Human and Ecological Risk Assessment San Juan 28-6#155 N Site

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Executive Summary

GHD has prepared an integrated Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) for the San Juan exploration pad 28-6 #155 N, which experienced an accidental release of approximately 186 bbls of natural gas condensate.

A series of Site investigation and soil removal actions were completed, including the collection of soil samples for the analysis of hydrocarbon constituents to support the HHRA and ERA.

The objective of the HHRA/ERA was to utilize the existing State and Federal risk assessment guidance to determine the potential for adverse effects on various receptors post-spill and subsequent to cleanup operations at the Site.

The risk analysis for soil relative to the residential and commercial/industrial exposure scenarios indicated that the principal constituent groups at the Site with concentrations in excess of the conservative screening levels included BTEX and TPH. These constituents were subjected to detailed human health risk assessment.

Ecological risk assessment of the soil analytical results relative to the conservative screening benchmarks for ecological receptors identified three BTEX constituents (COPECs) consisting of benzene, ethylbenzene, and xylene as requiring further evaluation in ecological risk assessment.

The 1993 OCD Remediation Guidelines require that corrective actions be taken to assure the protection of fresh waters, public health, and the environment. The removal of 2,102 cubic yards of hydrocarbon impacted soils in early 2015 was completed to fulfil this requirement. Subsequent soil boring and sandstone coring assessments in 2016 were conducted to delineate potential remaining hydrocarbons, and samples were collected and used in the comprehensive HHRA and ERA completed herein.

The results of the HHRA and ERA are conclusive in that any remaining hydrocarbons in Site soils do not pose any reasonable probability of injury or detriment to public health, fresh waters, animal or plan life, or property, or unreasonably interfere with public welfare or use of the property, currently or in future.

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Acronyms

95% UCL	95% Upper Confidence Level
ABS	Chemical Absorption Factor (unitless)
AES	Animas Environmental Services, LLC
AF	Soil to Skin Adherence Factor (mg/cm^2)
AT	Average Time
AUF	Area Use Factor
bbls	barrels company
BCOC	Bioaccumulative Chemicals of Concern
BERA	Baseline Ecological Risk Assessment
BLM	Bureau of Land Management
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
BTV	Background Threshold Values
BW	Body Weight
C	Chemical Concentration in Soil (mg/kg)

CCME	Canadian Council of Ministers of Environment
CDI	Chemical Daily Chemical Intake via Soil Ingestion (mg/kg body weight day)
CEM	Central Tendency Exposure
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CF	Conversion Factor
COEC	Constituents of Ecological Concern
COPC	Constituents of Potential Concern
COPEC	Constituents of Potential Ecological Concern
CSF	Cancer Slope Factor
DAF	Dilution Attenuation Factor
DF	Detection Frequency
DOI	Department of Interior
DRO	Diesel Range Organics
ECO-SSLs	Ecological Soil Screening Levels
ED	Exposure Duration
EF	Exposure Frequency
EPC	Exposure Point Concentrations
ERA	Ecological Risk Assessment
ERAGS	Ecological Risk Assessment Guidance for Superfund
ESV	Ecological Screening Values
F	Fahrenheit
FI	Fraction Ingested from Concentrated Source
FOD	Frequency of Detection
FT	Fraction Time Exposed
Ft	Feet
ft^2/d	Feet Squared Per Day
ft bgs	Feet Below Ground Surface
gpm	Gallons Per Minute
GHD	GHD Services Inc.
GRO	Gasoline Range Organics
Guide	USEPA's ProUCL Technical Guide
HEAL	Hall Environmental Analysis Laboratory
HHRA	Human Health Risk Assessment
HQ	Hazard Quotient
HI	Hazard Index
In	Inches
IR	Incidental Ingestion Rate
LADO	Lifetime Average Daily Dose
LCS/MS	Laboratory Control Supplies/Matrix Spikes
MBTA	Migratory Bird Treaty Act
MDL	Minimum Detection Limit
mg/kg	Milligrams Per Kilogram
mi	Miles
mph	Miles Per Hour
NFA	No Further Action
NMAC	New Mexico Administrative Code
NMED	New Mexico Environmental Department
NMGF	New Mexico Department of Game and Fish
NMOCD	New Mexico Oil Conservation Division
NMSSL	New Mexico Environmental Department Soil Screening Levels
ORNL	Oak Ridge National Laboratory
PACE	Pace Analytical Laboratories
PCL	Protective Concentration Level
PEF	Soil Particulate Emission Factor
PID	Photoionization Detector

Ppm	Parts Per Million
PRP	Potentially Responsible Parties
QA/QC	Quality Assurance/Quality Control
RAGS	Risk Assessment Guidance for Superfund
RB	Refinement Benchmark
RM	Reasonable Maxim
RME	Reasonable Maxim Exposure
RQ	Refinement Quotient
RSL	Regional Screening Level
SITE	San Juan Exploration Pad 28-6#155N
SLERA	Screening Level Ecological Risk Assessment
SQ	Screening Quotient
SQL	Sample Quantitation Limit
SSCL	Site Specific Cleanup Levels
SSG	Soil Screening Guidance
SSL	Soil Screening Levels
T&E	Threatened or Endangered Species
THQ	Target Hazard Quotient
TPH	Total Petroleum Hydrocarbons
TPHCWG	Total Petroleum Hydrocarbons Criteria Work Group
TRV	Toxicity Reference Values
UCL	Upper Confidence Limits
USEPA	United States Environmental Protection Agency
VISL	Vapor Intrusion Screening Levels
VOC	Volatile Organic Compounds

1. Introduction

GHD Services Inc. (GHD) on behalf of ConocoPhillips Company (ConocoPhillips) has prepared this integrated Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) for the San Juan exploration pad 28-6 #155 N (Site). In January 2015, the Site experienced an accidental release of approximately 186 barrels (bbls) of natural gas condensate from a corroded on-Site production tank. In response, ConocoPhillips conducted a series of Site investigation and soil removal actions, culminating with collecting confirmatory samples at various locations. The resulting analytical data are assessed for the potential to pose risk to human and ecological receptors.

The HHRA/ERA report includes a summary of the Site background, field activities through July 2016, as well as an updated Site plan showing the location of completed borehole locations and tabulation of field screening and laboratory analytical test results obtained to-date. The objective of the HHRA/ERA is to determine the potential for adverse effects on various receptors post-spill, and subsequent to cleanup operations at the Site.

