazard #3

Environmental - Utilities - Injury or property damage from utility strike/damage

Suggested FHSHB Ref:	III AN	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	HIGH	Inspections
Mitigated Risk:	MEDIUM	Specialized Checklist/Forms
Comments:	Utilities and Structures Checklist	

Hazard #4

Gravity - Struck by - Injury from falling object

Suggested FHSHB Ref:	III AC, IV A	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	H&S Standards
Mitigated Risk:	LOW	Job Briefing/Site Awareness
Comments:	Hard hat	

Hazard #5

Mechanical - Crushing - Injury by crushing body part in mechanical process

Suggested FHSHB Ref:	III S IV, E, F, G, O	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Site Awareness
Mitigated Risk:	LOW	Operator Competency per Standard
Comments:		

Hazard #6

Mechanical - Crushing - Injury by crushing body part in mechanical process

Suggested FHSHB Ref:	III S IV, E, F, G, O	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Site Awareness
Mitigated Risk:	LOW	Operator Competency per Standard
Comments:		

Task Specific HARC (continued)

Task 5:	Monitor well - Well development and purging mechanical methods including use of r

HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): FHSHB Ref: III F

Biological	L	Chemical	L	Driving	-	Electrical	L
Environmental	M	Gravity	M	Mechanical	M	Motion	L
Personal Safety	L	Pressure	L	Radiation	-	Sound	M

Hazard #1

Chemical - liquids, skin or eye irritation/damage/allergy

Suggested FHSHB Ref: III C, F, G, K, S, AG

Overall Unmitigated Risk: MEDIUM

Mitigated Risk: LOW

Comments:

To mitigate this hazard, use TRACK and the following:

PPE (see HASP "PPE" section)

Job Briefing/Site Awareness

Hazard #2

Chemical - liquids - injury or illness from vapor inhalation

Suggested FHSHB Ref: III C, F, G, K, S, AG

Overall Unmitigated Risk: MEDIUM

Mitigated Risk: LOW

Comments:

To mitigate this hazard, use TRACK and the following:

PPE (see HASP "PPE" section)

Job Briefing/Site Awareness

Hazard #3

Gravity - Struck by - Injury from falling object

Suggested FHSHB Ref: III AC, IV A

Overall Unmitigated Risk: MEDIUM

Mitigated Risk: LOW

Comments: Hard hat

To mitigate this hazard, use TRACK and the following:

Job Briefing/Site Awareness

PPE (see HASP "PPE" section)

Task Specific HARC (continued)

Task 6:	Sampling - Well sampling using diffusive samplers						
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):						FHSHB Ref:	III F
Biological	L	Chemical	L	Driving	-	Electrical	-
Environmental	L	Gravity	L	Mechanical	-	Motion	L
Personal Safety	L	Pressure	L	Radiation	-	Sound	L

Hazard #1

Chemical- liquids - injury or illness from skin absorption

Suggested FHSHB Ref:	III C, F, G, K, S, AG	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	PPE (see HASP "PPE" section)
Mitigated Risk:	LOW	Job Briefing/Site Awareness
Comments:		

Hazard #2

Chemical - liquids - injury or illness from vapor inhalation

Suggested FHSHB Ref:	III C, F, G, K, S, AG	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	PPE (see HASP "PPE" section)
Mitigated Risk:	LOW	Job Briefing/Site Awareness
Comments:		

Task Specific HARC (continued)

Task 7:	Survey - Land surveying

HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low): FHSHB Ref: III F

Biological	M	Chemical	-	Driving	-	Electrical	-
Environmental	M	Gravity	M	Mechanical	-	Motion	M
Personal Safety	L	Pressure	-	Radiation	-	Sound	L

Hazard #1

Motion - Struck by - Bodily injury from impact with moving object

Suggested FHSHB Ref: III S

Overall Unmitigated Risk: MEDIUM

Mitigated Risk: LOW

Comments: Use of spotter and using vehicle for blockage.

To mitigate this hazard, use TRACK and the following:

Site Awareness

Job Briefing/Site Awareness

Hazard #2

Biological - skin or eye irritation or injury from exposure to mammal, reptile, amphibian, fish, bird or

Suggested FHSHB Ref: III N

Overall Unmitigated Risk: MEDIUM

Mitigated Risk: LOW

Comments:

To mitigate this hazard, use TRACK and the following:

Job Briefing/Site Awareness

PPE (see HASP "PPE" section)

Hazard #3

Driving - Off road - Injury or vehicle damage from object impact/vehicle rollover/improper load securement

Suggested FHSHB Ref: III V, W, U, AO

Overall Unmitigated Risk: HIGH

Mitigated Risk: LOW

Comments: Use of spotter

To mitigate this hazard, use TRACK and the following:

Smith System (on line)

Select

Hazard Communication (HAZCOM)/Global Harmonization System (GHS)

☐ HAZCOM/GHS for this project is managed by the client or general contractor

List the chemicals anticipated to be used by Arcadis on this project per HAZCOM/GHS requirements.
(Modify quantities as needed)

	Preservatives	Qty
	Not applicable	
X	Hydrochloric acid	<500 ml
	Nitric acid	<500 ml
	Sulfuric acid	<500 ml
	Sodium hydroxide	<500 ml
	Zinc acetate	<500 ml
	Ascorbic acid	<500 ml
	Acetic acid	<500 ml
	Isopropyl alcohol	< 4 gal.
	Formalin (<10%)	< 4 gal.
	Methanol	<500 ml
	Sodium bisulfate	<500 ml

	Decontamination	Qty
	Not applicable	
X	Alconox	≤ 5 lbs
	Liquinox	≤ 1 gal
	Acetone	≤ 1 gal
	Methanol	≤ 1 gal
	Hexane	≤ 1 gal
	Isopropyl alcohol	≤ 4 gal
	Nitric acid	≤ 1 L
	Other:	

	Calibration	Qty.
	Not applicable	
X	Isobutylene/air	1 cyl
	Methane/air	1 cyl
	Pentane/air	1 cyl
	Hydrogen/air	1 cyl
	Propane/air	1 cyl
	Hydrogen sulfide/air	1 cyl
	Carbon monoxide/air	1 cyl
	pH standards (4,7,10)	≤ 1 gal
	Conductivity standards	≤ 1 gal
	Other:	

	Fuels	Qty.
X	Not applicable	
	Gasoline	≤ 5 gal
	Diesel	≤ 5 gal
	Kerosene	≤ 5 gal
	Propane	1 cyl
	Other:	

	Kits	
X	Not applicable	
	Hach (specify):	
	DTECH (specify):	
	Other:	

		Qty.
		1 kit
		1 kit
		1 kit

	Remediation	Qty.
X	Not applicable	

	Other:	Qty.
	Not applicable	
X	Spray paint	≤ 6 cans
	WD-40	≤ 1 can
	Pipe cement	≤ 1 can
	Pipe primer	≤ 1 can
	Mineral spirits	≤ 1 gal

	DOT(1):	Qty.
	MOT eligible soils	
	MOT eligible water	
	MOT eligible solids	
	MOT eligible liquids	

(1) Attach applicable Materials of Trade (MOT) generic shipping determination. SDS not generally applicable to this category.

SDSs for this project will be available in printed form in the company vehicle. All project workers will be notified of the SDS location in their initial safety briefing.

Contractor SDSs will be submitted to Arcadis in advance of work and will be filed with Arcadis SDSs as indicated above.

This project will not be utilizing materials subject to the HAZCOM Standard in bulk storage. In this HASP, bulk storage means any material stored on the project site in a bulk packaging >119 gallons (> 450 L) liquid capacity or a palletized quantity of a material in packagings ≤119 gallons (≤450 L) liquid capacity.

Air Monitoring

☐ There are no atmospheric chemical, radiological, or particulate hazards on this project requiring air monitoring.
☐ Air monitoring is the responsibility of the client or subcontractor.

Constituents of Interest:

Time Weighted Averages (TWAs) are ACGIH 8-Hr Threshold Limit Values (TLVs) unless noted.

Gasoline

TWA	30 ppm, Arcadis administrative limit	LEL/UEL (%):	1.4/7.6
STEL	500 ppm	VD (Air = 1):	NA
IDLH	NA	VP (mmHg):	38-300

TWA - Time Weighted Average (ACGIH TLV unless noted)
STEL - Short Term Exposure Limit
IDLH - Immediately Dangerous to Life and Health
LEL/UEL - Lower /Upper Explosive Limit
RGD - Relative Gas Density
VP - Vapor Pressure

Notes:

Required Monitoring Instruments, Action Levels and Monitoring Frequency

Gray fields below are not automated. Make necessary selections from drop down menus.

Photoionization Detector

Select Lamp: 10.6 eV

Computed action levels (PID units) (1):			Computed action levels have been manually adjusted.
<	16.7	Continue working	
	16.7 - 33.3	Levels sustained > 5 minutes, monitor continuously and review engineering controls and PPE. Proceed with caution.	
>	33.3	Stop work and contact SSO	

(1) Computed action levels are for PIDs which have not been programmed to correct TLVs for specific constituents or mixtures.

Particulate/aerosol monitoring is not required. Re-evaluate if visible dusts or aerosols cannot be controlled.

Action levels are in mg/m3			Computed action levels have been manually adjusted.
<	NA	Continue working	
	NA	Levels sustained > 5 minutes, monitor continuously and review engineering controls and PPE. Proceed with caution.	
>	NA	Stop work and contact SSO	

Breathing zone air monitoring using the above instruments will be performed at the following frequency:

30 Minute intervals

If manually logging air monitoring results, all results must be documented, including non-detects.

Multigas (including LEL/O2 and Hg vapor) monitoring is not required.

LEL/O2 Meter	0-5% LEL	Continue work
LEL/O2 Monitoring Not Required	>5-10% LEL	Continually monitor, review engineering controls, proceed with caution
	>10% LEL	Stop work, evacuate, contact SSO
	19.5%-23.5% O2	Normal, continue work
	<19.5% O2	O2 deficient, stop work, evacuate, contact SSO
	>23.5% O2	O2 enriched, stop work, evacuate, contact SSO

Additional Gas/Vapor Monitoring is Not Required

		1/2 TLV	Stop Work Action Level	Comments
	Ammonia	12.5 ppm	25 ppm	
	Carbon dioxide	2500 ppm	5000 ppm	
	Carbon monoxide	12.5 ppm	25 ppm	
	Chlorine	0.05 ppm	0.1 ppm	
	Hydrogen cyanide	2.35 ppm (skin)	4.7 ppm* (skin)	
	Hydrogen sulfide	0.5 ppm	1 ppm	
	Nitrogen dioxide	0.1 ppm	0.2 ppm	
	Phosphine	0.025 ppm	0.05 ppm	
	Sulfur dioxide	0.125 ppm	0.25* ppm	
	Mercury vapor	0.0125 mg/m3	0.025 mg/m3	

* Ceiling or STEL value

All air-monitoring instruments must be calibration checked daily, if used, per manufacturer's instructions. Calibration checks, including calibration gases used, must be documented.

Compound specific monitoring using colorimetric indicator tubes/chips is required

Indicator:		≤TWA	Continue work
X	Tube	>TWA	Stop work, review engineering controls and PPE, contact SSO
Compound(s): Benzene			

Indicator tube/chip monitoring frequency: >PID/FID action level at 15 minute intervals

Personal Protective Equipment (PPE)

See JSA or Permit for the task being performed for required PPE. If work is not conducted under a JSA or Permit, refer to the governing document for PPE requirements. At a minimum, the following checked PPE is required for all tasks during field work (outside of field office trailers and vehicles) not covered by a JSA or Permit on this project:

Minimum PPE required to be worn by all staff on project:

						Specify Type:
X	Hard hat		Snake chaps/guards		Coveralls:	
X	Safety glasses		Briar chaps		Apron:	
	Safety goggles		Chainsaw chaps		Chem. resistant gloves:	
	Face shield		Sturdy boot	X	Gloves other:	Nitrile
X	Hearing protection	X	Steel or comp. toe boot		Chemical boot:	
	Rain suit		Metatarsal boot		Boot other:	
	Other:			X	Traffic vest, shirt or coat:	Class II
					Life vest:	

Task specific PPE:
Comments:

Medical Surveillance

All Arcadis employees performing field work will be required to be current in HAZWOPER medical surveillance.

Client drug and/or alcohol testing will be required for all workers on this project. The project or task manager will instruct project participants on testing protocols.

Hazardous Materials Shipping and Transportation

A shipping determination package has been prepared, reviewed and provided to Arcadis field staff for this project.

Traffic Safety and Traffic Safety Plans (TSPs)

All or portions of the project work will be conducted in a parking lot and/or private roadway. A Non-ROW TSP addressing this work is attached to this HASP.

Arcadis Commercial Motor Vehicles (CMVs)

CMVs operated by Arcadis employees on public roadways will not be utilized on this project. Arcadis defines a CMV as any single vehicle with a gross vehicle weight rating (GVWR) ≥10,001 pounds or a truck and trailer combination with a combined GVWR ≥10,001 pounds (GVWR of truck + GVWR of trailer = ≥10,001 pounds).

Site Control

Based on the low hazards associated with the work being performed, a standard 10 ft diameter exclusion zone will be enforced around active work being performed on this project. The exclusion zone will be demarcated with cones and/or caution tape.

Decontamination

Due to the low hazards associated with the scope of work for this project, basic hygiene best management practices including washing hands and face prior to eating, drinking and consuming tobacco products will be used. If conditions change during the course of work warranting additional decontamination protocols, the additional decontamination protocols will be addressed in the applicable task JSA.

Sanitation

Portable restroom facilities and potable water will be provided by the Arcadis project team. Unless alternate requirements are stipulated in a plan supplement (i.e. Heat Injury and Illness Prevention Plan), permit or JSA, temporary restroom facilities will be provided with one toilet for every 20 project workers and bottled or non-plumbed potable water will be provided to project workers at 1 gallon/worker/day.

Safety Briefings

Arcadis will lead all safety briefings on this project and will document the safety briefing on a Tailgate Safety Briefing form or logbook. Safety briefings will be conducted once at the beginning of each work day unless the Site Safety Officer deems more frequent safety briefings will be required based on work being conducted. All project workers, including Arcadis subcontractors, will be required to attend the safety briefing. Site visitors and project workers not on duty during the morning safety briefing will receive the safety briefing upon their arrival onto the project site for the day.

Behavior Based Safety (BBS) Program

The CPM or APM is responsible for reviewing and establishing BBS goals for the project. These goals are summarized below.

TIP required at the following frequency on this project:
1 TIP per 5 work days
Near Miss reporting goals for this project:
1 NM per event
Other (specify):

Safety Equipment and Supplies

Safety equipment/supply requirements are addressed in the JSA or Permit for the task being performed. If work is not performed under a JSA or Permit, the following safety equipment is required to be present on site in good condition (Check all that apply):

X	First aid kit
	Bloodborne pathogens kit
X	Fire extinguisher
	Eyewash (ANSI compliant)
X	Eyewash (bottle)
X	Drinking water
	Other:

	Insect repellent:
X	Sunscreen
	Air horn
X	Traffic cones
	2-way radios
	Heat stress monitor
	Poisonous plant pre/post exposure lotion/soap

Control of Ticks and Poisonous Plants

Work on this project has a low tick exposure hazard. Use of inspect repellent (DEET and/or permethrin) is recommended. Wear light colored clothing to help identify presence of ticks on staff. Keep shirt tails inside pants.

Work on this project has a low poisonous plant exposure hazard. First aid kits should be equipped with post exposure soap as a precaution. Inspect work area for presence of hazard prior to initiating work at the location. Wear disposable gloves during work and while removing outer footwear.

International Travel

International travel is not required for this project.

Spill Control and Containment

Spill control and containment planning and implementation is not required for this project.

Use of Electronic Devices in Areas of Increased Safety Risk

Use of electronic devices (tablets, laptops, and/or cell phones) to collect data or document work is not anticipated on this project. If electronic devices are used, distraction hazards and use must be addressed and documented in the job briefing/safety briefing.

Signatures

I have read, understand and agree to abide by the requirements presented in this health and safety plan. I understand that I have the absolute right to stop work if I recognize an unsafe condition affecting my work until corrected.

Printed Name	Signature	Date

Add additional sheets if necessary

You have an absolute right to STOP WORK if unsafe conditions exist!

Attachments

Traffic Safety Plan (TSP)

Notes: ROW - Right of Way (Public) formerly known as "TCP"
Non-ROW - Not in the ROW (parking lots, etc.) formerly known as "STAR"

1.0 General

Plan type	Non-Right of Way (Non-ROW)
Project Name:	3 Saints Release
Project Number:	30036536
Developer Name:	Kevin Renlund
Duration of Project (in hours or days):	10 hours per day
Time Restrictions (Y/N, if Y describe below):	N
Not Applicable	
Not Applicable	
Not Applicable	NA
Not Applicable	
Not Applicable	NA

☐ Working on multiple roads?

Comments:

2.0 Work Description

Provide a brief description of scope of work:
Work will be performed on or near agricultural roads and other driving areas with minimal traffic.

3.0 Type and Duration

Work locations on this project will be: Intermediate work (1-8 hours per location)

Non-ROW work will be performed in: Active parking lot

Special traffic conditions may include (select most prevalent): Construction equipment

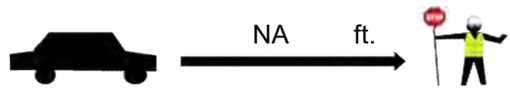
4.0 Traffic Control Layout, Number of Devices Required, and Phasing

The following Non-ROW requirements in the Traffic Safety Handbook applies:
Section 7.4 Long Duration Work in Parking Areas (>8 Hours) (DOT Facts-302c)

The menu below will be blank and is not applicable.

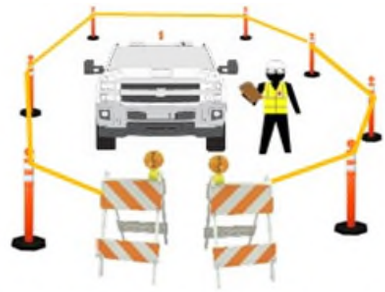
The menu below will be blank and is not applicable.

Non-ROW configuration:
An example non-ROW traffic control configuration for this project is illustrated below. The actual type and number of devices required are specified below. Don't leave vehicle doors open. Don't establish controls within 25 ft of the front or rear of parked large vehicles/rolling equipment without coordinating with the vehicle/equipment operator.

ROW minimum sign spacing distances for "A", "B" and "C" (as applicable) in referenced DOT Facts.	ROW oncoming traffic minimum site distance required to see Flagger and properly decelerate and stop.
A NA ft. B NA ft. C NA ft.	

ROW Cone Calculation (Values are default. Light grey fields may be modified based on actual road conditions)

	Active work area length (feet)	200
☐	Apply Optional Longitudinal Buffer (ft)?	0
	Lane width of offset (feet)	12
	Shoulder width of offset (feet)	8
	Posted speed limit	NA



Intermediate Term (1-8 Hours)
Channelizing Cones, Caution Tape and Type II Barricades

☐ **Shoulder Taper**

Taper Length (feet)	NA
Cones Required	NA
Cones Spacing (max., ft)	NA

☐ **Merging Taper**

Taper Length (feet)	NA
Cones Required	NA
Cones Spacing (max., ft)	NA

X	**Work Area**	
	Cone Spacing (max., ft)	10
	Cones Required	15
	Downstream Taper	
	Taper Length (feet)	NA
	Cones Required	NA
	Cone Spacing (max., ft)	NA
	Cones Required (minimum)	NA

Short to Long Term
Truck as Barrier to Traffic Exposure

Select the traffic control devices to be used and enter number each required:

Check all that apply:		*Wording or Pictogram*	*Number:*
	Warning signs		
	Warning signs		
	Warning signs		
	Stop/Slow paddle		
	Red flag		
	Drums		
X	Channelizer cone (42 inch height, 10 lb base)		15
	Channelizer cone (42 inch height, 30 lb base)		
	Traffic cones (≥ 18 inches tall)		NA
	Barricade:		
	Flags for cones		
	Lights (for night work)		
	Plastic fencing (rolls)		
X	Caution tape (rolls)		2
	Other (specify):		

Non-ROW Phasing:

1) Position truck as shield, if practical

2) Deploy traffic control devices

3) Affix flags, caution tape or fencing

4) Unload project equipment

5) Commence work

6) SSO to maintain controls

7) Remove controls in reverse order

Electronic Device Use Safety
Electronic devices (tablets, laptops and cell phones) used for data collection or work documentation are not anticipated to be used on this project. If these devices are used for data collection or work documentation, their use and distraction hazards must be addressed in the safety briefing.

Reviewed By:

HASP Reviewer: Robin Johl, ASP

Job Safety Analysis

General

JSA ID	45	**Status**	(3) Completed
Job Name	Environment-Groundwater Sampling and free product recovery	**Created Date**	2/4/2009
Task Description	Groundwater sampling	**Completed Date**	02/06/2009
Template	True	**Auto Closed**	False

Client / Project

Client	Arcadis AGMI
Project Number	000000100000
Project Name	GENERAL OVERHEAD
PIC	
Project Manager	

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Mason, Greg	6/1/2018	2/4/2009	Balcer, Denis	☑
HASP Reviewer	Coppola, Mija	2/6/2009	2/6/2009	Coppola, Mija	☐

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Stage at pre-determined sampling location and set up work zone and sampling equipment	1	Personnel could be hit by vehicular traffic	Set up cones and establish work area. Position vehicle so that field crew is protected from site traffic. Unload as close to work area as safely possible.	
		2	Vehicles parked too close to stationary objects may strike them when driving from location.	Park vehicle so first movement is forward. Park in a location that will be free of stationary objects, such as bollards, monitoring wells, fence posts, etc. when the vehicle pulls forward. Avoid backing! At work locations where space is not restricted, leave a minimum of _____ feet between the work vehicle and the nearest stationary object.	
		3	Sampling equipment, tools and monitoring well covers can cause tripping hazard	Keep equipment picked up and use TRACK to assess changes.	
2	Open wells to equilibrate and gauge wells	1	When squatting, personnel can be difficult to see by vehicular traffic.	Wear class II traffic vest if wells are located proximal to vehicular traffic. Use tall cones and the buddy system if practicable.	
		2	Pinchpoints on well vault can pinch or lacerate fingers	Use correct tools to open well vault/cap. Wear leather gloves when removing well vault lids, and chemical protective gloves while gauging. Wear proper PPE including safety boots, knee pads and safety glasses.	
		3	Lifting sampling equipment can cause muscle strain	Unload as close to work area as safely possible; use proper lifting and reaching techniques and body positioning; don't carry more than you can handle, and get help moving heavy or awkward objects.	
		4	Pressure can build up inside well causing cap to release under pressure	Keep head away from well cap when removing. If pressure relief valves are on well use prior to opening well	
3	Begin Purging Well and Collecting Parameter Measurements	1	Electrical shock can occur when connecting/disconnecting pump from the battery.	Make sure equipment is turned off when connecting/disconnecting. Wear leather gloves. Use GFCIs when using powered tools and pumps. Do not use in the rain or run electrical cords through wet areas.	
		2	Purge water can spill or leak from equipment	Stop purging activities immediately, stop leakage and block any drainage grate with absorbent pads. Call PM to notify them of any reportable spill.	
		3	Water spilling on the ground can cause muddy/slippery conditions	Be careful walking in work area when using plastic around well to protect from spillage	

3	Begin Purging Well and Collecting Parameter Measurements	4	Lacerations can occur when cutting materials such as plastic tubing	When cutting tubing, use tubing cutter. No open fixed blades should ever be used. When possible wear work gloves, leather type.	
		5	Purge water can splash into eyes	Pour water slowly into buckets/drums to minimize splashing. Wear safety glasses.	
4	Collect GW or Free Product Sample	1	Working with bailer rope can cause rope burns on hands.	Slowly raise and lower the rope or string for the bailer. Wear appropriate gloves for the task.	
		2	Sample containers could break or leak preservative	Discard any broken sampleware or glass properly. Do not overtighten sample containers. Wear chemical protective gloves.	
5	Recovery of Free Product from well	1	Exposure to free product	Additional chemical protection may be necessary based on the type of product. Additionally, safety goggles, a faceshield, or respiratory protection may be required. Verify in the HASP.	
6	Staging of Well Purge water and/or Free Product	1	Muscle strains can occur when moving purge water or drums	If using buckets, do not fill buckets up to the top. Always keep lid on buckets when traveling or moving them to another location. Only half fill buckets so when dumping the buckets weigh less. See drum handling JSA for movement of drums.	Drum handling JSA

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	long sleeve shirt/pants		Recommended
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	Nitrile	Required
	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs		Recommended
Miscellaneous PPE	other	Knee pads	Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Decontamination	Decon supplies (specify type)	alconox, DI water, spray bottle	Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
	flashlight		Required
Personal	eye wash (specify type)	bottle	Required
	insect repellent		Recommended
	sunscreen		Recommended
Traffic Control	barricades		Recommended
	traffic cones		Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Coppola, Mija HASP Reviewer Approve 2/6/2009	

Job Safety Analysis

General

JSA ID	38	**Status**	(3) Completed
Job Name	General Industry-Surveying - land	**Created Date**	2/2/2009
Task Description	Land surveying	**Completed Date**	02/02/2009
Template	True	**Auto Closed**	False

Client / Project

Client	Arcadis AGMI
Project Number	000000100000
Project Name	GENERAL OVERHEAD
PIC	
Project Manager	

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Coppola, Mija	9/26/2016	2/2/2009	Coppola, Mija	☐
HASP Reviewer	Coppola, Mija	2/4/2009	2/2/2009	Coppola, Mija	☐

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Site reconnaissance and walk-around	1	Slips/trips/falls can occur from walking on uneven ground surface.	Survey the site upon arrival. Note any site conditions that may pose a potential hazard.	JSA-Roadway Work ARCHSFS017
		2	Site workers or equipment can be struck by site vehicular traffic	Wear Class II traffic vest and cone off the work area. Follow the JSA and Field H&S Handbook for roadway work.	
		3	Slip / Trip / Fall	Slope >30° - Avoid walking down / up slope, use alternate route. Use an offset adapter that attaches to a survey rod to reach location. Use fall protection (Personal Fall Arrest) if accessing slope. Stop Work and contact Corporate H&S if controls are not adequate. Slope <30° - Ensure footwear has adequate traction, use over boot traction when muddy / wet. Use walking stick or trekking pole.	
		4	Exposure to ticks.	Assess locations for possible tick habitat. When possible, walk over thin, low grasses, dirt or rock paths. Avoid tall grasses, weeds and beds of fallen leaves (likely nest areas). Wear permethrin spray, heavily applied, on clothing (where permitted) and DEET (30% or higher) on exposed skin. Wear light colored clothing to make ticks more visible. Check for ticks on clothing and skin frequently. Tape pant legs to boots if working in potential tick habitat for extended periods. In areas with very high potential for exposure or known infestations, wear disposable coveralls.	
		5	Contact with poison ivy, poison oak or sumac may result in severe skin irritation.	Learn to identify how urushiol-containing plants appear during all seasons. Avoid contact with skin or clothing. Give plants a wide berth as younger plants in the area may be more difficult to recognize and the vines extending from recognized areas also contain urushiol. Consider applying a barrier cream to exposed skin. In areas where the plants are prevalent or in cases where individuals have known allergic responses to urushiol (ie. poison ivy), wear chemically protective disposable coveralls.	
2	Deployment and retrieval of traffic control devices during roadway work	1	Stuck by vehicles	Face traffic and use spotter if not facing traffic, stay off the travelled roadway to extent practical, wear Class II (minimum) traffic vest. Familiarize yourself with work zone control layout prior to deploying devices.	

2	Deployment and retrieval of traffic control devices during roadway work	2	Slips trips and falls on uneven road or land surfaces	Do not carry objects that obscure visibility of ground surface when walking, wear footgear with ankle support and good tread, use buddy system when carrying large bulky objects.	
		3	Lifting heavy or bulky signage or traffic channeling device	Brake down load to manageable size. Do not over reach to grab cones from the interior of the project vehicle. Use proper lifting techniques, maintain good vehicle housekeeping to easily retrieve control devices. Use buddy system to move heavy objects like barrels.	
		4	Pinch points to hands on folding components of sign stands	Wear leather gloves or other suitable glove. Watch for hazard and avoid placing hands in pinch areas. Do not hurry through setup/take down.	
3	Sharpen machete, brush axe or other cutting tool	1	Sharpening machete can cause lacerations and can generate metal shavings that can cause eye abrasions.	Secure blade to a sturdy fixture such as work bench and use vice. Make sure that sharp edge does not come in contact with fingers/body when sharpening. Sharpen blade 4"-10" above handle. Tip is not sharpened. Use Kevlar gloves and safety glasses.	
		2	Cuts from unsheathed/uncovered cutting tool upon completion of sharpening activity	Promptly sheath or cover cutting blade of cutting tool upon completion of sharpening task, do not "stick" machetes in ground until needed for use.	
4	Line cutting with machete	1	Improper use of the machete can cause lacerations	Do not reach or over-extend when cutting, and cut away from the body at 45 degree angle. Always keep machete sharpened. Do not use tool if the handle becomes wet/slippery. Never stick the blade into the ground--sheath machete when not in use. See the Field H&S Handbook for detailed machete use instructions (section DD).	Field H&S Handbook Section DD
		2	Utility lines can be accidentally severed during cutting	Inspect area for location of overhead lines prior to starting the task. Do not use machete when cutting vegetation that is close to utility lines. Use more appropriate tools such as garden clippers or shears.	
		3	Biologicals such as poisonous plants, bees/wasps, and other insects can be encountered during cutting of vegetation or brush.	Attempt to identify biological concerns prior to starting task. Use identification techniques outlined in the Field H&S Handbook.	
		4	Cardio and muscle fatigue can be experienced from prolonged use of machete or when using machete for cutting of thick vegetation.	Take proper rest breaks, and rotate work jobs with co-workers. For thick vegetation, make sure the machete is the best tool for the job.	
		5	Impalement hazards from falls onto stumps of cut vegetation	Be aware of hazard and avoid walking in cut areas where vegetation exists that could present an impalement hazard. In areas where longer term work areas are cleared, take time to cut vegetation closer to ground surface without an angular cut.	
		6	Objects can fall once cut, or particles can become airborne getting into eyes or puncturing skin.	Wear hard hat, safety glasses and steel-toe shoes. Determine a safe fall zone. Do not use hard strokes when cutting with the machete to limit flying particles.	
		7	Fallen branches and vegetation can cause tripping hazard	Remove freshly cut limbs and brush from the work area to ensure balance, reduce slips and falls, and reduce obstructions.	
5	Line cutting using brush axe or chainsaw (must be approved by Party Chief).	1	Improper use of the brush axe or chainsaw can cause serious injury	Inspect equipment before use, and keep chain sharp. Hold the chainsaw with both hands, never cut above shoulder height. Keep saw close to your body. Carry brush axes sheathed with blade facing away from body. Do not carry brush axes when carrying other large or bulky objects.	Site clearing JSA

5	Line cutting using brush axe or chainsaw (must be approved by Party Chief).	2	Struck by brush axe	Maintain proper separation distance when cutting, ensure anti-slip tape or other material on handles of brush axe to prevent slipping out of hands, wear gloves with good gripping capability.	
		3	Utility lines can be accidentally severed during cutting	Inspect area for location of overhead lines prior to starting the task. Note direction of fall for trees and ensure contact with utility lines will not occur	
		4	Objects can fall once cut, or particles can become airborne getting into eyes or puncturing skin.	Wear hard hat, safety glasses and steel-toe boots. Determine a safe fall zone to limit flying particles.	
		5	Fallen branches and vegetation can cause tripping hazard	Remove freshly cut limbs and brush from the work area to ensure balance, reduce slips and falls, and reduce obstructions.	
		6	Noise hazards (chainsaw)	Wear hearing protection (ear plugs or ear muffs)	
6	Removal of manhole covers	1	Pinch points and scrape hazards when removing MH cover.	Do not place fingers under lid during removal. Use shovels, pry bars, etc. to place under lid edge to lift. Wear sturdy work glove. Wear steel toe boot. Do not purposely drop lids.	
		2	Back/neck/arm/shoulder strains and hand blisters could occur from over lifting, or not lifting properly.	Use proper lifting techniques, keep back straight, lift with legs, use “J” Hook or pry bar, Buddy System required	
7	Equipment set-up, calibration and survey of target area	1	Slips/trips/falls can occur from walking on uneven ground surface.	Watch for uneven ground, debris, and trip hazards. If possible clear area of trip hazards. Wear gloves and heavy denim work pants to avoid cuts when working in heavy brush/briers. Use buddy system to spot for uneven ground while surveying.	
8	Placement of stakes	1	Hands/fingers/arms can get struck by hammer/mallet. Splinters and lacerations can occur if stake splinters during hammering.	Wear leather work gloves and safety glasses when placing stakes.	
9	Placement of monuments	1	Back strain from digging holes or mixing concrete	Use proper shoveling techniques and keep back straight. Use the right tool for the job.	refer to Concrete work JSA
		2	Exposure to concrete can cause skin irritation or illness	Wear impermeable glove during mixing and concrete placement, promptly wash exposed skin. Do not use bare hands to mix, place, or finish concrete.	
		3	Inhalation of concrete dust during mixing	Keep face away from concrete when poured out of bag, Promptly wet concrete to be mixed.	