2. Site Assessment

2.1 History and Background

2.1.1 Spill Event

A release of approximately 186 bbls of natural gas condensate was discovered on January 27, 2015 from a corroded perforation in an on-Site production tank. ConocoPhillips removed impacted soils resulting in a final excavation measuring 64 feet (ft) wide, 71 ft long and 19 ft deep. A total of 2,102 cubic yards of soil was removed for disposal at the Industrial Ecosystems Inc. facility in Aztec, NM. The depth of the excavation was limited by hard sandstone at 19 feet below ground surface (ft bgs). Excavation soil samples were collected from the sidewalls on February 27, 2015, and from the bottom on April 30, 2015. All samples were submitted for laboratory analyses of volatile organic compounds (VOCs), including benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8021B and for total petroleum hydrocarbons (gasoline, diesel and oil range organics, TPH) by EPA Method 8015D.

Results indicated that the VOC and TPH concentrations for the final walls were below the New Mexico Oil Conservation Division (NMOCD) screening levels established for the Site of 10 milligrams per kilogram (mg/kg, or ppm) for benzene, 50 mg/kg for total BTEX, and 100 ppm for total TPH. However, the base of the excavation had total BTEX concentrations of 434.6 mg/kg and a TPH concentration of 4,490 mg/kg, both above the corresponding NMOCD screening levels.

The confirmatory sampling results were also compared to the New Mexico Environment Department Soil Screening Levels (NMSSLs) from the Risk Assessment Guidance for Site Investigations and Remediation (NMED, 2015). The individual BTEX constituents are all below their respective Construction Worker Soil NMSSLs (142 mg/kg for benzene, 14,000 mg/kg for toluene, 1,770 mg/kg for ethylbenzene, and 798 mg/kg for xylenes). The total TPH result of 4,490 mg/kg from the bottom sample, however, was above the TPH soil screening level of 3,000 mg/kg for Industrial/Occupational Exposure (Table 6-2, NMED 2015) and, thus, additional action was deemed necessary. In April 2015, after potassium permanganate was applied to the soils in the open excavation, the base was again sampled, but this time the results for VOCs and TPH were below the applicable NMOCD and NMSSLs thresholds.

In April 2016, the Site surface owner, the U.S. Bureau of Land Management (BLM), required ConocoPhillips to core into the sandstone to assess the vertical extent of potential remaining hydrocarbon impacts. This request was fulfilled by ConocoPhillips further described in Section 2.1.2 below.

2.1.2 April 2016 Drilling Activities by GHD

In April 2016, the open excavation source area was evaluated by a New Mexico licensed Professional Engineer and sloping designed to allow for a track-mounted drilling rig and crew to drive down to the bottom of the excavation to core into the sandstone. This drilling effort was designed to ascertain the vertical extent of potential hydrocarbons remaining in the subsurface. Six borings were cored into the sandstone to depths ranging from 5 to 40 ft below the base of the excavation (19 ft bgs; for a total depth up to nearly 60 ft bgs) using the air-rotary drilling method (Figure 2.1). The sandstone core samples were field-screened for VOCs using a calibrated photoionization detector (PID), and for TPH a PetroFlag hydrocarbon analyzer. Samples were also submitted for laboratory analyses using the EPA Method 8021B for BTEX and EPA Method 8015D for TPH. Logs for borings CH-1 through CH-6 are presented in Appendix G.

The corresponding results indicate that the NMOCD screening levels for total BTEX (<50 mg/kg) and total TPH (<100 mg/kg) were achieved between surface and 24 to 39 ft bgs in all borings, with the exception of CH-1. CH-1 encountered total BTEX concentrations of 64.5 mg/kg and 93.62 mg/kg at 20 and 30 ft bgs, respectively, as well as TPH concentrations of 850 mg/kg and 1,040 mg/kg at the same respective depths. The sample analyzed at 40 ft bgs in CH-1 indicated concentrations of these constituents below the NMOCD screening levels.

The laboratory results of the April 21-22, 2016 boring assessment were forwarded to the BLM on May 3, 2016, at the agency’s request, prior to submitting a formal summary report. Upon review of the results, BLM required further assessment of subsurface conditions in the south/southwest corner of the existing excavation (i.e., in the general area of CH-1). BLM agreed to allow the excavation to be backfilled with clean fill prior to remobilizing to the Site with the purpose of placing additional borings to assess the potential hydrocarbon impacts at this last location.

Between June 28 and July 7, 2016 five additional borings, B-7 through B-11, were drilled at the south/southwest corner of the original excavated area. These borings were drilled using the Stratex method in the approximately 19 ft of silty/sandy soils overlying the sandstone. Air-rotary coring was used to core into the sandstone. The borings were drilled/cored to depths from 32 to 42.5 ft bgs. Logs of borings B-7 through B-11 are presented in Appendix H. The sandstone core samples were field-screened for VOCs using a PID. Boring locations and total depths were prescribed in the field by an environmental scientist representative from BLM. Field screening results indicated that all soils/sandstone cores were below the Site screening levels (NMOCD and NMED) to the total depths drilled. Bottom samples from each boring were submitted for confirmatory analyses using the EPA Method 8021B for BTEX and the EPA Method 8015D for TPH.

The BLM field representative expressed satisfaction with the locations of the borings, as well as the field screening results relative to further delineation of the horizontal and vertical extent of hydrocarbon impacts. However, for the purposes of the quantitative risk assessment detailed in this report, one additional boring (CH-11) was drilled as close as possible to the CH-1 boring to obtain samples of hydrocarbon-impacted material. Field screening of a sample collected at 22.5 ft bgs in boring CH-11 displayed a PID reading of 155 ppm, suggesting the presence of hydrocarbons. In addition to BTEX and TPH, samples were analyzed for aromatic and aliphatic hydrocarbon fractionations using methods TX1005 and TX1006.

2.2 Site Setting

The San Juan Basin accounts for half of the Navajo section of the Colorado Plateau physiographic province. The area is characterized by a wide range of land forms from broad uplands and wide valleys, to deep canyons, badlands, volcanic plugs, mesas, buttes, and hogbacks. In areas away from canyons and mesas or buttes, local relief is generally low.

2.2.1 Geology

The San Jose Formation of Eocene age outcrops at the Site, as well as over the surface of a vast portion of the San Juan Basin. The San Jose Formation was deposited in various fluvial-type environments. In general, the unit consists of an interbedded sequence of sandstone, siltstone, and variegated shale. The thickness of the San Jose Formation varies from 200 ft in the west and south to almost 2,700 ft in the center of the San Juan Basin.