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	long sleeve shirt/pants		Recommended
Eye Protection	safety glasses		Required
Foot Protection	boots	reinforced toe boots	Required
	rubber boots		Recommended
Hand Protection	work gloves (specify type)	Kevlar for machete use, leather for cutting	Required
Head Protection	hard hat		Recommended
Miscellaneous PPE	other	snake chaps	Recommended
	traffic vest--Class II or III	orange during hunting season	Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
	Other	snake chaps depending on work location	Recommended
Personal	insect repellent		Required
	sunscreen		Required
	water/fluid replacement		Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Coppola, Mija HASP Reviewer Approve 2/2/2009	

Job Safety Analysis

General

JSA ID	8121	**Status**	(3) Completed
Job Name	General Industry-Driving - passenger vehicles	**Created Date**	8/24/2012
Task Description	Driving a car, van, or truck on public roadways.	**Completed Date**	05/30/2013
Template	True	**Auto Closed**	False

Client / Project

Client	Arcadis AGMI
Project Number	000001410000
Project Name	HEALTH & SAFETY
PIC	
Project Manager	

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Moyers, Samuel H	12/18/2012	5/30/2013	Tremblay, Tony	☑
HASP Reviewer	Santaniello, Julie A.	6/13/2013	5/30/2013	Balcer, Denis M	☑
Quality Reviewer	Lujan, Teresa M.	6/17/2013	6/17/2013	Metzger, Kenneth	☐

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Pre-Trip Inspection	1	Failing to perform pre-trip inspections may cause mechanical failure, accident or injury	Perform walk around of vehicle with particular attention to tire inflation and condition. Check lights, wipers, seatbelts for proper operating condition. Properly adjust seat and mirrors prior to vehicle operation. Use or review vehicle inspection checklist as required under the MVSP.	ARC HSGE024 Motor Vehicle Safety Standard (MVSP)
		2	Scrapes, cuts, burns to hand if inspecting engine fluids and/or tires. Eye splash hazard if inspecting engine fluids. Pinch or crush hazards when opening or closing hood, trunk or tailgate.	Wear protective gloves and safety glasses as described below when checking under hood or tires. Use TRACK and keep hands clear when opening/closing hood, trunk, or tailgate to avoid crush or pinch hazard.	
		3	Improperly secured cargo may dislodge creating injury, property damage or road hazard.	Ensure all cargo is properly secured to prevent movement while the vehicle is in opertation. This includes cargo in the cab of the vehicle.	
2	Driving a motor vehicle on public streets	1	Failing to observe traffic flow ahead increases risk of hard braking resulting in potential impact of vehicle ahead, being struck by another vehicle from behind and decreases decision making time.	Use Smith System Key #1, "Aim High in Steering". **Look ahead (15 seconds if possible) to observe traffic flow and traffic signals.** Adjust speed accordingly to keep vehicle moving and avoid frequent braking. Select lane of least traffic and adjust speed based on observed signal timing when possible. Avoid following directly behind large vehicles that obscure view ahead.	Smith System "5-Keys" is a registered trademark of Smith System Driver Improvement Institute, Inc.
		2	Failing to observe vehicles, pedestrians, bicyclists and other relevant objects in vicinity of your vehicle increases risk of side swipes, rear ending, and third party injury.	Use Smith System Key #2, "Get the Big Picture". **Maintain 360 degrees of awareness around vehicle.** Check a mirror every 6-8 seconds, maintain space around the vehicle, choose a lane that avoids being boxed in. Look for pedestrian activity ahead in crosswalks or sidewalks. Watch for construction zone approach signs and act early by executing lane changes and reducing speed.	

2	Driving a motor vehicle on public streets	3	Failing to keep your eyes moving increases risk of not seeing relevant vehicles, pedestrians and objects in your vicinity that may impair your ability to make timely and appropriate driving decisions and also increases risk of accident.	Use Smith System Key #3, "Keep Your Eyes Moving". **Move your eyes every 2 seconds and avoid staring while evaluating relevant objects.** Scan major and minor intersections prior to entering them. Check mirrors.	
		4	Failing to maintain space around and in front of your vehicle increases risk of striking another vehicle or being struck by another vehicle. Insufficient space shortens time for effective driving decision making resulting in increased accident risk.	Use Smith System #4, "Leave Yourself an Out". **Use 4 second rule when following a vehicle.** Avoid driving in vehicle clusters by adjusting speed and using lanes that permit maximum space and visibility. When stopped, keep one car length space in front of vehicle ahead or white line.	
		5	Failing to communicate with other drivers and pedestrians increases risk of striking vehicles, pedestrians, or being struck by other vehicles, especially from the rear.	Use Smith System Key #5, "Make Sure They See You". **Brake early and gradually when stopping to reduce potential of being rear ended.** Keep foot on brake while stopped. Use turn signals and horn effectively. Establish eye contact with other drivers and pedestrians to extent practical. Use vehicle positioning that promotes being seen.	
		6	Distractions within the vehicle takes focus off driving, increases risk of accident decreases time for making effective driving decisions.	**Cell phone use (any type or configuration) is prohibited while the vehicle is in motion.** Familiarize yourself with vehicle layout and controls (radio, temperature controls, etc.) prior to operating unfamiliar vehicles. Set controls prior to operating vehicle. Use GPS in unfamiliar areas to avoid use of paper maps/directions while driving. Set GPS prior to vehicle operation. Pull over and stop to modify GPS functions. Avoid consuming food or drink while driving.	
3	Parking	1	Parking vehicle in areas of clustered parked vehicles or near facility entrance may impair visibility to oncoming traffic in lot and increase exposure to pedestrian traffic.	**Use pull through parking or back into parking space when permitted or practical.** When practical and safe to do so, park away from other vehicles and avoid parking near the facility entrance or loading docks. If available, use a spotter to aid in backing activity. Back no further than necessary and back slowly. Get out and look (GOAL) if uncertain of immediate surroundings. Tap horn prior to backing.	

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses	While checking engine or tires	Required
Hand Protection	work gloves (specify type)	Leather or equivalent checking engine or tires	Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
	other	Vehicle kit (applies to company trucks)	Required
Miscellaneous	fire extinguisher	Applies to company trucks	Required
	first aid kit	Applies to company trucks	Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Santaniello, Julie A. HASP Reviewer Revise 9/6/2012	Revise per suggested mark-ups
Employee: **Role** **Review Type** **Completed Date**	Santaniello, Julie A. HASP Reviewer Approve 5/30/2013	
Employee: **Role** **Review Type** **Completed Date**	Lujan, Teresa M. Quality Reviewer NA 6/17/2013	Very good write up. The reminder of the 5 Key Smith Driving rules are essential in everyday driving. The practice of these has and will make you a better driver and keep you safe.

Job Safety Analysis

General

JSA ID	166	**Status**	(3) Completed
Job Name	Environment-Sample cooler handling	**Created Date**	5/1/2009
Task Description	Sample cooler handling	**Completed Date**	05/13/2009
Template	True	**Auto Closed**	False

Client / Project

Client	Arcadis AGMI
Project Number	000000100000
Project Name	GENERAL OVERHEAD
PIC	
Project Manager	

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Coppola, Mija A	12/19/2011	5/11/2009	Ebert, Joachim	☐
HASP Reviewer	Moyers, Samuel H	5/25/2009	5/13/2009	Tremblay, Tony	☑

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Transfer field samples to sample packing area	1	Lifting heavy coolers may result in muscle strain especially to lower back.	Use proper lifting techniques and keep back straight. Use buddy system for large coolers, Use mechanical aids like hand trucks if readily available to move coolers. Do not over fill coolers with full sample containers for temporary movement to the sample prep area. Ensure an adequate supply of sample coolers are in field.	
		2	Hazards to hands from broken glass caused by over tightening lids or improper placement in cooler	Inspect all bottles and bottle caps for cracks/leaks before and after filling container. Do not over tighten sample lids. Clean up any broken bottles immediately, avoid contact with sample preservatives. Wear leather gloves when handling broken glass.	
		3	Exposure to chemicals (acid preservatives or site contaminants) on the exterior of sample bottles after filling.	Wear protective gloves for acid preservatives and safety glasses with side shields during all sample container handling activities (before and after filling), Once filled follow project specific HASP PPE requirements for skin and eye protection.	
		4	Samples containing hazardous materials may violate DOT/IATA HazMat shipping regulations	All persons filling a sample bottle or preparing a cooler for shipment must have complete ARCADIS DOT HazMat shipping training. Compare the samples collected to the materials described in the Shipping Determination for the Project and ensure consistent. Re-perform all Shipping determinations if free product is collected and not anticipated during planning.	
2	Sample cooler selection	1	Sample coolers with defective handles, lid hinges, lid hasps cracked or otherwise damaged may result in injury (cuts to hands, crushing of feet if handle breaks etc)	Only use coolers that are new or in like new condition, No rope handled coolers unless part of the manufacturer's handle design.	ARCADIS Shipping Guide US-001
		2	Selection of excessively large coolers introduces lifting hazards once the cooler is filled.	Select coolers and instruct lab to only provide coolers of a size appropriate for the material being shipped. For ordinary sample shipping sample coolers should be 48 quart capacity or smaller to reduce lifting hazards.	
3	Pack Samples	1	Pinch points and abrasions to hands from cooler lid closing unexpectedly	Beware that lid could slam shut; block/brace if needed; be wary of packing in strong winds. New coolers may be more prone to self closing, tilt cooler back slightly to facilitate keeping lid open.	

3	Pack Samples	2	Awkward body positions and contact stress to legs and knees when preparing coolers on irregular or hard ground surfaces.	Plan cooler prep activities. Situate cooler where neutral body positions can be maintained if practical, like truck tailgate. Avoid cooler prep on rough gravel surfaces unless knees and legs protected during kneeling.	
		3	Frostbite or potential for oxygen deficiency when packing with dry ice. Contact cold stress to fingers handling blue ice or wet ice	Dry ice temperature is -109.30F. Wear thermal protective gloves. DO NOT TOUCH with bare skin! Dry ice sublimates at room temp and could create oxygen deficiency in closed environment. Maintain adequate ventilation! Do not keep dry ice in cab of truck. Wear gloves when handling blue ice or gaging wet ice. Dry Ice is DOT regulated for air shipping, follow procedures in Shipping Determination.	
4	Sealing, labeling and Marking Cooler	1	Cuts to hands and forearms from strapping tape placement or removing old tape and labels	Do not use a fixed, open-blade knife to remove old tags/labels, USE SCISSORS or other safety style cutting device. Only use devices designed for cutting. Do not hurry through task.	
		2	Lifting and awkward body position hazards from taping heavy coolers, dropping coolers on feet during taping.	Do not hurry through the taping tasks, ensure samples in cooler are evenly distributed in cooler to reduce potential for overhanging cooler falling off edge of tailgate/table when taping.	
		3	Improper labeling and marking may result in violation of DOT/IATA HazMat shipping regulations delaying shipment or resulting in regulatory penalty	Do not deviate from ARCADIS Shipping Guide or Shipping Determination marking or labeling requirements.	
5	Offering sample cooler to a carrier or lab courier for shipment.	1	Lifting heavy coolers may result in muscle strain especially to lower back.	See lifting hazard controls above.	
		2	Carrier refusal to accept cooler may cause shipping delay and/or result in violation of DOT HazMat shipping regulations.	Promptly report all rejected and refused shipments to the ARCADIS DOT Program Manager. Do Not re-offer shipment if carrier requires additional labels markings or paperwork inconsistent with your training or Shipping Determination without contacting the ARCADIS DOT Compliance Manager.	

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Hand Protection	chemical resistant gloves (specify type)	nitrile	Required
	work gloves (specify type)	leather	Required

Supplies

Type	Supply	Description	Required
Miscellaneous	Other	Scissors	Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Moyers, Samuel H HASP Reviewer Revise 5/11/2009	Kevlar is required? Leather work gloves are listed. i suggest just leather gloves.
Employee: **Role** **Review Type** **Completed Date**	Moyers, Samuel H HASP Reviewer Approve 5/13/2009	

Job Safety Analysis

General

JSA ID	45	**Status**	(3) Completed
Job Name	Environment-Groundwater Sampling and free product recovery	**Created Date**	2/4/2009
Task Description	Groundwater sampling	**Completed Date**	02/06/2009
Template	True	**Auto Closed**	False

Client / Project

Client	Arcadis AGMI
Project Number	000000100000
Project Name	GENERAL OVERHEAD
PIC	
Project Manager	

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Coppola, Mija A	6/12/2012	2/4/2009	Ebert, Joachim	☐
HASP Reviewer	Coppola, Mija A	2/6/2009	2/6/2009	Ebert, Joachim	☐

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Stage at pre-determined sampling location and set up work zone and sampling equipment	1	Personnel could be hit by vehicular traffic	Set up cones and establish work area. Position vehicle so that field crew is protected from site traffic. Unload as close to work area as safely possible.	
		2	Sampling equipment, tools and monitoring well covers can cause tripping hazard	Keep equipment picked up and use TRACK to assess changes.	
2	Open wells to equilibrate and gauge wells	1	When squatting, personnel can be difficult to see by vehicular traffic.	Wear class II traffic vest if wells are located proximal to vehicular traffic. Use tall cones and the buddy system if practicable.	
		2	Pinchpoints on well vault can pinch or lacerate fingers	Use correct tools to open well vault/cap. Wear leather gloves when removing well vault lids, and chemical protective gloves while gauging. Wear proper PPE including safety boots, knee pads and safety glasses.	
		3	Lifting sampling equipment can cause muscle strain	Unload as close to work area as safely possible; use proper lifting and reaching techniques and body positioning; don't carry more than you can handle, and get help moving heavy or awkward objects.	
		4	Pressure can build up inside well causing cap to release under pressure	Keep head away from well cap when removing. If pressure relief valves are on well use prior to opening well	
3	Begin Purging Well and Collecting Parameter Measurements	1	Electrical shock can occur when connecting/disconnecting pump from the battery.	Make sure equipment is turned off when connecting/disconnecting. Wear leather gloves. Use GFCIs when using powered tools and pumps. Do not use in the rain or run electrical cords through wet areas.	
		2	Purge water can spill or leak from equipment	Stop purging activities immediately, stop leakage and block any drainage grate with absorbent pads. Call PM to notify them of any reportable spill.	
		3	Water spilling on the ground can cause muddy/slippery conditions	Be careful walking in work area when using plastic around well to protect from spillage	
		4	Lacerations can occur when cutting materials such as plastic tubing	When cutting tubing, use tubing cutter. No open fixed blades should ever be used. When possible wear work gloves, leather type.	
		5	Purge water can splash into eyes	Pour water slowly into buckets/drums to minimize splashing. Wear safety glasses.	
4	Collect GW or Free Product Sample	1	Working with bailer rope can cause rope burns on hands.	Slowly raise and lower the rope or string for the bailer. Wear appropriate gloves for the task.	

4	Collect GW or Free Product Sample	2	Sample containers could break or leak preservative	Discard any broken sampleware or glass properly. Do not overtighten sample containers. Wear chemical protective gloves.	
5	Recovery of Free Product from well	1	Exposure to free product	Additional chemical protection may be necessary based on the type of product. Additionally, safety goggles, a faceshield, or respiratory protection may be required. Verify in the HASP.	
6	Staging of Well Purge water and/or Free Product	1	Muscle strains can occur when moving purge water or drums	If using buckets, do not fill buckets up to the top. Always keep lid on buckets when traveling or moving them to another location. Only half fill buckets so when dumping the buckets weigh less. See drum handling JSA for movement of drums.	Drum handling JSA

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Dermal Protection	long sleeve shirt/pants		Recommended
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	Nitrile	Required
	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs		Recommended
Miscellaneous PPE	other	Knee pads	Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Decontamination	Decon supplies (specify type)	alconox, DI water, spray bottle	Required
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
	flashlight		Required
Personal	eye wash (specify type)	bottle	Required
	insect repellant		Recommended
	sunscreen		Recommended
Traffic Control	barricades		Recommended
	traffic cones		Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Coppola, Mija A HASP Reviewer Approve 2/6/2009	

Job Safety Analysis

General

JSA ID	44	**Status**	(3) Completed
Job Name	Environment-Drilling, soil sampling, well installation	**Created Date**	2/4/2009
Task Description	Drilling, soil sampling, and well installation	**Completed Date**	02/04/2009
Template	True	**Auto Closed**	False

Client / Project

Client	ARCADIS-AGMI
Project Number	000000100000
Project Name	GENERAL OVERHEAD
PIC	
Project Manager	

User Roles

Role	Employee	Due Date	Completed Date	Supervisor	Active
Developer	Coppola, Mija A	6/28/2012	2/4/2009	Ebert, Joachim	☐
HASP Reviewer	Coppola, Mija A	2/6/2009	2/2/2009	Ebert, Joachim	☐

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Set up necessary traffic and public access controls	1	Struck by vehicle due to improper traffic controls	Use a buddy system for placing site control cones and/or signage. Position vehicle so that you are protected from moving traffic. Wear Class II traffic vest	
2	Utility Clearance	1	Potential to encounter underground or above ground utilities while drilling.	Complete utility clearance in accordance with the ARCADIS Utility Clearance H&S Standard.	ARCADIS H&S Standard ARCHSFS019
3	General drill rig operation	1	Excessive noise is generated by rig operation.	When the engine is used at high RPMs or soil samples are being collected, use hearing protection.	
		2	During drill rig operation, surfaces will become hot and cause burns if touched, and COCs in the soils more readily vaporize generating airborne contaminates.	Due to friction and lack of a drilling fluid, heat will be produced during this method. Mainly drill augers. Be careful handling split spoons. Wear proper work gloves. When soils and parts become heated, the COC could volatilize. Air monitoring should always be performed in accordance with the HASP.	
		3	Moving parts of the drilling rig can pull you in causing injury. Pinch points on the rig and auger connections can cause pinching or crushing of body parts.	Stay at least 5 feet away from moving parts of the drill rig. Know where the kill switch is, and have the drillers test it to verify that it is working. Do not wear loose clothing, and tie long hair back. Avoid wearing jewelry while drilling. Cone off the work area to keep general public away from the drilling rig.	
		4	Dust and debris can cause eye injury and soil cuttings and/or water could contain COCs.	Wear safety glasses and stay as far away from actual drilling operation as practicable. Wear appropriate gloves to protect from COCs.	
		5	Drilling equipment laying on the ground (i.e. augers, split spoons, decon equipment, coolers, etc), create a tripping hazard. Water from decon buckets generate mud and cause a slipping hazard.	Keep equipment and trash picked up, and store away from the primary work area.	
		6	The raised derrick can strike overhead utilities, tree limbs or other elevated items	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Clearance H&S Standard for guidance.	

4	Mudd rotary drilling	1	The raised derrick can strike overhead utilities, tree limbs or other elevated items.	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	
		2	This technology uses fluid, which collects with sediments in large basin. Fluid can splash out and cause slipping/mud hazard. Liquid mixture can splash into your eyes.	Wear rubber boots if needed, and keep clear of muddy/wet area as much as practicable. If area becomes excessively muddy, consider mud spikes or covering the area with a material that improves traction. Wear safety glasses.	
5	Hollow stem auger drilling	1	All hazards in step 3 apply. Additionally,The raised derrick can strike overhead utilities, tree limbs or other elevated items	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	
		2	Hands or fingers can get caught and crushed if trying to clean by hand or with tools while the auger is still turning.	Auger should always be stopped and clutch disengaged prior to cleaning.	
6	Air Rotary Drilling	1	This drilling method works with high air pressure and can generate flying debris that can strike your body or get in your eyes.	When the drill rig is being driven into media, it will produce flying debris. The flaps behind the drill rig should stay closed whenever possible to reduce the risk of flying debris. Safety glasses and hard hat should always be worn when the drill rig is operating. When penetrating asphalt, protect surrounding cars that may be present to avoid damage to pain or windshields.	
		2	The raise derrick can strike overhead utilities, tree limbs or other elevated items.	Never move this rig with the derrick up. Ensure there is proper clearance to raise the derrick and that you are far enough away from overhead power lines. See the Utility clearance H&S Standard for guidance.	
		3	When drilling through bedrock prior to groundwater, dust can be produced from pulverization. Inhalation of dusts/powder can occur.	Supplemental water should be used to manage dust and/or dust masks should be used if necessary.	
7	Reverse rotary drilling	1	This method will use fresh water to pump out drill cuttings through the center of the casing. Water/sediment mixture is generated and could cause contact with impacted soils or groundwater.	Ensure the pit construction can hold the amount of cuttings that are anticipated. Air monitoring should also be used of pit area.	
		2	Fire hydrants are often used for water source. Hydrants deliver water at high pressure. Pressurized water can cause flying parts/debris and excessive slipping hazards.	Water usage from fire hydrants should be cleared with local municipalities prior to use. Only persons that know how to use the hydrant should be performing this task. Ensure all connections are tight, and hose line is not run over to cut by traffic. Any leaks from the hydrant should be reported immediately.	
		3	Settling pit construction can cause tripping hazard from excavated soils, and plastic sheeting can cause slipping.	Cone off the area to keep the general public/visitors away from the settling pit. Ensure proper sloping of excavation.	
		4	The raised derrick can strike overhead utilities, tree limbs or other elevated items.	Never move the rig with the derrick up. Ensure there is proper clearance to raise the derrick, and that you are far enough away from overhead power lines. See the Utility Location H&S policy and procedure for guidance.	

8	Rotosonic drilling	1	Fire hydrants are often used for water source. Hydrants deliver water at high pressure. Pressurized water can cause flying parts/debris and excessive slipping hazards.	Water usage from fire hydrants should be cleared with local muncipalities prior to use. Only persons that know how to use the hydrant should be performing this task. Ensure all connections are tight, and hose line is not run over to cut by traffic. Any leaks from the hydrant should be reported immediately.	
		2	This method requires a lot of clearance. The drill head can turn 90 degrees to attach to the next drill flight or casing. This usually requires a large support truck to park directly behind the rig. As the drill head raises the new casing flight is angled down at the same time until it can be turned completely vertical.	Ensure sufficient overhead clearance.	
		3	Heavy lifting of cores can cause muscle strain.	Always use 2 people to move core containers. Use caution moving core samples to layout area. Plan layout area to ensure adequate aisle space between core runs for logging. Keep back straight and use job rotation.	
		4	The rotosonic drill head can move very quickly up and down while working on a borehole. Moving parts can strike someone or catch body parts.	The operator and helper must communicate and stay clear of the path of the drill head. The drill utilizes two large hydraulic clamps to continuously hold casings while load/unloading previous casings. Do not wear loose clothing.	
9	Direct push drilling	1	The drill rods will be handled by workers most of the time rather than the rig doing it, therefore pinch points can cause lacerations and crushing of fingers/body parts.	Keep a minimum of 5 feet away from drill rig operation and moving parts.	
		2	The direct push rigs are usually meant to fit in spaces where larger rig can't. Tight spaces can pin workers.	Do not put yourself between the rig and a fixed object. Use Spotters or a tape measure to ensure clearances in tight areas. Pre-plan equipment movement from one location to the next.	
		3	Some direct push equipment is controlled by wireless devices. These controls can fail and equipment can strike workers or cause damage to property.	The drill rig should be used in a large open area to test wireless controls prior to moving to boring locations. The operator of the rig will test the kill switch with wireless remote prior to use. Operator will stay in range of rig while moving so that wireless signal will not be too weak and cause errors to the controls.	
		4	Sampling sleeves must be cut to obtain access to soil. Cutting can cause lacerations.	It's preferable to let the driller cut the sleeves open. Many drillers have holders for the sleeve to allow for stability when cutting. If you cut the sleeves, use a hook blade, change blade regularly, and cut away from the body.	
		5	Soil cores may contain contaminated media.	Wear nitrile gloves and saftey glasses for protection from contaminated media when logging soil borings.	
10	Rock coring	1	Flying debris can hit workers or cause debris to get in eyes.	Rock chips or overburden may become airborne from drilling method. Wear safety glasses and hard hat and remain at a safe distance from back of drill rig.	
		2	Heavy lifting of cores can cause muscle strain.	Always use 2 people to move core containers. Use caution moving core samples to layout area. Plan layout area to ensure adequate aisle space between core runs for logging. Keep back straight and use job rotation.	

11	Sample collection and processing	1	Injuries can result from pinch points on sampling equipment, and from breakage of sample containers.	Care should be taken when opening sampling equipment. Look at empty containers before picking them up, and do not over-tighten container caps. Use dividers to store containers in the cooler so they do not break.	Sample Cooler Handling JSA
		2	Lifting heavy coolers can cause back injuries.	Use two people to move heavy coolers. Use proper lifting techniques.	
12	Monitoring well installation	1	Same hazards as in Step 3 with general drill rig operation	See step 3	
		2	Monitoring well construction materials can clutter the work area causing tripping hazards.	Well construction materials should be picked up during the well installation process.	
		3	Heavy lifting can cause muscle strains, and cutting open bags can cause lacerations.	Well construction materials are usually 50 lbs or greater. Team lift or use drill rig to hoist bags. Always use work gloves while cutting open bags.	
		4	Well pack material (i.e. sand, grout, bentonite) can become airborne and get in your eyes.	Wear safety glasses for protection from airborne sand and dust.	
		5	Cutting the top of the well to size can cause jagged/sharp edges on the top of the well casing.	Wear gloves when working with the top of the well casing, and file any sharp jagged edges that resulted from cutting to size.	
13	Soil cutting and purge water management	1	Moving full drums can cause back injury, or pinching/crushing injury.	Preferably have the drilling contractor move full drums with their equipment. If this is not practicable, use lift assist devices such as drum dollies, lift gates, etc. Employ proper lifting techniques, and perfrom TRACK to identify pinch/crush points. Wear leather work gloves, and clear all walking and work areas of debris prior to moving a drum.	Drum Handling JSA

PPE — Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses		Required
Foot Protection	steel-toe boots		Required
Hand Protection	chemical resistant gloves (specify type)	Nitrile	Required
	work gloves (specify type)	leather	Required
Head Protection	hard hat		Required
Hearing Protection	ear plugs		Required
Miscellaneous PPE	traffic vest--Class II or III		Required
Respiratory Protection	dust mask		Recommended

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
Decontamination	Decon supplies (specify type)	Driller to provide and manage	Recommended
Miscellaneous	fire extinguisher		Required
	first aid kit		Required
Personal	eye wash (specify type)	bottle	Required
	water/fluid replacement		Recommended
Traffic Control	traffic cones		Required

Review Comments

Reviewer		Comments
Employee: **Role** **Review Type** **Completed Date**	Coppola, Mija A HASP Reviewer Approve 2/2/2009	

MATERIAL SAFETY DATA SHEET

ALCONOX®

Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS, Australian WorkSafe, Japanese Industrial Standard JIS Z 7250:2000, and European Union REACH Regulations

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME:	**ALCONOX®**
CHEMICAL FAMILY NAME:	Detergent.
PRODUCT USE:	Critical-cleaning detergent for laboratory, healthcare and industrial applications
U.N. NUMBER:	Not Applicable
U.N. DANGEROUS GOODS CLASS:	Non-Regulated Material
SUPPLIER/MANUFACTURER'S NAME:	Alconox, Inc.
ADDRESS:	30 Glenn St., Suite 309, White Plains, NY 10603. USA
EMERGENCY PHONE:	**TOLL-FREE in USA/Canada** 800-255-3924
	International calls 813-248-0585
BUSINESS PHONE:	914-948-4040
DATE OF PREPARATION:	May 2011
DATE OF LAST REVISION:	February 2008

SECTION 2 - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: This product is a white granular powder with little or no odor. Exposure can be irritating to eyes, respiratory system and skin. It is a non-flammable solid. The Environmental effects of this product have not been investigated.

US DOT SYMBOLS

Non-Regulated

CANADA (WHMIS) SYMBOLS

EUROPEAN and (GHS) Hazard Symbols

Signal Word: **Warning!**

EU LABELING AND CLASSIFICATION:

Classification of the substance or mixture according to Regulation (EC) No1272/2008 Annex 1
EC# 205-633-8 This substance is not classified in the Annex I of Directive 67/548/EEC
EC# 268-356-1 This substance is not classified in the Annex I of Directive 67/548/EEC
EC# 231-838-7 This substance is not classified in the Annex I of Directive 67/548/EEC
EC# 231-767-1 This substance is not classified in the Annex I of Directive 67/548/EEC
EC# 207-638-8 Index# 011-005-00-2
EC# 205-788-1 This substance is not classified in the Annex I of Directive 67/548/EEC

GHS Hazard Classification(s):

Eye Irritant Category 2A

Hazard Statement(s):

H319: Causes serious eye irritation

Precautionary Statement(s):

P260: Do not breath dust/fume/gas/mist/vapors/spray
P264: Wash hands thoroughly after handling
P271: Use only in well ventilated area.
P280: Wear protective gloves/protective clothing/eye protection/face protection/

Hazard Symbol(s):

[Xi] Irritant

Risk Phrases:
R20: Harmful by inhalation
R36/37/38: Irritating to eyes, respiratory system and skin

Safety Phrases:
S8: Keep container dry
S22: Do not breath dust
S24/25: Avoid contact with skin and eyes

HEALTH HAZARDS OR RISKS FROM EXPOSURE:

ACUTE: Exposure to this product may cause irritation of the eyes, respiratory system and skin. Ingestion may cause gastrointestinal irritation including pain, vomiting or diarrhea.