2.2.2 Hydrology and Hydrogeology

Groundwater is associated with alluvial and fluvial sandstone aquifers. Thus, the occurrence of groundwater is mainly controlled by the distribution of sandstone in the formation. The distribution of such sandstone is the result of original depositional extent, plus any post-depositional modifications, namely erosion and structural deformation. Transmissivity data for San Jose Formation are minimal. Values of 40 and 120 feet squared per day (ft^2/d) were determined from two aquifer tests (Stone et al., 1983). The reported or measured discharges from 46 water wells completed in San Jose Formation range from 0.15 to 61 gallons per minute (gpm), with the median of 5 gpm. Most of the wells provide water for livestock and potable domestic use.

2.2.3 Climate

The climate is generally arid to semiarid. In the central part of the San Juan Basin, annual precipitation is generally 10 inches (in). Most precipitation (approximately 60% of the total) occurs during summer months in the form of local, often intense thunderstorms. Higher elevations receive considerable winter precipitation. Maximum temperatures generally occur in July, and minima are recorded in January. Temperature extremes in the basin include a high of 110 degrees Fahrenheit (ºF) at Fruitland, NM, 42 miles (mi) northwest of the Site, and a low of -48 ºF at Dulce, NM, 33 mi northeast of the Site. Wind directions vary in the basin because of topography (numerous ridges and valleys). Spring is the windiest season, with wind velocities averaging 10 to 12 miles per hour (mph), whereas summer winds average only 8 mph. The average evaporation during the period May through October is 46 in.

2.2.4 Land Use

Land use in the area is principally petroleum extraction and stock grazing (cattle and sheep), as well as various recreational activities. The Site has no use restrictions or restrictive covenants.

2.2.5 EDR Results

As part of the Site assessment activities, GHD performed an EDR search for the Site and its surroundings. The corresponding results are summarized below.

2.2.5.1 Water Wells

Limited data are available on water wells in the area. A survey by iWater shows that a groundwater well near San Juan 28-6 unit 7 (located west of the Site) at approximately 90 ft bgs.

2.2.5.2 Residences

Limited data are available on residences. The Site is rural and remote, i.e., not in a location that is conducive to residency. However, there is one residence (Don Schreiber house) located on the other side of the Encierro Canyon, and several hundred meters to the north of the Site.

2.2.5.3 Sensitive Receptors

Due to the remote location of the Site, there are no schools, nursing homes, daycares, and hospitals at, or near the Site.

2.2.5.4 Contaminated Sites and Landfills

Due to the remote location of the Site, there are no contaminated sites or landfills at, or near the Site.

2.2.5.5 Surface Waters and Public Water Intakes

Due to the nature of the Site and geographical region, there are only ephemeral surface water bodies near the Site. An ephemeral creek is present at the base of the Encierro Canyon. This ephemeral creek is not a public water intake.

2.2.6 Constituents of Interest

Historical activities at the Site were associated with the accidental release of natural gas condensate. Accordingly, the constituents of interest include TPH, PAHs, and BTEX, which are VOCs.

2.2.7 Transport and Fate

There are several potential mechanisms for transporting constituents from one or more source area to areas that may be frequented by receptors. One such mechanism is overland surface flow during storm events. Constituents dissolved in storm water, or adsorbed to particles suspended in storm water, may be transported from source areas to other portions of the Site.

The fate of constituents in surface flow is dependent on the chemical and physical properties of the constituents and their interaction with the physical and biological properties of the habitats. For example, VOCs transported in surface runoff will likely volatilize to the atmosphere. Hydrophobic compounds will likely leave solution and bind to organic matter in the soil, or in the sediment, of a nearby waterbody. Other less hydrophobic compounds may remain in solution.

Wind is another potential mechanism for transport of chemical constituents from source to receptors areas. Constituents transported by wind may be deposited on land or nearby water conveyances.

Another potential source of transport is the movement of chemicals dissolved in water percolating through soil. If the downward migration of constituents intersects groundwater, constituents may be transported via groundwater flow. The fate of constituents in groundwater is dependent upon the chemical and physical properties of the specific constituents and the interaction of the constituents with the physical properties of the subsurface soil. Hydrophobic constituents (i.e., those constituents with low aqueous solubility) will likely leave aqueous solutions and will bind to organic matter in subsurface soil. Other less hydrophobic constituents may remain in solution. If there are constituents that are transported in groundwater, they could potentially discharge into nearby waterbodies.

3. Data for Risk Assessment

The soil data for risk assessment were collected in February 2015, April 2015, February 2016, April 2016, and July 2016 as part of various Site investigations, excavation, confirmatory, and step-out sampling activities described in Section 2. Environmental media samples were submitted to Hall Environmental Analysis Laboratory (HEAL) located in Albuquerque, New Mexico and Pace Analytical (Pace) located in Lenexa, Kansas. The corresponding results were initially screened "as is" (i.e., without consideration of what impacted media was excavated and what remains on-Site) to identify the constituents of potential concern. All analytical results available for the Site are presented in Table 2.1. The risk assessments performed in Chapters 5 and 6 take the next step, and consider "current conditions" where the excavated soil results are excluded from final risk conclusions.

3.1 Validation

Prior to performing the risk assessment, soil data were validated by a GHD chemist. Evaluation of the data was based on information obtained from the chain of custody forms, finished report forms, method blank data, and recovery data from surrogate spikes/laboratory control samples (LCS)/matrix spikes (MS). The QA/QC criteria by which these data have been assessed are outlined in the analytical methods and applicable guidance from the document titled, "*USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*," USEPA 540-R-08-01, June 2008.

3.2 Treatment of Non-Detects

Non-detects (censored datasets) was evaluated following the appropriate methodology outlined in the most recent version of US EPA's ProUCL Technical Guide (Guide). Currently, the Guide indicates that the Kaplan-Meier (KM) method yields more precise and accurate estimate of decision characteristics than those based on substitution and regression on order statistics. The use of one-half the minimum detection limit (MDL) or sample quantitation limit (SQL), or other simple substitution methods, are not considered appropriate methods for handling non-detects. In this report, the KM method was applied with ProUCL.

3.3 Data Usability Statement

Based on the results of validation, as well as the data review by a senior GHD risk assessor, the soil data appear to be acceptable for the purpose of performing human health and ecological risk assessments.

4. Review of Risk-Based Closure Programs Applicable to the Site

The Site assessment data discussed in Sections 2 and 3 are evaluated for the potential for unacceptable risks to human and ecological receptors. The process of conducting human and ecological risk assessments has been well established at Federal, State, and Regional sites. The corresponding risk-based approaches have been captured in legislation, guidance documentation, and successful cleanup actions/closures. As such, there is an extensive track record of regulatory, legal, risk, and practical precedents to facilitate safe closures of contaminated sites using risk-based approaches.

Below, is an overview of key risk programs applicable to the Site. The presented information is discussed in context of Site conditions, nature of operations, and how it relates to the risk assessment in this report. The methods and approaches selected for the current risk assessment are consistent with those from the United States Environmental Protection Agency (USEPA), NMED, and contiguous states, as well as the standard risk assessment practice.

4.1 Federal Risk Guidance

Much of the risk assessment science dates back nearly 50 years to the inception of the USEPA and, subsequently, the enacting of the National Oil and Hazardous Substance Pollution Contingency Plan (NOHSPCP; 53 Federal Register 51394), as well as the Superfund program. The Superfund program was created in 1980 when Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). It facilitates the USEPA's interaction with communities, potentially-responsible parties (PRPs), scientists, researchers, contractors, and state/local/ tribal/Federal authorities to identify hazardous waste sites, test the conditions of these sites, formulate cleanup plans, and to conduct clean-up. With the establishment of the Superfund program and the allotment of substantial funds for clean-up, the USEPA began to generate guidance[1] on how to conduct human health and ecological risk assessments. Over the years, risk guidance has accumulated into an extensive collection of reference documents, commonly referred to as RAGS (Risk Assessment Guidance for Superfund) and (Ecological Risk Assessment Guidance for Superfund). Specific titles used in the current risk assessment are listed in Sections 6 and 7.

The scientific principle behind the risk assessment is the toxicological concept of "dose makes the poison." That is, certain levels of exposure are acceptable as long as they are below the specified health-based limits. For human receptors, the acceptable incremental cancer risk ranges from 1 in 1,000,000 (1E-06) to 1 in 10,000 (1E-05), and for non-cancer effects, is 1 to 3 times (as quantified by the Hazard Quotient [HQ] or Index [HI]) the toxicity reference dose[2]. For ecological receptors, any residual risks must be demonstrated as not to impact health of populations, or individual Threatened or Endangered Species (T&E). These risk decision criteria, along with standard risk

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[1] Also based on policies in the National Oil and Hazardous Substance Pollution Contingency Plan (53 Federal Register 51394).

[2] https://www.epa.gov/risk/regional-removal-management-levels-chemicals-rmls

assessment tools from Federal and State risk guidance, including New Mexico, are adopted in the current risk assessment since the Site has Federal and State regulatory involvement.

4.2 New Mexico Risk Guidance

Recently (July 2015), New Mexico has issued a new version of the Risk Assessment Guidance for Site Investigation and Remediation[3]. Within it, NMED discusses the soil screening guidance (SSG) and the methodology to derive site- and chemical-specific soil screening levels (SSLs), tap water screening levels, and vapor intrusion screening levels (VISLs). The SSG utilizes risk assessment methods from various USEPA risk assessment guidance documentation, including identifying and evaluating the appropriate exposure pathways and receptors based on default or site-specific, exposure parameters under residential and non-residential land use scenarios.

The SSG provides site managers with a risk-based framework for developing and applying the SSLs, and determining whether certain areas or entire sites are contaminated to an extent which warrants further investigation, or can be left in place. The risk framework is intended to assist and streamline site investigation and corrective action process by focusing resources on those sites or areas that pose the greatest risk to human health and the environment. NMED indicates that the implementation of the methodologies outlined within the SSG may significantly reduce the time necessary to complete site investigations and cleanup actions, as well as improve the consistency of these investigations among similar sites in New Mexico.

NMED recognizes that there is a wide spectrum of contamination that could be present at a site, from heavy impacts requiring removal, to those below even the most conservative and generic screening levels. The agency states that appropriate, site-specific cleanup goals acceptable to, and approved by the agency, may fall anywhere within this range. NMED notes that the SSLs, which are based on the 1E-05 target risk for carcinogens and a HQ of 1 for noncarcinogens, are protective of domestic groundwater. As such, the NMED SSLs serve as a generic benchmark for screening level comparisons of contaminant concentrations in soil and do not themselves represent cleanup standards. Hence, the SSLs alone do not trigger the need for a response action or define “unacceptable” levels of contamination in soil.

While concentrations above the NMED SSLs presented in this document do not automatically designate this Site as “contaminated” or trigger the need for a response action, detected concentrations in Site soils exceeding screening levels suggest that further assessment is appropriate, including performing a Site-specific risk assessment, which is performed in Sections 6 and 7. Further optional evaluation may also include additional sampling to better characterize the nature and extent of contamination, consideration of background levels, reevaluation of constituents of potential concern or associated risk and hazard using site-specific parameters, and/or a reassessment of the assumptions associated with the generic SSLs (e.g., appropriateness of route-to-route extrapolations and use of chronic toxicity values to evaluate childhood and construction-worker exposures). A full range of NMED risk assessment steps and procedures for evaluating human and ecological health, including exposure averaging, Site-specific conceptual exposure model, and cleanup level development, are considered in this risk assessment.

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[3] https://www.env.nm.gov/HWB/guidance.html

4.3 New Mexico Oil Conservation Division

New Mexico Oil Conservation Division (OCD) regulates oil, gas, and geothermal activity in New Mexico. OCD gathers well production data, permits new wells, enforces the division's rules and the state's oil and gas statutes, oversees plugging and abandoning of wells, and ensures responsible land restoration. The applicable statues are written into Parts 1 thru 39 of Title 19, Chapter 15 of the New Mexico Administrative Code (NMAC) and are captured in Guidelines for Remediation of Leaks, Spills, and Releases.[4] NMAC is primarily designed to control exploration and production aspects, with some components having environmental application such as the establishment of Closure Criteria for Recycling Containments under 19.15.34 NMAC[5]. There is no source provided for these criteria, but they appear to be based on the analytical detection or, perhaps, aesthetic limits of the methods cited in 19.15.34 NMAC. As such, they are general in nature, do not consider site-specific conditions, or otherwise encompass technical/health risk assessment aspects.

4.4 Bureau of Land Management Risk Guidance

As the major Federal land owner in New Mexico, the BLM is an important local stakeholder. Furthermore, BLM in New Mexico manages one of the largest oil and gas programs on Federal lands. BLM Law Enforcement is responsible for investigating incidents relating to theft of natural resources, loss of associated royalties, vandalism of equipment related to oil and gas production, violations of the Migratory Bird Treaty Act (MBTA), as well as hazardous material non-compliance. BLM does not have separate regulations concerning contamination and cleanup, but as a Department of the Interior (DOI) agency, it defers to State and Federal guidance (i.e., USEPA) regarding risk assessment and cleanup.