CHRONIC: This product contains an ingredient which may be corrosive.

TARGET ORGANS: ACUTE: Eye, respiratory System, Skin CHRONIC: None Known

SECTION 3 - COMPOSITION and INFORMATION ON INGREDIENTS

HAZARDOUS INGREDIENTS:	CAS #	EINECS #	ICSC #	WT %	HAZARD CLASSIFICATION; RISK PHRASES
Sodium Bicarbonate	144-55-8	205-633-8	1044	33 - 43%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium (C10 – C16) Alkylbenzene Sulfonate	68081-81-2	268-356-1	Not Listed	10 – 20%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium Tripolyphosphate	7758-29-4	231-838-7	1469	5 - 15%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Tetrasodium Pyrophosphate	7722-88-5	231-767-1	1140	5 - 15%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Sodium Carbonate	497-19-8	207-638-8	1135	1 - 10%	HAZARD CLASSIFICATION: [Xi] Irritant RISK PHRASES: R36
Sodium Alcohol Sulfate	151-21-3	205-788-1	0502	1 – 5%	HAZARD CLASSIFICATION: None RISK PHRASES: None
Balance of other ingredients are non-hazardous or less than 1% in concentration (or 0.1% for carcinogens, reproductive toxins, or respiratory sensitizers).					

NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-2004 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR, EU Directives and the Japanese Industrial Standard *JIS Z 7250: 2000*.

SECTION 4 - FIRST-AID MEASURES

Contaminated individuals of chemical exposure must be taken for medical attention if any adverse effect occurs. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to health professional with contaminated individual.

EYE CONTACT: If product enters the eyes, open eyes while under gentle running water for at least 15 minutes. Seek medical attention if irritation persists.

SKIN CONTACT: Wash skin thoroughly after handling. Seek medical attention if irritation develops and persists. Remove contaminated clothing. Launder before re-use.

INHALATION: If breathing becomes difficult, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Seek medical attention if breathing dificulty continues.

INGESTION: If product is swallowed, call physician or poison control center for most current information. If professional advice is not available, do not induce vomiting. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow. Seek medical advice. Take a copy of the label and/or MSDS with the victim to the health professional.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing skin, or eye problems may be aggravated by prolonged contact.

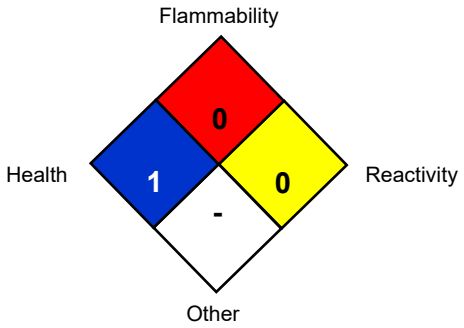
RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and reduce over-exposure.

SECTION 5 - FIRE-FIGHTING MEASURES

FLASH POINT: Not Flammable
AUTOIGNITION TEMPERATURE: Not Applicable
FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): NA Upper (UEL): NA
FIRE EXTINGUISHING MATERIALS: As appropriate for surrounding fire. Carbon dioxide, foam, dry chemical, halon, or water spray.

UNUSUAL FIRE AND EXPLOSION HAZARDS: This product is non-flammable and has no known explosion hazards.
Explosion Sensitivity to Mechanical Impact: Not Sensitive.
Explosion Sensitivity to Static Discharge: Not Sensitive
SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Isolate materials not yet involved in the fire and protect personnel. Move containers from fire area if this can be done without risk; otherwise, cool with carefully applied water spray. If possible, prevent runoff water from entering storm drains, bodies of water, or other environmentally sensitive areas.

NFPA RATING SYSTEM



HMIS RATING SYSTEM

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD (BLUE)	**1**
FLAMMABILITY HAZARD (RED)	**0**
PHYSICAL HAZARD (YELLOW)	**0**

PROTECTIVE EQUIPMENT			
EYES	RESPIRATORY	HANDS	BODY
	See Sect 8		See Sect 8

For Routine Industrial Use and Handling Applications

Hazard Scale: 0 = Minimal **1** = Slight **2** = Moderate **3** = Serious **4** = Severe * = Chronic hazard

SECTION 6 - ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Personnel should be trained for spill response operations.
SPILLS: Contain spill if safe to do so. Prevent entry into drains, sewers, and other waterways. Sweep, shovel or vacuum spilled material and place in an appropriate container for re-use or disposal. Avoid dust generation if possible. Dispose of in accordance with applicable Federal, State, and local procedures (see Section 13, Disposal Considerations).

SECTION 7 - HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat, drink, smoke, or apply cosmetics while handling this product. Avoid breathing dusts generated by this product. Use in a well-ventilated location. Remove contaminated clothing immediately.

STORAGE AND HANDLING PRACTICES: Containers of this product must be properly labeled. Store containers in a cool, dry location. Keep container tightly closed when not in use. Store away from strong acids or oxidizers.

SECTION 8 - EXPOSURE CONTROLS - PERSONAL PROTECTION

EXPOSURE LIMITS/GUIDELINES:

Chemical Name	CAS#	ACGIH TWA	OSHA TWA	SWA
Sodium Bicarbonate	144-55-8	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust
Sodium (C10 – C16) Alkylbenzene Sulfonate	68081-81-2	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust
Sodium Tripolyphosphate	7758-29-4	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust
Tetrasodium Pyrophosphate	7722-88-5	5 mg/m³	5 mg/m³	5 mg/m³
Sodium Carbonate	497-19-8	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust
Sodium Alcohol Sulfate	151-21-3	10 mg/m³ Total Dust	15 mg/m³ Total Dust	10 mg/m³ Total Dust

Currently, International exposure limits are not established for the components of this product. Please check with competent authority in each country for the most recent limits in place.

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure exposure levels are maintained below the limits provided below. Use local exhaust ventilation to control airborne dust. Ensure eyewash/safety shower stations are available near areas where this product is used.

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132) or equivalent standard of Canada, or standards of EU member states (including EN 149 for respiratory PPE, and EN 166 for face/eye protection), and those of Japan. Please reference applicable regulations and standards for relevant details.

RESPIRATORY PROTECTION: Based on test data, exposure limits should not be exceeded under normal use conditions when using Alconox Detergent. Maintain airborne contaminant concentrations below guidelines listed above, if applicable. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards, Canadian CSA Standard Z94.4-93, the European Standard EN149, or EU member states.

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: Use chemical resistant gloves to prevent skin contact.. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: Use body protection appropriate to prevent contact (e.g. lab coat, overalls). If necessary, refer to appropriate Standards of Canada, or appropriate Standards of the EU, Australian Standards, or relevant Japanese Standards.

SECTION 9 - PHYSICAL and CHEMICAL PROPERTIES

PHYSICAL STATE:	Solid
APPEARANCE & ODOR:	White granular powder with little or no odor.
ODOR THRESHOLD (PPM):	Not Available
VAPOR PRESSURE (mmHg):	Not Applicable
VAPOR DENSITY (AIR=1):	Not Applicable.
BY WEIGHT:	Not Available
EVAPORATION RATE (nBuAc = 1):	Not Applicable.
BOILING POINT (C°):	Not Applicable.
FREEZING POINT (C°):	Not Applicable.
pH:	9.5 (1% aqueous solution)
SPECIFIC GRAVITY 20°C: (WATER =1)	0.85 – 1.1
SOLUBILITY IN WATER (%)	>10% w/w
COEFFICIENT OF WATER/OIL DIST.:	Not Available
VOC:	None
CHEMICAL FAMILY:	Detergent

SECTION 10 - STABILITY and REACTIVITY

STABILITY: Product is stable
DECOMPOSITION PRODUCTS: When heated to decomposition this product produces Oxides of carbon (COx)
MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong acids and strong oxidizing agents.
HAZARDOUS POLYMERIZATION: Will not occur.
CONDITIONS TO AVOID: Contact with incompatible materials and dust generation.

SECTION 11 - TOXICOLOGICAL INFORMATION

TOXICITY DATA: Toxicity data is available for mixture:

CAS# 497-19-8 LD50 Oral (Rat)	4090 mg/kg
CAS# 497-19-8 LD50 Oral (Mouse)	6600 mg/kg
CAS# 497-19-8 LC50 Inhalation (Rat)	2300 mg/m³ 2H
CAS# 497-19-8 LC50 Inhalation (Mouse)	1200 mg/m³ 2H
CAS# 7758-29-4 LD50 Oral (Rat)	3120 mg/kg
CAS# 7758-29-4 LD50 Oral (Mouse)	3100 mg/kg
CAS# 7722-88-5 LD50 Oral (Rat)	4000 mg/kg

SUSPECTED CANCER AGENT: None of the ingredients are found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.
IRRITANCY OF PRODUCT: Contact with this product can be irritating to exposed skin, eyes and respiratory system.
SENSITIZATION OF PRODUCT: This product is not considered a sensitizer.
REPRODUCTIVE TOXICITY INFORMATION: No information concerning the effects of this product and its components on the human reproductive system.

SECTION 12 - ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.
ENVIRONMENTAL STABILITY: No Data available at this time.
EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this product's effects on plants or animals.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this product's effects on aquatic life.

SECTION 13 - DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations, those of Canada, Australia, EU Member States and Japan.

SECTION 14 - TRANSPORTATION INFORMATION

US DOT; IATA; IMO; ADR:
THIS PRODUCT IS NOT HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.
PROPER SHIPPING NAME: Non-Regulated Material
HAZARD CLASS NUMBER and DESCRIPTION: Not Applicable
UN IDENTIFICATION NUMBER: Not Applicable
PACKING GROUP: Not Applicable.
DOT LABEL(S) REQUIRED: Not Applicable
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2004): Not Applicable
MARINE POLLUTANT: None of the ingredients are classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B)

U.S. DEPARTMENT OF TRANSPORTATION (DOT) SHIPPING REGULATIONS:
This product is not classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:
This product is not classified as Dangerous Goods, per regulations of Transport Canada.

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA):
This product is not classified as Dangerous Goods, by rules of IATA:

INTERNATIONAL MARITIME ORGANIZATION (IMO) DESIGNATION:
This product is not classified as Dangerous Goods by the International Maritime Organization.

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR):

This product is not classified by the United Nations Economic Commission for Europe to be dangerous goods.

SECTION 15 - REGULATORY INFORMATION

UNITED STATES REGULATIONS

SARA REPORTING REQUIREMENTS: This product is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act., as follows: None

TSCA: All components in this product are listed on the US Toxic Substances Control Act (TSCA) inventory of chemicals.

SARA 311/312:

Acute Health: Yes Chronic Health: No Fire: No Reactivity: No

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this product. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. CERCLA REPORTABLE QUANTITY (RQ): None

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): None of the ingredients are on the California Proposition 65 lists.

CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: All of the components of this product are on the DSL Inventory

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: No component of this product is on the CEPA First Priorities Substance Lists.

CANADIAN WHMIS CLASSIFICATION and SYMBOLS: This product is categorized as a Controlled Product, Hazard Class D2B as per the Controlled Product Regulations

EUROPEAN ECONOMIC COMMUNITY INFORMATION:

EU LABELING AND CLASSIFICATION:

Classification of the mixture according to Regulation (EC) No1272/2008. See section 2 for details.

AUSTRALIAN INFORMATION FOR PRODUCT:

AUSTRALIAN INVENTORY OF CHEMICAL SUBSTANCES (AICS) STATUS: All components of this product are listed on the AICS.

STANDARD FOR THE UNIFORM SCHEDULING OF DRUGS AND POISONS: Not applicable.

JAPANESE INFORMATION FOR PRODUCT:

JAPANESE MINISTER OF INTERNATIONAL TRADE AND INDUSTRY (MITI) STATUS: The components of this product are not listed as Class I Specified Chemical Substances, Class II Specified Chemical Substances, or Designated Chemical Substances by the Japanese MITI.

INTERNATIONAL CHEMICAL INVENTORIES:

Listing of the components on individual country Chemical Inventories is as follows:

Asia-Pac:	Listed
Australian Inventory of Chemical Substances (AICS):	Listed
Korean Existing Chemicals List (ECL):	Listed
Japanese Existing National Inventory of Chemical Substances (ENCS):	Listed
Philippines Inventory if Chemicals and Chemical Substances (PICCS):	Listed
Swiss Giftliste List of Toxic Substances:	Listed
U.S. TSCA:	Listed

SECTION 16 - OTHER INFORMATION

PREPARED BY: Paul Eigbrett Global Safety Management, 10006 Cross Creek Blvd. Suite 440, Tampa, FL 33647

Disclaimer: To the best of Alconox, Inc. knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness is not guaranteed and no warranties of any type either express or implied are provided. The information contained herein relates only to this specific product.

ANNEX:

IDENTIFIED USES OF ALCONOX® AND DIRECTIONS FOR USE

Used to clean: Healthcare instruments, laboratory ware, vacuum equipment, tissue culture ware, personal protective equipment, sampling apparatus, catheters, tubing, pipes, radioactive contaminated articles, optical parts, electronic components, pharmaceutical apparatus, cosmetics manufacturing equipment, metal castings, forgings and stampings, industrial parts, tanks and reactors. Authorized by USDA for use in federally inspected meat and poultry plants. Passes inhibitory residue test for water analysis. FDA certified.

Used to remove: Soil, grit, grime, buffing compound, slime, grease, oils, blood, tissue, salts, deposits, particulates, solvents, chemicals, radioisotopes, radioactive contaminations, silicon oils, mold release agents.

Surfaces cleaned: Corrosion inhibited formulation recommended for glass, metal, stainless steel, porcelain, ceramic, plastic, rubber and fiberglass. Can be used on soft metals such as copper, aluminum, zinc and magnesium if rinsed promptly. Corrosion testing may be advisable.

Cleaning method: Soak, brush, sponge, cloth, ultrasonic, flow through clean-inplace. Will foam—not for spray or machine use.

Directions: Make a fresh 1% solution (2 1/2 Tbsp. per gal., 1 1/4 oz. per gal. or 10 grams per liter) in cold, warm, or hot water. If available use warm water. Use cold water for blood stains. For difficult soils, raise water temperature and use more detergent. Clean by soak, circulate, wipe, or ultrasonic method. Not for spray machines, will foam. For nonabrasive scouring, make paste. Use 2% solution to soak frozen stopcocks. To remove silver tarnish, soak in 1% solution in aluminum container. RINSE THOROUGHLY—preferably with running water. For critical cleaning, do final or all rinsing in distilled, deionized, or purified water. For food contact surfaces, rinse with potable water. Used on a wide range of glass, ceramic, plastic, and metal surfaces. Corrosion testing may be advisable.