4.5 Contiguous States Risk Guidance

Bordered by the oil and gas-producing States of Texas, Oklahoma, Kansas, Colorado, Utah, and Arizona, the State of New Mexico is not isolated in its assessment of the potential risks associated with hydrocarbon impacts, including those on Federal lands. Similar to New Mexico, the States of Texas[6], Oklahoma[7], Kansas[8], Colorado[9], Utah[10], and Arizona[11] have established methodologies for conducting Site-specific, multi-tiered risk-assessments to aid in ensuring consistent, effective, and efficient site closure mechanisms. These programs are also sourced largely in the Federal Superfund program and share similar features, including the development of site-specific, risk-based cleanup goals. Therefore, the execution of the risk assessment using NMED guidance and tools would be consistent not only with Federal, but also regional site cleanup and closure procedures.

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[4] http://www.emnrd.state.nm.us/OCD/documents?7C_spill1.pdf

[5] http://www.emnrd.state.nm.us/OCD/rules.html

[6] http://www.tceq.state.tx.us/remediation/trrp/trrp.html

[7] http://www.deq.state.ok.us/lpdnew/FactSheets/RiskBasedDecisionMakingSiteCleanup.pdf

[8] http://www.kdheks.gov/remedial/rsk_manual_page.html

[9] https://www.colorado.gov/pacific/cdphe/approach-soil-screening-values

[10] http://www.rules.utah.gov/publicat/code/r315/r315-101.htm

[11] http://legacy.azdeq.gov/environ/waste/cleanup/index.html#risk

5. Human Health Risk Assessment

5.1 Introduction

The significance of the analytical results discussed in Sections 2 and 3, relative to the potential for impacts on human health, is assessed below. In accordance with the USEPA's Risk Assessment Guidance for Superfund (RAGS) (USEPA, 1989) and the NMED's Risk Assessment Guidance for Site Investigations and Remediation (NMED, 2015), the main steps in an HHRA are hazard identification, exposure assessment, toxicity assessment, and risk characterization.

Traditionally, these steps are executed in sequence to yield a “forward” risk assessment, which helps to determine whether current or future exposures may, or may not, be associated with potentially unacceptable health risks/hazards. However, the “reverse” risk assessment approach performed herein, where risk-based screening levels are compared to the exposure media concentrations, is also recognized by the USEPA (via the Regional Screening Level [RSL] methodology; USEPA, 2015) and NMED (via NMED's 2015 Risk Assessment Guidance for Site Investigations and Remediation; NMED, 2015).

The main reason for conducting a “reverse” risk assessment for the Site is simplicity and efficiency. The comparison of exposure media results to the screening levels readily identifies not only the potential risks on a sample-by-sample basis (or point-to-point; a conservative approach), but also directly delineates locations within the Site where detected concentrations in Site media may need remediation and/or risk management decisions. This is the end product of the reverse HHRA.

The Reasonable Maximum Exposure (RME) and Central Tendency Exposure (CTE) scenarios are commonly used in risk assessments (per USEPA's Risk Assessment Guidance for Superfund; USEPA, 1989; USEPA, 2002; and USEPA, 2004). As such, they are incorporated into the current HHRA to account for exposure averaging, which is experienced by actual receptors. The use of the RME and CTE exposure scenarios helps to offset the built-in conservatism in general risk assessments and facilitates realistic (i.e., pragmatic) risk conclusions that are directly applicable to remedy design and risk management. This approach also strikes a balance between the practical nature of a "reverse" risk assessment and the traditional "forward" risk assessment. Current risk assessment conservatively and preferentially relies on the RME risk conclusions.

5.2 Conceptual Exposure Model for Human Receptors

The hazard identification step involves the development of a CEM (also commonly referred to as the conceptual site model) for human receptors and the identification of constituents of potential concern (COPCs) via screening of exposure media data against conservative screening levels (this step was performed in Section 3.1). The CEM for the Site is discussed below.

A CEM is a simplified representation of the relationship between chemical sources, fate& transport processes, exposure pathways, and exposure routes to receptors at a given location. Its purpose is to identify complete exposure pathways that must be addressed in a risk assessment. Per the USEPA (1989), a complete exposure pathway must have the following components:

1) source of a chemical constituent; 2) transport mechanism from source to receptor; 3) exposure point; and 4) route to the receptor. A pathway is incomplete if any of these four components are missing. Otherwise, the pathway is complete and must be evaluated further.

A conservative CEM for the Site is presented in Figure 5.1. Soil is the primary source medium. Air is considered a secondary source medium based on the potential for soil particulate matter (or dust) to be entrained and present in ambient and indoor air. Additional secondary source media include soil gas (through volatilization from soil), garden produce (grown in the contaminated soil), beef (from cattle grazing on the contaminated soil), groundwater (through leaching from soil), and surface water/sediment (through storm water runoff during wet events).

The current land use of the Site is rangeland, where the prairies are used for livestock grazing. Since there are no restrictions on the current designated land use, the Site is required to maintain its unrestricted status into foreseeable future. Therefore, based on the current and future land use, the on-Site receptors may include all receptor types from construction; utility; outdoor; indoor workers (adults) performing excavation, maintenance, and regular workplace activities, to residents (adults and children), as well as occasional young adult trespassers (see Figure 5.1).

5.3 Potentially-Complete Exposure Pathways

Based on the characterization of the Site and their current/future use, the potentially-complete exposure pathways for each current/future receptor are:

- Current/Future Construction/Utility Worker (adult):
    - Dermal contact with soil, sediment[12], groundwater, surface water[13];
    - Ingestion of soil, sediment, groundwater, surface water; and
    - Inhalation of soil/sediment particulate matter (or dust) and vapors entrained in ambient air.
- Current/Future Outdoor Worker (adult):
    - Dermal contact with soil, sediment, groundwater, surface water;
    - Ingestion of soil, sediment, groundwater, surface water; and
    - Inhalation of soil/sediment particulate matter (or dust) and vapors entrained in ambient air.
- Current/Future Trespasser (young adult):
    - Dermal contact with soil, sediment, groundwater, surface water;
    - Ingestion of soil, sediment, groundwater, surface water; and
    - Inhalation of soil/sediment particulate matter (or dust) and vapors entrained in ambient air.
- Future Indoor Worker (adult):
    - Dermal contact with surface soil dust, groundwater;
    - Ingestion of surface soil dust, groundwater; and

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[12] The Site is dry and does not have perennial bodies; “sediment” is defined here for all applicable receptors as dry soil at the bottom of storm drainage areas.

[13] Storm water in drainage areas for all applicable receptors.

  - Inhalation of soil particulate matter (or dust) entrained in ambient air and indoor air, and inhalation of volatile constituents, if present, migrating to ambient air and indoor air.
- Future Resident (child and adult):
  - Dermal contact with soil, sediment, groundwater, surface water;
  - Ingestion of soil, sediment, groundwater, surface water;
  - Inhalation of soil particulate matter (or dust) entrained in ambient air and indoor air, and inhalation of volatile constituents, if present, migrating to ambient air and indoor air; and
  - Ingestion of garden produces grown in potentially-affected soil and/or beef from cattle raised in potentially-affected soil.

For the purposes of this assessment, a worker is an adult (exposure parameters based on age from 16 to 30 years per USEPA, 2004) and a trespasser is a young adult (youth) (exposure parameters based on age from 6 to 16 years per USEPA, 2004).

An outdoor worker is a receptor that performs his/her duties primarily outdoors for a set period of time (8 hours per day, 225 days per year, for 25 years per NMED, 2015). Outdoor workers can be directly exposed to surface soil, ambient air (dust and vapor), and groundwater (if working near subsurface excavations that encounter groundwater), though to a lesser degree than a construction/utility worker described below. An outdoor worker may also be directly exposed to sediment and surface water occasionally present during infrequent wet events.

A construction/utility worker is expected to be present at the Site on short-term basis and is limited by the duration of construction, maintenance, and subsurface activities. However, due to the invasive nature of construction, the worker may be exposed to all potentially-affected media including, surface/subsurface soil, ambient air (dust and vapor), and groundwater (if conducting subsurface excavations that encounter groundwater) via dermal contact, ingestion, and inhalation. However, the typical implementation of personal protective equipment, safety procedures, and industrial hygiene measures will limit or eliminate such exposures for these receptors. A construction/utility worker may also be directly exposed to sediment and surface water occasionally during infrequent wet events.

A trespasser may enter the Site and inadvertently come into contact with potentially-affected surface/subsurface soil, ambient air (dust and vapor), and groundwater (while excavations that encounter groundwater remain open). However, any resulting exposures typically would be limited and brief. A trespasser may also be directly exposed to sediment and surface water occasionally during infrequent wet events.

Indoor workers are not currently present on Site, but may be in the future, since there is no land use restriction. An indoor worker is an occupant of a commercial building who infrequently ventures beyond their indoor work space, other than a parking lot, and works scheduled hours each day. This type of receptor has limited potential for direct exposure to soil, ambient air (dust), and indoor air (vapors if volatile constituents are present), and groundwater. Any affected dust originating from surface soil may exist in ambient air and enter the building and lead to exposure. Although exposures to this source are expected to be relatively low, the indoor worker is assumed to be exposed to a concentration equivalent to surface soil as described in USEPA (2002). Dermal and ingestion exposure to groundwater use is possible in future because there is no restriction on the use of groundwater at the Site.

A resident is a young child from age 0 to 2 years, a child from age 2 to 6 years, a young adult from age 6 to 16 years, or an adult from age 16 to 26 years (USEPA, 2004 and USEPA, 2014b). This receptor accounts for potential young child, child, and young adult exposures to mutagenic carcinogens (USEPA, 2006). The resident is expected to occupy a dwelling, and the associated land, for as long as a lifetime. During that time, repeated exposure to surface soil, ambient air (dust), and indoor air (vapors if volatile constituents are present) may occur. Future exposure to groundwater via potable water may be possible since its use at the Site is not prohibited. Local residents may also venture into the storm water drainage areas and be directly exposed to sediment and surface water occasionally during infrequent wet events.

Given the arid climate at the Site and lack of perennial bodies of water nearby, the only surface water (and the associated “sediment”) is that of sporadic flood events inundating dry washes. Given their infrequent nature and lack of impacted material remaining, the Site receptor exposure frequency is set accordingly low.

5.4 Incomplete Exposure Pathways

Based on field observations, local geology, and historical investigations on Site, the groundwater at the Site is very deep (estimated depth approximately 200 ft bgs) (GHD, 2015 and 2016). Therefore, current/future exposure to groundwater encountered while conducting/entering excavations is not likely. As a result, this pathway is not quantified in the HHRA.

Ambient air exposure pathway is deemed incomplete since surficial and immediate subsurface impacts have been excavated. For the same reason, leaching to groundwater is not expected and any residual hydrocarbons are likely to degrade over short distances (ITRC, 2014).

As there are neither residential dwellings nor commercial/industrial structures on-Site currently, the residential receptors and indoor worker receptors are only considered for future scenarios in this HHRA as a conservative approach.

NMED (2015) indicates that the ingestion of homegrown produce should be considered as a potential exposure pathway for residents. Specifically, for those sites greater than two acres in size, grazing of cattle must be evaluated to determine if beef ingestion is a plausible and complete exposure pathway. Because the size of the Site is approximately 1.5 acres, a quantitative assessment of this pathway is not required (NMED, 2015).

The CEM is incorporated into the overall risk assessment for the Site. Additional details on the CEM and receptors are contained in Tables 5.1 through 5.7.

5.5 Determination of Human Health COPCs

COPCs are chemicals related to a site that have the potential to pose unacceptable risk to human health. In general, constituents are identified as COPCs based on their detected concentrations relative to default screening levels, frequency of occurrence, and history of use. The screening levels are generic (i.e., apply to all sites), and therefore, are necessarily conservative.

The initial screening step helps to ensure that all potential risks due to specific constituents, however minimal, are identified early on. The Site-specific cleanup levels (SSCLs) can then be used in the refinement step to identify any notable risks that may need to be addressed via remediation and/or institutional controls. Any constituents determined to be present in the exposure medium of interest (i.e., soil) at concentrations above the relevant USEPA and NMED screening levels, and that had a detection frequency (DF) greater than 5 percent (after USEPA, 1989), were identified as COPCs.

The dataset applied in the COPC screening were from historical and recent investigations (see Section 3). The COPCs above the screening levels were carried forward to the HHRA and are listed in the Section 5.5.1 below. These COPCs were assessed further by comparing the detected concentrations to the SSCLs developed for the potentially-complete exposure pathways for the Site.

Additionally, and consistent with the USEPA guidance (USEPA, 2004), two measures of average exposure were calculated (also referred to as the Exposure Point Concentrations [EPCs]) for comparison to SSCLs for industrial soil: the CTE estimate and the RME estimate. The CTE is mathematically represented by the arithmetic or geometric mean, and the RME by the 95 percent Upper Confidence Limit (95% UCL) on the mean calculated using USEPA's ProUCL software. Risk conclusions are conservatively based on the RME scenarios.