Section 1 - Chemical Product and Company Identification 61

Material Name: Hydrochloric Acid **CAS Number:** 7647-01-0
Chemical Formula: ClH
Structural Chemical Formula: HCl
EINECS Number: 231-595-7
ACX Number: X1002202-3
Synonyms: 4-D BOWL SANITIZER; ACIDE CHLORHYDRIQUE; ACIDO CLORHIDRICO; ACIDO CLORIDRICO; ANHYDROUS HYDROCHLORIC ACID; ANHYDROUS HYDROGEN CHLORIDE; AQUEOUS HYDROGEN CHLORIDE; BOWL CLEANER; CHLOORWATERSTOF; CHLOROHYDRIC ACID; CHLOROWODOR; CHLORURE D'HYDROGENE; CHLORURE D'HYDROGENE ANHYDRE; CHLORURO DE HIDROGENO; CHLORWASSERSTOFF; CLORURO DE HIDROGENO ANHIDRO; EMULSION BOWL CLEANER; EPA PESTICIDE CHEMICAL CODE 045901; HYDROCHLORIC ACID; HYDROCHLORIC ACID GAS; HYDROCHLORIDE; HYDROGEN CHLORIDE; HYDROGEN CHLORIDE (HCL); HYGEIA CREME MAGIC BOWL CLEANER; MURIATIC ACID; MURIATIC ACID); NOW SOUTH SAFTI-SOL BRAND CONCENTRATED BOWL CLEANSE WITHMAGIC ACTIO; PERCLEEN BOWL AND URINAL CLEANER; SPIRITS OF SALT; VARLEY'S OCEAN BLUE SCENTED TOILET BOWL CLEANER; VARLEY POLY-PAK BOWL CREME; WHITE EMULSION BOWL CLEANER; WUEST BOWL CLEANER SUPER CONCENTRATED
General Use: Hydrogen chloride is used to produce pharmaceutical hydrochlorides; vinyl chloride from acetylene; alkyl chlorides from olefins and arsenious chloride from arsenious oxide; electronic grade for etching semiconductor crystals. Used in the chlorination of rubber; in organic reactions involving isomerization, polymerization and alkylation; as a catalyst and condensing agent; for making chlorine where economical; in the separation of cotton from wool and cotton de-linting; as flux in the babbitt type of metal alloy; etching semi-conductor crystals.
Hydrochloric acid is used for pickling and heavy duty cleaning of metal parts; rust and scale removal. The production of chlorides; neutralizing bases; a laboratory reagent. For hydrolyzing starch and proteins in preparations for food. As a catalyst and solvent in organic synthesis. As "spirits of salts" for cleaning of lime and masonry from new brickwork. As flux or flux component for soldering; manufacture of "killed spirits".

Section 2 - Composition / Information on Ingredients

Name	CAS	%
hydrogen chloride	7647-01-0	> 99.0

OSHA PEL
Ceiling: 5 ppm, 7 mg/m^3.

NIOSH REL
Ceiling: 5 ppm (7 mg/m^3).

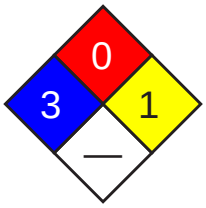
DFG (Germany) MAK
TWA: 5 ppm; PEAK: 5 ppm.

ACGIH TLV
Ceiling: 2 ppm.

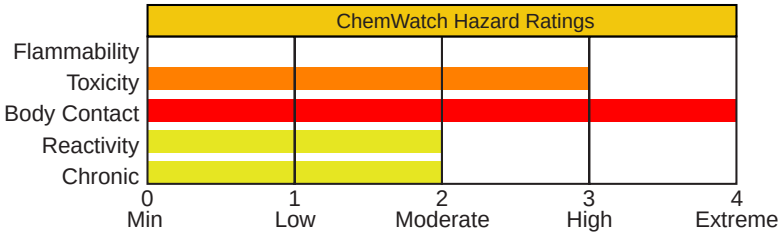
IDLH Level
50 ppm.

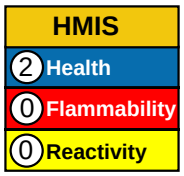
EU OEL
TWA: 5 ppm; STEL: 10 ppm.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word
Danger!

Corrosive Compressed Gas

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless gas; characteristic suffocating, pungent odor. Corrosive. Stored as compressed gas which may cause frostbite. Chronic Effects: erosion of teeth.

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Potential Health Effects

Target Organs: eyes, skin, respiratory system, liver (in animals)
Primary Entry Routes: inhalation, skin contact, eye contact
Acute Effects

Inhalation: The vapor is extremely discomforting to the upper respiratory tract, may cause severe mucous membrane damage and may be harmful if inhaled.
Inhalation of quantities of liquid mist may be extremely hazardous, even lethal due to spasm, extreme irritation of larynx and bronchi, chemical pneumonitis and pulmonary edema.
A single severe exposure may cause coughing and choking; bleeding of nose, inflammation and occasionally ulceration of the nose, throat and larynx. Fluid on the lungs followed by generalized lung damage may follow.
Breathing of vapor may aggravate asthma and inflammatory or fibrotic pulmonary disease.
High concentrations cause necrosis of the tracheal and bronchial epithelium, pulmonary edema, atelectasis and emphysema and damage to the pulmonary blood vessels and liver.
Inhalation hazard is increased at higher temperatures.
The vapor from heated material is extremely discomforting to the upper respiratory tract and lungs if inhaled.
Continued severe exposure can result in pulmonary edema and corrosion of tissues in the nose and throat.

Eye: Hydrogen Chloride: The vapor is extremely discomforting to the eyes and is capable of causing pain and severe conjunctivitis. Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.
The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.
Hydrochloric Acid: Eye contact is extremely painful and may cause rapid corneal damage. The liquid is extremely corrosive to the eyes and is capable of causing severe damage with loss of sight.
The vapor is highly discomforting and may be corrosive to the eyes. The vapor from heated material is extremely discomforting to the eyes.

Skin: The material is corrosive to the skin and may cause chemical burns.
Toxic effects may result from skin absorption. Bare unprotected skin should not be exposed to this material. The material may accentuate any pre-existing skin condition.
The vapor is discomforting to the skin.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The liquid is extremely corrosive if swallowed and is capable of causing burns to mouth, throat, esophagus, with extreme discomfort, pain and may be fatal if swallowed in quantity. Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic exposure may cause discoloration or erosion of the teeth, bleeding of the nose and gums; and ulceration of the nasal mucous membranes.
Repeated exposures of animals to concentrations of about 34 ppm produced no immediate toxic effects.
Workers exposed to hydrochloric acid suffered from gastritis and a number of cases of chronic bronchitis have also been reported.
Repeated or prolonged exposure to dilute solutions may cause dermatitis. Repeated exposure to low vapor concentrations can cause skin tenderness, bleeding of the nose and gums, chronic bronchitis, gastritis.

Section 4 - First Aid Measures

See DOT ERG

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately flush body and clothes with large amounts of water, using safety shower if available.
Quickly remove all contaminated clothing, including footwear.
Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

Ingestion: Contact a Poison Control Center. Rinse mouth out with plenty of water. Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to strong acids:
1.Airway problems may arise from laryngeal edema and inhalation exposure.
Treat with 100% oxygen initially.
2.Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.

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3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.
4.Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.

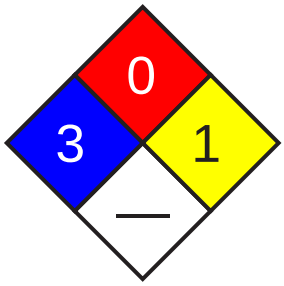
INGESTION:
1.Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.
2.Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.
3.Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.
4.Charcoal has no place in acid management.
5.Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:
1.Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.
2.Deep second-degree burns may benefit from topical silver sulfadiazine.

EYE:
1.Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.
2.Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.
3.Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

Section 5 - Fire-Fighting Measures

See DOT ERG



Fire Diamond

Flash Point: Nonflammable
Autoignition Temperature: Not applicable
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: Water spray or fog; foam; Bromochlorodifluoromethane (BCF) (where regulations permit); Dry agent; Carbon dioxide.
General Fire Hazards/Hazardous Combustion Products: Noncombustible liquid. Will not burn, but heat produces highly toxic fumes/vapors.
Heating may cause expansion or decomposition leading to violent rupture of containers. Decomposes on heating and produces toxic fumes of hydrogen chloride. Decomposition may produce toxic fumes of chlorine.
Reacts with metals producing flammable/explosive hydrogen gas. Contact with moisture or water may generate heat causing ignition. Reacts vigorously with alkalis. Moderate fire hazard when in contact with reducing agents.
Fire Incompatibility: Reacts with metals producing flammable/explosive hydrogen gas.
Avoid reactions with metals, metal oxides, hydroxides, amines, carbonates, alkaline materials, acetic anhydride, cyanides, sulphides, sulphites, phosphides, acetylides, borides, carbides, silicides, vinyl acetate, formaldehyde and potassium permanganate, unsaturated organics, metal acetylides, sulphuric acid.
Note: Compatibility with plastics should be confirmed prior to use.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation. Cool fire-exposed containers with water spray from a protected location. If safe to do so, remove containers from path of fire. Equipment should be thoroughly decontaminated after use. Water spray or fog may be used to disperse vapor. Do not approach cylinders suspected to be hot. If safe to do so, stop flow of gas.

Section 6 - Accidental Release Measures

See DOT ERG

Small Spills: DO NOT touch the spill material. Clean up all spills immediately. Wear fully protective PVC clothing and breathing apparatus. Contain and absorb spill with sand, earth, inert material or vermiculite. Use soda ash or slaked lime to neutralize. Collect residues and place in labeled plastic containers with vented lids. Clear area of personnel and move upwind. Avoid breathing vapors and contact with skin and eyes. Do not exert excessive pressure on valve; do not attempt to operate damaged valve. Water spray or fog may be used to disperse vapor.
Large Spills: Contact fire department and tell them location and nature of hazard. Clear area of personnel and move upwind. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation. Stop leak if safe to do so. Remove leaking cylinders to a safe place if possible. Release pressure under safe, controlled conditions by opening the valve. Do not exert excessive pressure on valve; do not attempt to operate damaged valve. Shut off all possible sources of ignition and increase ventilation. Water spray or fog may be used to disperse vapor. Use soda ash or slaked lime to neutralize.
Collect and seal in labeled drums for disposal. Wash spill area with large quantities of water. If contamination of

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drains or waterways occurs, advise emergency services. After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing. DO NOT touch the spill material. Contain and absorb spill with sand, earth, inert material or vermiculite.
DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist and vapor, breathing vapors and contact with skin and eyes.
Avoid physical damage to containers. Use in a well-ventilated area. Wear protective clothing and gloves when handling containers. Handle and open container with care.
WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material. When handling, DO NOT eat, drink or smoke. Always wash hands with soap and water after handling. Work clothes should be laundered separately. Use good occupational work practices. Observe manufacturer's storing and handling recommendations.
Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Local exhaust ventilation may be required for safe working, i.e. to keep exposures below required standards; otherwise, PPE is required.
Keep dry. Reacts violently with water.
Transport containers on a trolley. Avoid sources of heat. DO NOT transfer gas from one cylinder to another.

Recommended Storage Methods: Packaging as recommended by manufacturer. Check that containers are clearly labeled.
Cylinder. Ensure the use of equipment rated for cylinder pressure. Ensure the use of compatible materials of construction. Valve protection cap to be in place until cylinder is secured, connected. Cylinder must be properly secured either in use or in storage. Cylinder valve must be closed when not in use or when empty. Segregate full from empty cylinders. WARNING: Suckback into cylinder may result in rupture. Use back-flow preventive device in piping.
Hydrochloric acid: Packs of 2.5 litres or less require a child-resistant closure. Glass container or Plastic carboy or Polylined drum.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: If risk of overexposure exists, wear air supplied breathing apparatus. Provide adequate ventilation in warehouse or closed storage areas. Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i. e. , to keep exposures below required standards; otherwise, PPE is required.
If risk of inhalation or overexposure exists, wear NIOSH-approved respirator or work in fume hood. Hydrogen chloride vapors will not be adequately absorbed by organic vapor respirators.

Personal Protective Clothing/Equipment:

Eyes: Chemical goggles. Full face shield.
DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Neoprene gloves; rubber gloves. Nitrile gloves.
Safety footwear. Rubber boots.
Hydrochloric acid: Barrier cream and Neoprene gloves or Elbow length PVC gloves. Nitrile gloves.
PVC boots or PVC safety gumboots.

Respiratory Protection:
Exposure Range >5 to <50 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 50 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: white

Other: Ensure there is ready access to a safety shower; Eyewash unit.
Acid-resistant overalls. Full protective suit. Operators should be trained in procedures for safe use of this material.

Glove Selection Index:
BUTYL ..... Best selection
BUTYL/NEOPRENE ..... Best selection
HYPALON ..... Best selection
NEOPRENE..... Best selection
NEOPRENE/NATURAL..... Best selection
NITRILE+PVC ..... Best selection
PE/EVAL/PE ..... Best selection
SARANEX-23 ..... Best selection
VITON/NEOPRENE ..... Best selection
PVC..... Best selection

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NITRILE ..... Best selection
NATURAL RUBBER..... Satisfactory; may degrade after 4 hours continuous immersion
NATURAL+NEOPRENE..... Satisfactory; may degrade after 4 hours continuous immersion
NAT+NEOPR+NITRILE ..... Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Hydrogen chloride: Colorless, corrosive gas. Pungent suffocating odor. White fumes in moist air. Soluble in methanol, ethanol, ether and benzene.
Hydrochloric acid: Clear to light yellow (orange tint for inhibited grades) fuming corrosive liquid with sharp, suffocating odor.

Physical State: Hydrogen chloride: Compressed gas; Hydrochloric acid: Liquid
Odor Threshold: 0.26 to 0.3 ppm
Vapor Pressure (kPa): < 24.8 at 25 °C
Vapor Density (Air=1): 1.268 at 20 °C
Formula Weight: 36.461
Specific Gravity (H_2O=1, at 4 °C): < 1.19 at 20 °C
Evaporation Rate: Slow

pH: Hydrochloric acid: < 1
Boiling Point: -85 °C (-121 °F)
Freezing/Melting Point: -114.44 °C (-173.992 °F)
Volatile Component (% Vol): 100
Decomposition Temperature (°C): Not applicable
Water Solubility: 56.1 g/100 cc hot water at 60 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Decomposes in the presence of moisture to produce corrosive acid. May generate sufficient heat to ignite combustible materials. Presence of heat source and direct sunlight (ultra-violet radiation). Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.
Storage Incompatibilities: Hydrogen chloride: Segregate from most common metals and their alloys, alkalis, unsaturated organics, fluorine, metal carbides, metal acetylides, potassium permanganate and sulfuric acid. Compatibility with plastics should be confirmed prior to use.
Hydrochloric acid: Segregate from alkalies, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates. Avoid storage with metals, metal oxides, hydroxides, amines, carbonates, alkaline materials, acetic anhydride, cyanides, sulphides, sulphites, phosphides, acetylides, borides, carbides, silicides, vinyl acetate, formaldehyde and potassium permanganate. Reacts with zinc, brass, galvanized iron, aluminum, copper and copper alloys.

Section 11 - Toxicological Information

Toxicity
Inhalation (human) LC_{Lo}: 1300 ppm/30 m
Inhalation (human) LC_{Lo}: 3000 ppm/5 m
Inhalation (rat) LC_{50}: 3124 ppm/60 m
Inhalation (rat) LC_{50}: 4701 ppm/30 m
Oral (rat) LD_{50}: 900 mg/kg

Irritation
Eye (rabbit): 5 mg/30 s - mild

See *RTECS* MW 4025000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: TL_m Gambusia affinis (mosquito fish) 282 ppm/96 hr (fresh water) /Conditions of bioassay not specified; Lethal Lepomis macrochirus (bluegill sunfish) 3.6 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Cockle 330 to 1,000 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Carassius auratus (goldfish) 178 mg/l (1 to 2 hr survival time) /Conditions of bioassay not specified; LC_{50} Shore crab 240 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Shrimp 100 to 330 ppm/48 hr (salt water) /Conditions of bioassay not specified; LC_{100} Trout 10 mg/l 24 hr /Conditions of bioassay not specified
Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options. Treat and neutralize at an effluent treatment plant. Bury residue in an authorized landfill. Decontaminate empty containers with a lime slurry. Return empty containers to supplier or bury empty containers at an authorized landfill.
Return empty cylinders to supplier.