5.5.1 Summary of Identified COPCs and Exposure Pathways

The most sensitive screening levels (i.e., those intended for residential application and developed for groundwater protections with tap water screening levels) were selected to identify the COPCs (Table 3.1, Figures 5.1 and 5.2) even if the most sensitive land use is not planned. Based on the identified COPCs and the associated exposure media, the human exposure pathways that are potentially complete and are further evaluated quantitatively in the HHRA, are summarized in Table 5.2.

5.6 Exposure Assessment

Exposure is defined as the contact of a receptor (i.e., a person) with a chemical or physical agent. Exposure assessment is the estimation of the magnitude, frequency, duration, and routes associated with the receptor chemical contact. Exposure assessment provides a systematic analysis of the potential exposure mechanism by which a receptor may be exposed to a chemical at a given study area (USEPA, 1989). This step in the risk assessment is very important, because if there is no exposure there is also no risk.

The following guidance documents were considered in quantifying the level of exposure at the Site:

i. NMED, 2015. New Mexico Environmental Department Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015;

ii. USEPA, 1989. Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1 89/002, December 1989;

iii. USEPA, 1991b. Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual (Part B, Development of Risk Based Preliminary Remediation Goals), Publication 9285.7 01B;

iv. USEPA, 1997. Exposure Factors Handbook, EPA/600/P 95/002F, August 1997;

v. USEPA, 2002a. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4 24, December 2002;

vi. USEPA, 2004. Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual, (Part E; Supplemental Guidance for Dermal Risk Assessment), Final, EPA/540/R/99/005, July 2004;

vii. USEPA, 2005. Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Office of Solid Waste and Emergency Response, United States Environmental Protection Agency, EPA530 R 05 006, September 2005; and

viii. USEPA, 2006a. Child Specific Exposure Factors Handbook (External Review Draft), EPA 600 R06 096A, September 2006.

In a traditional HHRA, exposure estimates are calculated to reflect chemical concentration in exposure media, contact rate, and exposure time in a term called intake or a dose. Current HHRA is directed toward the development of SSCLs, where estimates of intake are combined with the NMED's target risk/hazard thresholds in a reverse fashion to produce a safe concentration for a given media of interest (primarily soil at the Site). The details on deriving the SSCL equations are presented in Section 5.7.

Standard intake equations from the USEPA (1989; 2004; and 2005) are applied to quantify exposure to the COPCs identified in soil (Section 5.7.1). The receptor exposure factors and assumptions for each potentially-complete exposure pathway are presented in Section 5.7.4.

5.7 Development of SSCLs

The risk characterization step of the HHRA relies on the SSCLs for residential and commercial/industrial soil developed specifically for the Site receptors. These SSCLs are based on exposure modeling combined with appropriate COPC toxicity reference values (TRVs) and the NMED's policy-based target cancer risk threshold of 1E-05, and target non-cancer hazard threshold of 1 (NMED, 2015).

Site-specific input regarding exposure assumptions for the Site receptors were incorporated into the development of the SSCLs in residential and commercial/industrial soil. Details on the SSCL calculation methodology are summarized below. Data on the CEM, assumptions, and SSCL equations/input/calculations are summarized in Tables 5.2 through 5.19. Additional risk characterization is facilitated by the calculation of EPCs based on the RME and CTE estimates, and comparing these EPCs to the SSCL values for residential and commercial/industrial soil.

5.7.1 Forward Exposure Equations

Based on standard USEPA guidance (USEPA, 2004), forward equations for intake of COPCs via exposure to various exposure media and routes are as follows:

Soil Incidental Ingestion Exposure Route

The standard forward equation for calculating chemical intake via incidental ingestion of soil is:

$$CDI = \frac{C \times IR \times EF \times ED \times CF \times FI}{BW \times AT}$$ **Equation 1**

Where:

CDI = Chronic daily chemical intake via soil ingestion (mg/kg body weight-day)

C = Chemical concentration in soil (mg/kg)

IR = Incidental ingestion rate (mg soil/day)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

CF = Conversion factor (10^{-6} kg/mg)

FI = Fraction ingested from contaminated source (unitless)

BW = Body weight (kg)

AT = Averaging time (averaging period; days)

Soil Dermal Contact Exposure Pathway

The standard forward equation for calculating chemical intake via dermal exposure to soil is:

$$CDI = \frac{C \times SA \times AF \times ABS \times EF \times ED \times CF}{BW \times AT}$$ **Equation 2**

Where:

CDI = Chronic daily chemical intake via dermal contact (mg/kg body weight-day)

C = Chemical concentration in soil (mg/kg)

SA = Skin surface area available for contact (cm^2/event)

AF = Soil to skin adherence factor (mg/cm^2)

ABS = Chemical absorption factor (unitless)

EF = Exposure frequency (events/year)

ED = Exposure duration (years)

CF = Conversion factor (10^{-6} kg/mg)

BW = Body weight (kg)

AT = Averaging time (averaging period; days)

Soil Particulate Matter Inhalation Exposure Route

The standard forward equation for calculating chemical intake from the inhalation of particulate matter originating from soil is:

$$CDI = \frac{C \times FT \times EF \times ED \times \left(1/PEF\right)}{AT}$$ **Equation 3**

Where:

CDI = Chronic daily chemical intake via soil particulate matter (mg/m^3)

C = Chemical concentration in soil (mg/kg)

FT = Fraction time exposed (unitless)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

PEF = Soil particulate emission factor (m^3/kg; calculated in Table 3.16)

AT = Averaging time (averaging period, days)

The forward equations presented above are combined (to simulate simultaneous exposure to Site media) and then solved for the exposure media concentration term as described below.

5.7.2 Reverse Exposure Equations

The potential for non-cancer health effects associated with exposure to COPCs is generally evaluated by comparing an exposure level over a specified time period to a reference dose or a concentration. This ratio, termed the hazard quotient (HQ), is calculated as:

$$HQ = \frac{CDI}{RfD\ or\ RfC}$$

Equation 4

Where:

HQ = The Hazard Quotient (unitless) is the ratio of the exposure dose of a chemical to a reference dose, which is not expected to cause adverse effects from a lifetime exposure. A hazard quotient equal to or below 1 is considered protective of human health and corresponds to NMED's target non-carcinogenic hazard threshold (NMED, 2015).

CDI = The Chronic Daily Intake, or exposure, is the chemical dose calculated by applying the exposure scenario assumptions, and is expressed as either mg/kg body weight/day for ingestion and dermal exposure or as mg/m^3 for inhalation exposures. The intake represents the average daily chemical dose over the expected period of exposure.

RfD = The Reference Dose is a daily dose believed not to cause an adverse effect from a lifetime of exposure (mg/kg body weight-day). The RfD is based on experimental data and/or epidemiological studies.