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Section 14 - Transport Information

DOT Hazardous Materials Table Data (49 CFR 172.101):

Note: This material has multiple possible HMT entries. Choose the appropriate one based on state and condition of specific material when shipped.

Shipping Name and Description: Hydrogen chloride, anhydrous
ID: UN1050
Hazard Class: 2.3 - Poisonous gas
Packing Group:
Symbols:
Label Codes: 2.3 - Poison Gas, 8 - Corrosive
Special Provisions: 3
Packaging: **Exceptions:** None **Non-bulk:** 304 **Bulk:** None
Quantity Limitations: **Passenger aircraft/rail:** Forbidden **Cargo aircraft only:** Forbidden
Vessel Stowage: **Location:** D **Other:** 40

Shipping Name and Description: Hydrochloric acid
ID: UN1789
Hazard Class: 8 - Corrosive material
Packing Group: II - Medium Danger
Symbols:
Label Codes: 8 - Corrosive
Special Provisions: A3, A6, B3, B15, IB2, N41, T8, TP2, TP12
Packaging: **Exceptions:** 154 **Non-bulk:** 202 **Bulk:** 242
Quantity Limitations: **Passenger aircraft/rail:** 1 L **Cargo aircraft only:** 30 L
Vessel Stowage: **Location:** C **Other:**

Shipping Name and Description: Hydrochloric acid
ID: UN1789
Hazard Class: 8 - Corrosive material
Packing Group: III - Minor Danger
Symbols:
Label Codes: 8 - Corrosive
Special Provisions: IB3, T4, TP1, TP12
Packaging: **Exceptions:** 154 **Non-bulk:** 203 **Bulk:** 241
Quantity Limitations: **Passenger aircraft/rail:** 5 L **Cargo aircraft only:** 60 L
Vessel Stowage: **Location:** C **Other:**

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4) 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Listed
RQ: 5000 lb
TPQ: 500 lb
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Group, Inc. extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

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Isobutylene

Safety Data Sheet P-4614

This SDS conforms to U.S. Code of Federal Regulations 29 CFR 1910.1200, Hazard Communication.

Date of issue: 01/01/1979 Revision date: 10/17/2016 Supersedes: 02/27/2015

SECTION: 1. Product and company identification

1.1. Product identifier

Product form	:	Substance
Name	:	Isobutylene
CAS No	:	115-11-7
Formula	:	C4H8 / CH2=C(CH3)2
Other means of identification	:	Isobutene, 2-methylpropene

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Industrial use. Use as directed.

1.3. Details of the supplier of the safety data sheet

Praxair, Inc.
10 Riverview Drive
Danbury, CT 06810-6268 - USA
T 1-800-772-9247 (1-800-PRAXAIR) - F 1-716-879-2146
www.praxair.com

1.4. Emergency telephone number

Emergency number : Onsite Emergency: 1-800-645-4633

CHEMTREC, 24hr/day 7days/week
— Within USA: 1-800-424-9300, Outside USA: 001-703-527-3887
(collect calls accepted, Contract 17729)

SECTION 2: Hazard identification

2.1. Classification of the substance or mixture

GHS-US classification

Flam. Gas 1 H220
Liquefied gas H280

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :

GHS02 GHS04

Signal word (GHS-US) : DANGER

Hazard statements (GHS-US) : H220 - **EXTREMELY FLAMMABLE GAS**
H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED
OSHA-H01 - MAY DISPLACE OXYGEN AND CAUSE RAPID SUFFOCATION
CGA-HG04 - MAY FORM EXPLOSIVE MIXTURES WITH AIR
CGA-HG01 - MAY CAUSE FROSTBITE

Precautionary statements (GHS-US) : P202 - Do not handle until all safety precautions have been read and understood
P210 - Keep away from Heat, Open flames, Sparks, Hot surfaces. - No smoking
P271+P403 - Use and store only outdoors or in a well-ventilated place
P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely
P381 - Eliminate all ignition sources if safe to do so
CGA-PG05 - Use a back flow preventive device in the piping
CGA-PG12 - Do not open valve until connected to equipment prepared for use
CGA-PG06 - Close valve after each use and when empty
CGA-PG11 - Never put cylinders into unventilated areas of passenger vehicles
CGA-PG02 - Protect from sunlight when ambient temperature exceeds 52°C (125°F)

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2.3. Other hazards

Other hazards not contributing to the classification : None.

2.4. Unknown acute toxicity (GHS US)

No data available

SECTION 3: Composition/Information on ingredients

3.1. Substance

Name	Product identifier	%
Isobutylene (Main constituent)	(CAS No) 115-11-7	100

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Remove to fresh air and keep at rest in a position comfortable for breathing. If not breathing, give artificial respiration. If breathing is difficult, trained personnel should give oxygen. Call a physician.

First-aid measures after skin contact : The liquid may cause frostbite. For exposure to liquid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). Water temperature should be tolerable to normal skin. Maintain skin warming for at least 15 minutes or until normal coloring and sensation have returned to the affected area. In case of massive exposure, remove clothing while showering with warm water. Seek medical evaluation and treatment as soon as possible.

First-aid measures after eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Contact an ophthalmologist immediately.

First-aid measures after ingestion : Ingestion is not considered a potential route of exposure.

4.2. Most important symptoms and effects, both acute and delayed

No additional information available

4.3. Indication of any immediate medical attention and special treatment needed

None.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Carbon dioxide, Dry chemical, Water spray or fog.

5.2. Special hazards arising from the substance or mixture

Fire hazard : **EXTREMELY FLAMMABLE GAS**. If venting or leaking gas catches fire, do not extinguish flames. Flammable vapors may spread from leak, creating an explosive reignition hazard. Vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point. Explosive atmospheres may linger. Before entering an area, especially a confined area, check the atmosphere with an appropriate device.

Explosion hazard : **EXTREMELY FLAMMABLE GAS**. Forms explosive mixtures with air and oxidizing agents.

Reactivity : No reactivity hazard other than the effects described in sub-sections below.

5.3. Advice for firefighters

Firefighting instructions : **DANGER: FLAMMABLE LIQUID AND VAPOR.** Evacuate all personnel from danger area. Use self-contained breathing apparatus. Immediately cool surrounding containers with water spray from maximum distance, taking care not to extinguish flames. Avoid spreading burning liquid with water. Remove ignition sources if safe to do so. If flames are accidentally extinguished, explosive reignition may occur. Reduce vapors with water spray or fog. Stop flow of liquid if safe to do so, while continuing cooling water spray. Remove all containers from area of fire if safe to do so. Allow fire to burn out. On-site fire brigades must comply with OSHA 29 CFR 1910.156 and applicable standards under 29 CFR 1919 Subpart L - Fire Protection.

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Special protective equipment for fire fighters	:	Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.
Other information	:	Containers are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.).

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : **DANGER: Flammable, liquefied gas.** FORMS EXPLOSIVE MIXTURES WITH AIR. Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Remove all sources of ignition if safe to do so. Reduce vapors with fog or fine water spray, taking care not to spread liquid with water. Shut off flow if safe to do so. Ventilate area or move container to a well-ventilated area. Flammable vapors may spread from leak and could explode if reignited by sparks or flames. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with an appropriate device.

6.1.1. For non-emergency personnel

No additional information available

6.1.2. For emergency responders

No additional information available

6.2. Environmental precautions

Try to stop release. Prevent waste from contaminating the surrounding environment. Prevent soil and water pollution. Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.

6.3. Methods and material for containment and cleaning up

No additional information available

6.4. Reference to other sections

See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only non-sparking tools. Use only explosion-proof equipment

Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Never insert an object (e.g, wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use; keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container and could cause the pressure relief device to fail prematurely, venting the container contents. For other precautions in using this product, see section 16.

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7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store only where temperature will not exceed 125°F (52°C). Post "No Smoking/No Open Flames" signs in storage and use areas. There must be no sources of ignition. Separate packages and protect against potential fire and/or explosion damage following appropriate codes and requirements (e.g, NFPA 30, NFPA 55, NFPA 70, and/or NFPA 221 in the U.S.) or according to requirements determined by the Authority Having Jurisdiction (AHJ). Always secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the container is not in use. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods. For other precautions in using this product, see section 16

OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.

7.3. Specific end use(s)

None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Isobutylene (115-11-7)		
ACGIH	ACGIH TLV-TWA (ppm)	250 ppm

8.2. Exposure controls

Appropriate engineering controls : Use an explosion-proof local exhaust system. Local exhaust and general ventilation must be adequate to meet exposure standards. MECHANICAL (GENERAL): **Inadequate - Use only in a closed system.** Use explosion proof equipment and lighting.

Eye protection : Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield during cylinder changeout or whenever contact with product is possible. Select eye protection in accordance with OSHA 29 CFR 1910.133.

Skin and body protection : Wear metatarsal shoes and work gloves for cylinder handling, and protective clothing where needed. Wear appropriate chemical gloves during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.132, 1910.136, and 1910.138.

Respiratory protection : When workplace conditions warrant respirator use, follow a respiratory protection program that meets OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable). Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure. For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA).

Thermal hazard protection : Wear cold insulating gloves when transfilling or breaking transfer connections.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Gas

Molecular mass : 56 g/mol

Color : Colorless.

Odor : Poor warning properties at low concentrations. Sweetish.

Odor threshold : Odor threshold is subjective and inadequate to warn for overexposure.

pH : Not applicable.

Relative evaporation rate (butyl acetate=1) : No data available

Relative evaporation rate (ether=1) : Not applicable.

Melting point : -140.3 °C

Freezing point : No data available

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Boiling point	:	-6.9 °C
Flash point	:	-80 °C (closed cup)
Critical temperature	:	144.7 °C
Auto-ignition temperature	:	465 °C
Decomposition temperature	:	No data available
Flammability (solid, gas)	:	1.8 - 8.8 vol %
Vapor pressure	:	260 kPa
Critical pressure	:	4000 kPa
Relative vapor density at 20 °C	:	No data available
Relative density	:	0.63
Density	:	0.599 g/cm³ (at 20 °C)
Relative gas density	:	2
Solubility	:	Water: 388 mg/l
Log Pow	:	2.35
Log Kow	:	Not applicable.
Viscosity, kinematic	:	Not applicable.
Viscosity, dynamic	:	Not applicable.
Explosive properties	:	Not applicable.
Oxidizing properties	:	None.
Explosion limits	:	No data available

9.2. Other information

Gas group	:	Liquefied gas
Additional information	:	Gas/vapor heavier than air. May accumulate in confined spaces, particularly at or below ground level

SECTION 10: Stability and reactivity

10.1. Reactivity

No reactivity hazard other than the effects described in sub-sections below.

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

May occur.

10.4. Conditions to avoid

High temperature. Catalyst.

10.5. Incompatible materials

Halogens. Oxidizing agents. Acids.

10.6. Hazardous decomposition products

Thermal decomposition may produce : Carbon monoxide. Carbon dioxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Not classified

Isobutylene (\f)115-11-7	
LC50 inhalation rat (mg/l)	620 mg/l/4h
LC50 inhalation rat (ppm)	541657 ppm/1h
ATE US (gases)	270828.500 ppmV/4h
ATE US (vapors)	620.000 mg/l/4h
ATE US (dust, mist)	620.000 mg/l/4h

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Skin corrosion/irritation : Not classified

pH: Not applicable.

Serious eye damage/irritation : Not classified

pH: Not applicable.

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Isobutylene (115-11-7)	
National Toxicology Program (NTP) Status	1 - Evidence of Carcinogenicity

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : No known ecological damage caused by this product.

12.2. Persistence and degradability

Isobutylene (115-11-7)	
Persistence and degradability	The substance is biodegradable. Unlikely to persist.

12.3. Bioaccumulative potential

Isobutylene (115-11-7)	
Log Pow	2.35
Log Kow	Not applicable.
Bioaccumulative potential	Not expected to bioaccumulate due to the low log Kow (log Kow < 4). Refer to section 9.

12.4. Mobility in soil

Isobutylene (115-11-7)	
Mobility in soil	No data available.
Ecology - soil	Because of its high volatility, the product is unlikely to cause ground or water pollution.

12.5. Other adverse effects

Effect on ozone layer : None

Effect on the global warming : No known effects from this product

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Do not attempt to dispose of residual or unused quantities. Return container to supplier.

SECTION 14: Transport information

In accordance with DOT

Transport document description : UN1055 Isobutylene, 2.1

UN-No.(DOT) : UN1055

Proper Shipping Name (DOT) : Isobutylene

Class (DOT) : 2.1 - Class 2.1 - Flammable gas 49 CFR 173.115

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Hazard labels (DOT) : 2.1 - Flammable gas

DOT Special Provisions (49 CFR 172.102) : 19 - For domestic transportation only, the identification number UN1075 may be used in place of the identification number specified in column (4) of the 172.101 table. The identification number used must be consistent on package markings, shipping papers and emergency response information
T50 - When portable tank instruction T50 is referenced in Column (7) of the 172.101 Table, the applicable liquefied compressed gases are authorized to be transported in portable tanks in accordance with the requirements of 173.313 of this subchapter

Additional information

Emergency Response Guide (ERG) Number : 115 (UN1055)

Other information : No supplementary information available.

Special transport precautions : Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers: - Ensure there is adequate ventilation. - Ensure that containers are firmly secured. - Ensure cylinder valve is closed and not leaking. - Ensure valve outlet cap nut or plug (where provided) is correctly fitted. - Ensure valve protection device (where provided) is correctly fitted.

Transport by sea

UN-No. (IMDG) : 1055
Proper Shipping Name (IMDG) : ISOBUTYLENE
Class (IMDG) : 2 - Gases
MFAG-No : 115

Air transport

UN-No. (IATA) : 1055
Proper Shipping Name (IATA) : Isobutylene
Class (IATA) : 2
Civil Aeronautics Law : Gases under pressure/Gases flammable under pressure

SECTION 15: Regulatory information

15.1. US Federal regulations

Isobutylene (115-11-7)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard Delayed (chronic) health hazard Sudden release of pressure hazard Fire hazard

15.2. International regulations

CANADA

Isobutylene (115-11-7)
Listed on the Canadian DSL (Domestic Substances List)

EU-Regulations

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Isobutylene (115-11-7)
Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

15.2.2. National regulations

Isobutylene (115-11-7)
Listed on the AICS (Australian Inventory of Chemical Substances) Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China) Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory Listed on the Korean ECL (Existing Chemicals List) Listed on NZIoC (New Zealand Inventory of Chemicals) Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances) Listed on INSQ (Mexican National Inventory of Chemical Substances)

15.3. US State regulations

Isobutylene(115-11-7)	
U.S. - California - Proposition 65 - Carcinogens List	No
U.S. - California - Proposition 65 - Developmental Toxicity	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	No
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	No
State or local regulations	U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List

SECTION 16: Other information

Other information : When you mix two or more chemicals, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Before using any plastics, confirm their compatibility with this product

Praxair asks users of this product to study this SDS and become aware of the product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this SDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Safety Data Sheet. Since the use of this information and the conditions of use are not within the control of Praxair, Inc, it is the user's obligation to determine the conditions of safe use of the product

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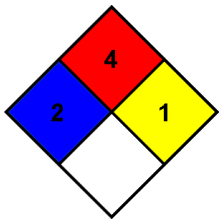
NFPA health hazard	: 2 - Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is given.
NFPA fire hazard	: 4 - Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.
NFPA reactivity	: 1 - Normally stable, but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.



HMIS III Rating

Health	: 1 Slight Hazard - Irritation or minor reversible injury possible
Flammability	: 4 Severe Hazard
Physical	: 2 Moderate Hazard

SDS US (GHS HazCom 2012) - Praxair

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

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Safety Data Sheet

RUST-OLEUM CORPORATION
* Trusted Quality Since 1921 *
www.rustoleum.com

1. Identification

Product Name:	ICWB LSPR 12PK WHITE MARKING	**Revision Date:**	2/18/2019
Product Identifier:	203039	**Supercedes Date:**	8/17/2018
Recommended Use:	Marking Paint/Aerosols		
Supplier:	Rust-Oleum Corporation 11 Hawthorn Parkway Vernon Hills, IL 60061 USA	**Manufacturer:**	Rust-Oleum Corporation 11 Hawthorn Parkway Vernon Hills, IL 60061 USA
Preparer:	Regulatory Department		
Emergency Telephone:	24 Hour Hotline: 847-367-7700		

2. Hazard Identification

Classification

Symbol(s) of Product

Signal Word
Danger

Possible Hazards
35% of the mixture consists of ingredient(s) of unknown acute toxicity.

GHS HAZARD STATEMENTS

Carcinogenicity, category 2	H351	Suspected of causing cancer.
Compressed Gas	H280	Contains gas under pressure; may explode if heated.
Flammable Aerosol, category 1	H222	Extremely flammable aerosol.
STOT, repeated exposure, category 2	H373	May cause damage to organs through prolonged or repeated exposure.

GHS LABEL PRECAUTIONARY STATEMENTS

P201	Obtain special instructions before use.
P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P211	Do not spray on an open flame or other ignition source.
P251	Do not pierce or burn, even after use.
P260	Do not breathe dust/fume/gas/mist/vapors/spray.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P308+P313	IF exposed or concerned: Get medical advice/attention.
P314	Get medical advice/attention if you feel unwell.
P405	Store locked up.
P410+P403	Protect from sunlight. Store in a well-ventilated place.
P410+P412	Protect from sunlight. Do not expose to temperatures exceeding 50°C / 122°F.
P501	Dispose of contents/container in accordance with local, regional and national regulations.

3. Composition / Information On Ingredients

HAZARDOUS SUBSTANCES

Chemical Name	CAS-No.	Wt.% Range	GHS Symbols	GHS Statements
Propane	74-98-6	10-25	GHS04	H280
Titanium Dioxide	13463-67-7	2.5-10	Not Available	Not Available
n-Butane	106-97-8	2.5-10	GHS04	H280
Naphtha, Petroleum, Hydrotreated Light	64742-49-0	2.5-10	GHS08	H304
Xylenes (o-, m-, p- isomers)	1330-20-7	2.5-10	GHS02-GHS07	H226-315-319-332
Hydrous Magnesium Silicate	14807-96-6	1.0-2.5	Not Available	Not Available
n-Butyl Acetate	123-86-4	1.0-2.5	GHS02-GHS07	H226-336
Ethylbenzene	100-41-4	1.0-2.5	GHS02-GHS07-GHS08	H225-304-332-351-373
Octane	111-65-9	0.1-1.0	GHS02-GHS07-GHS08	H225-304-315-336

4. First-Aid Measures

FIRST AID - EYE CONTACT: Immediately flush eyes with plenty of water for at least 15 minutes holding eyelids open. Get medical attention. Do NOT allow rubbing of eyes or keeping eyes closed.

FIRST AID - SKIN CONTACT: Wash skin with soap and water. Remove contaminated clothing. Get medical attention if irritation develops or persists.

FIRST AID - INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention. Do NOT use mouth-to-mouth resuscitation. If you experience difficulty in breathing, leave the area to obtain fresh air. If continued difficulty is experienced, get medical assistance immediately.

FIRST AID - INGESTION: Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. Get immediate medical attention. If swallowed, get medical attention.

5. Fire-Fighting Measures

EXTINGUISHING MEDIA: Alcohol Film Forming Foam, Carbon Dioxide, Dry Chemical, Dry Sand, Water Fog

UNUSUAL FIRE AND EXPLOSION HAZARDS: FLASH POINT IS LESS THAN 20°F. EXTREMELY FLAMMABLE LIQUID AND VAPOR!Water spray may be ineffective. Closed containers may explode when exposed to extreme heat due to buildup of steam. Closed containers may explode when exposed to extreme heat. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame. Perforation of the pressurized container may cause bursting of the can. No unusual fire or explosion hazards noted.

SPECIAL FIREFIGHTING PROCEDURES: Water may be used to cool closed containers to prevent pressure buildup and possible autoignition or explosion. Full protective equipment including self-contained breathing apparatus should be used. Evacuate area and fight fire from a safe distance. Use water spray to keep fire-exposed containers cool. Containers may explode when heated.

Special Fire and Explosion Hazard (Combustible Dust): No Information

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Contain spilled liquid with sand or earth. DO NOT use combustible materials such as sawdust. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Remove all sources of ignition, ventilate area and remove with inert absorbent and non-sparking tools. Dispose of according to local, state (provincial) and federal regulations. Do not incinerate closed containers. Ventilate area, isolate spilled material, and remove with inert absorbent. Dispose of contaminated absorbent, container, and unused contents in accordance with local, state, and federal regulations.

7. Handling and Storage

HANDLING: Wash thoroughly after handling. Wash hands before eating. Remove contaminated clothing and launder before reuse. Use only with adequate ventilation. Follow all SDS and label precautions even after container is emptied because it may retain product residues. Avoid breathing fumes, vapors, or mist. Avoid contact with eyes, skin and clothing.

STORAGE: Store in a dry, well ventilated place. Keep container tightly closed when not in use. Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame. Contents under pressure. Do not store above 120 ° F. Store large quantities in buildings designed and protected for storage of flammable aerosols. Keep away from heat, sparks, flame and sources of ignition. Avoid excess heat. Product should be stored in tightly sealed containers and protected from heat, moisture, and foreign materials.

Advice on Safe Handling of Combustible Dust: No Information

8. Exposure Controls / Personal Protection

Chemical Name	CAS-No.	Weight % Less Than	ACGIH TLV-TWA	ACGIH TLV-STEL	OSHA PEL-TWA	OSHA PEL-CEILING
Propane	74-98-6	20.0	N.E.	N.E.	1000 ppm	N.E.
Titanium Dioxide	13463-67-7	10.0	10 mg/m3	N.E.	15 mg/m3	N.E.
n-Butane	106-97-8	10.0	N.E.	1000 ppm	N.E.	N.E.
Naphtha, Petroleum, Hydrotreated Light	64742-49-0	10.0	N.E.	N.E.	N.E.	N.E.
Xylenes (o-, m-, p- isomers)	1330-20-7	10.0	100 ppm	150 ppm	100 ppm	N.E.
Hydrous Magnesium Silicate	14807-96-6	5.0	2 mg/m3	N.E.	N.E.	N.E.
n-Butyl Acetate	123-86-4	5.0	50 ppm	150 ppm	150 ppm	N.E.
Ethylbenzene	100-41-4	5.0	20 ppm	N.E.	100 ppm	N.E.
Octane	111-65-9	1.0	300 ppm	N.E.	500 ppm	N.E.

PERSONAL PROTECTION

ENGINEERING CONTROLS: Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof ventilation equipment. Provide general dilution of local exhaust ventilation in volume and pattern to keep TLV of hazardous ingredients below acceptable limits. Prevent build-up of vapors by opening all doors and windows to achieve cross-ventilation.

RESPIRATORY PROTECTION: A respiratory protection program that meets OSHA 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use. A NIOSH/MSHA approved air purifying respirator with organic vapor cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits.

SKIN PROTECTION: Use gloves to prevent prolonged skin contact. Nitrile or Neoprene gloves may afford adequate skin protection.

EYE PROTECTION: Use safety eyewear designed to protect against splash of liquids.

OTHER PROTECTIVE EQUIPMENT: Refer to safety supervisor or industrial hygienist for further guidance regarding types of personal protective equipment and their applications.

HYGIENIC PRACTICES: Wash thoroughly with soap and water before eating, drinking or smoking. Remove contaminated clothing immediately and launder before reuse.

Engineering Measures for Combustible Dust: No Information

9. Physical and Chemical Properties

Appearance:	Aerosolized Mist	**Physical State:**	Liquid
Odor:	Mild	**Odor Threshold:**	N.E.
Relative Density:	0.883	**pH:**	N.D.
Freeze Point, °C:	N.D.	**Viscosity:**	N.D.
Solubility in Water:	Miscible	**Partition Coefficient, n-octanol/ water:**	N.D.
Decompostion Temp., °C:	N.D.		
Boiling Range, °C:	-37 - 537	**Explosive Limits, vol%:**	0.9 - 12.6
Flammability:	Does not Support Combustion	**Flash Point, °C:**	-96
Evaporation Rate:	Faster than Ether	**Auto-ignition Temp., °C:**	N.D.
Vapor Density:	Heavier than Air	**Vapor Pressure:**	N.D.

(See "Other information" Section for abbreviation legend)

10. Stability and Reactivity

CONDITIONS TO AVOID: Avoid temperatures above 120°F (49°C). Avoid all possible sources of ignition.

INCOMPATIBILITY: Incompatible with strong oxidizing agents, strong acids and strong alkalies.

HAZARDOUS DECOMPOSITION: By open flame, carbon monoxide and carbon dioxide. When heated to decomposition, it emits acrid smoke and irritating fumes. Contains solvents which may form carbon monoxide, carbon dioxide, and formaldehyde.

HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.

STABILITY: This product is stable under normal storage conditions.

11. Toxicological Information

EFFECTS OF OVEREXPOSURE - EYE CONTACT: Causes Serious Eye Irritation

EFFECTS OF OVEREXPOSURE - SKIN CONTACT: May cause skin irritation. Allergic reactions are possible.

EFFECTS OF OVEREXPOSURE - INHALATION: Harmful if inhaled. High gas, vapor, mist or dust concentrations may be harmful if inhaled. Avoid breathing fumes, spray, vapors, or mist. High vapor concentrations are irritating to the eyes, nose, throat and lungs. Prolonged or excessive inhalation may cause respiratory tract irritation.

EFFECTS OF OVEREXPOSURE - INGESTION: Harmful if swallowed.

EFFECTS OF OVEREXPOSURE - CHRONIC HAZARDS: May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion, and blurred vision) and/or damage. High concentrations may lead to central nervous system effects (drowsiness, dizziness, nausea, headaches, paralysis, and blurred vision) and/or damage. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. Overexposure to xylene in laboratory animals has been associated with liver abnormalities, kidney, lung, spleen, eye and blood damage as well as reproductive disorders. Effects in humans, due to chronic overexposure, have included liver, cardiac abnormalities and nervous system damage. IARC lists Ethylbenzene as a possible human carcinogen (group 2B). Contains Titanium Dioxide. Titanium Dioxide is listed as a Group 2B-"Possibly carcinogenic to humans" by IARC. No significant exposure to Titanium Dioxide is thought to occur during the use of products in which Titanium Dioxide is bound to other materials, such as in paints during brush application or drying. Risk of overexposure depends on duration and level of exposure to dust from repeated sanding of surfaces or spray mist and the actual concentration of Titanium Dioxide in the formula. (Ref: IARC Monograph, Vol. 93, 2010)

PRIMARY ROUTE(S) OF ENTRY: Eye Contact, Ingestion, Inhalation, Skin Absorption, Skin Contact

ACUTE TOXICITY VALUES

The acute effects of this product have not been tested. Data on individual components are tabulated below:

CAS-No.	Chemical Name	Oral LD50	Dermal LD50	Vapor LC50
13463-67-7	Titanium Dioxide	>10000 mg/kg Rat	2500 mg/kg	N.E.
106-97-8	n-Butane	N.E.	N.E.	658 mg/L Rat
64742-49-0	Naphtha, Petroleum, Hydrotreated Light	>5000 mg/kg Rat	>3160 mg/kg Rabbit	>4951 mg/L Rat
1330-20-7	Xylenes (o-, m-, p- isomers)	3500 mg/kg Rat	>4350 mg/kg Rabbit	29.08 mg/L Rat
14807-96-6	Hydrous Magnesium Silicate	6000	N.E.	30
123-86-4	n-Butyl Acetate	10768 mg/kg Rat	>17600 mg/kg Rabbit	> 21 mg/L Rat
100-41-4	Ethylbenzene	3500 mg/kg Rat	15400 mg/kg Rabbit	17.4 mg/L Rat
111-65-9	Octane	N.E.	N.E.	>23.36 mg/L Rat

N.E. - Not Established

12. Ecological Information

ECOLOGICAL INFORMATION: Product is a mixture of listed components.

13. Disposal Information

DISPOSAL INFORMATION: Do not incinerate closed containers. This product as supplied is a USEPA defined ignitable hazardous waste. Dispose of unusable product as a hazardous waste (D001) in accordance with local, state, and federal regulation.

14. Transport Information

	Domestic (USDOT)	International (IMDG)	Air (IATA)	TDG (Canada)
UN Number:	N.A.	1950	1950	N.A.
Proper Shipping Name:	Aerosols	Aerosols	Aerosols, flammable	Aerosols
Hazard Class:	N.A.	2	2.1	N.A.
Packing Group:	N.A.	N.A.	N.A.	N.A.
Limited Quantity:	Yes	Yes	Yes	Yes

15. Regulatory Information

U.S. Federal Regulations:

CERCLA - SARA Hazard Category

This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Gas under pressure, Carcinogenicity, Specific target organ toxicity (single or repeated exposure)

Sara Section 313:

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR part 372:

Chemical Name	CAS-No.
Xylenes (o-, m-, p- isomers)	1330-20-7
Ethylbenzene	100-41-4

Toxic Substances Control Act:

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(b) if exported from the United States:

Chemical Name	CAS-No.
Castor oil, sulfated, sodium salt	68187-76-8

U.S. State Regulations:

California Proposition 65:

WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov.

16. Other Information

HMIS RATINGS

Health:	2*	**Flammability:**	4	**Physical Hazard:**	0	**Personal Protection:**	X

NFPA RATINGS

Health:	2	**Flammability:**	4	**Instability**	0

Maximum Incremental Reactivity 0.83

SDS REVISION DATE: 2/18/2019

REASON FOR REVISION:

Revision Description Changed
Substance and/or Product Properties Changed in Section(s):
01 - Identification
08 - Exposure Controls/Personal Protection
09 - Physical & Chemical Properties
11 - Toxicological Information
14 - Transport Information
Substance Hazard Threshold % Changed
Substance Hazardous Flag Changed
Product Composition Changed

Legend: N.A. - Not Applicable, N.E. - Not Established, N.D. - Not Determined

Rust-Oleum Corporation believes, to the best of its knowledge, information and belief, the information contained herein to be accurate and reliable as of the date of this safety data sheet. However, because the conditions of handling, use, and storage of these materials are beyond our control, we assume no responsibility or liability for personal injury or property damage incurred by the use of these materials. Rust-Oleum Corporation makes no warranty, expressed or implied, regarding the accuracy or reliability of the data or results obtained from their use. All materials may present unknown hazards and should be used with caution. The information and recommendations in this material safety data sheet are offered for the users' consideration and examination. It is the responsibility of the user to determine the final suitability of this information and to comply with all applicable international, federal, state, and local laws and regulations.

Arcadis U.S., Inc.

410 N. 44th Street

Suite 1000

Phoenix

Arizona 85008

Phoenix

Arizona 85008

Tel 602 438 0883

Fax 602 438 0102

www.arcadis.com