RfC = The Reference Concentration is a daily concentration in air believed not to cause an adverse effect from even a lifetime of exposure (mg/m^3). The RfC is based on experimental data.

The potential for cancer-type effects associated with exposures to carcinogenic COPCs is generally evaluated over a lifetime. Therefore, cancer risks are calculated utilizing the following general equation:

$$CR = LADD \times CSF \qquad \textbf{Equation 5}$$

Where:

CR = Estimated upper bound on additional cancer risk over a lifetime of an individual exposed to a carcinogen for a specified time (unitless). The NMED's policy-based target carcinogenic risk threshold is 1E-05 (NMED, 2015).

$LADD$ = The Lifetime Average Daily Dose of the chemical calculated using exposure scenario assumptions and expressed in mg/kg body weight-day. The intake represents the total lifetime chemical dose averaged over an individual expected lifetime of 70 years.

CSF = The Cancer Slope Factor models the potential carcinogenic response and is expressed as (mg/kg body weight-day)$^{-1}$.

For the development of SSCLs, the equations above, once combined with the intake equations and the NMED's target risk/hazard thresholds, are applied to develop media concentrations that are protective of human health.

For example, for the ingestion exposure to soil, substituting the intake equation (Equation 1) into Equation 4 yields:

$$HQ = {\dfrac{C \times IR \times EF \times ED \times CF \times FI}{BW \times AT}} \Big/ {RfD} \qquad \textbf{Equation 6}$$

Applying the NMED's target hazard quotient threshold (*THQ*) of 1, rearranging Equation 6 to solve for *C,* and re-naming *C* as the *SSCL* produces the following:

$$SSCL = \frac{THQ \times RfD \times BW \times AT}{IR \times EF \times ED \times CF \times FI} \qquad \textbf{Equation 7}$$

Exposure to soil via dermal contact and particulate matter inhalation can also be accounted for in the SSCL by adding Equations 2 and 3 to Equation 7, per USEPA (2002) guidance. Thus, the calculation of the SSCL becomes:

$$SSCL = \frac{THQ \times AT}{EF \times ED \times \left[\left(1/_{RfD} \right) \times IR \times CF \times FI \times \left(1/_{BW} \right) + \left(1/_{RfD} \right) \times SA \times AF \times CF \times ABS \times \left(1/_{BW} \right) + \left(1/_{RfC} \right) \times FT \times \left(1/PEF \right) \right]}$$

Equation 8

SSCLs are developed for cancer and non-cancer health effects via this procedure. Tables 5.10 through 5.15 list the equations used to calculate SSCLs. These equations and the adopted methodology are consistent with those used by the USEPA to derive the RSLs[14].

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[14] https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables-may-2016

The final SSCLs (i.e., most sensitive levels for the applicable receptors and exposure pathway/routes) are then determined as follows:

1. For each receptor and exposure pathway, the lower of the carcinogenic and non-carcinogenic chemical cleanup level is selected for that receptor and exposure pathway.
2. If more than one SSCL is available, the lowest value is identified as the final SSCL for a given medium and a COPC.

The final SSCLs are summarized in Tables 5.16 and 5.17 for commercial/industrial land use and residential land use, respectively. The most sensitive receptors (i.e., those with the lowest SSCLs chosen as the final SSCLs) are the construction/utility worker (due to direct contact with COPCs) for commercial/industrial soil.

5.7.3 Soil SSCLs for Protection of Groundwater

BTEX was identified as a group COPC because the detected concentrations in soil exceeded the screening levels developed for groundwater protection (Table 3.1). In the development of generic NMED SSLs, a Dilution Attenuation Factor (DAF) of 20 was deemed as being reasonably protective to maintain an approach that is protective of groundwater quality (NMED, 2015). SSCLs for the protection of groundwater can be developed using the NMED site-specific model approach, which is generally more sensitive to the DAF than to other parameters in the soil water partition equation. However, no sufficient Site-specific data on hydrologic conditions (e.g. hydraulic conductivity and infiltration rate) are available to calculate a Site-specific DAF, thus the default value was employed.

BTEX leaching to groundwater is not a concern because the soil-to-groundwater pathway is considered incomplete under practical scenarios since: 1) the depth to groundwater at the Site is very large (estimated approximately 200 ft bgs); and 2) BTEX is volatile and readily biodegradable by natural attenuation. Therefore, the SSCLs for protection of groundwater at the Site are not developed for BTEX, and this constituent group is not evaluated quantitatively in current HHRA.

5.7.4 Total Petroleum Hydrocarbon Criteria Work Group (TPHCWG) Approach

The TPH cleanup levels calculated by GHD were based on the TPHCWG methodology, which is a scientifically-defensible approach takes into consideration the composition of a given petroleum mixture in terms of the hydrocarbon chain length (i.e., number of carbons present), structure (i.e., linear [aliphatic] or ring [aromatic] arrangement of carbons), boiling range composition (i.e., from volatile to heavy fractions), and toxicity.

Since TPH is a highly variable mixture of many aliphatic and aromatic hydrocarbons, the current scientific approach for assessing potential health hazards due to TPH exposure requires determining the actual hydrocarbon fraction composition of the TPH mixture present. The TPHCWG has developed toxicity levels for specific aliphatic/aromatic hydrocarbon ranges and, therefore, a meaningful comparison between the exposure media data and these levels requires them to share similar mixture composition. This has been recognized in the TCEQ (2000) guidance document, "*Development of Human Health PCLs for Total Petroleum Hydrocarbon Mixtures,*" which is based on the aliphatic/aromatic hydrocarbon fractions approach developed by the TPHCWG.

The approach has been widely adopted for evaluating human health risk from petroleum hydrocarbons in soil throughout the United States (e.g., Texas, Massachusetts, etc.).

The development of risk-based cleanup levels for TPH depends on the composition of the petroleum hydrocarbon product at a given location. Differences in composition reflect differences in the proportion of toxic and mobile hydrocarbons, which directly influence the potential for environmental impact and drive the magnitude of the cleanup level. The composition of a given petroleum hydrocarbon product can usually be determined using gas chromatography.

Because TPH has been established as a COPC for the Site, the TPHCWG approach is applied to the Site where two recent (July 6, 2016) soil samples at the hydrocarbon source area were analyzed by TX1005 and TX1006. These two analytical methods are capable of splitting the sample into multiple hydrocarbon fractions and structures (i.e., carbon chains and rings) as listed below.

Aliphatic Fractions	***Aromatic Fractions***
C_6 $>C_6$-C_8 $>C_8$-C_{10} $>C_{10}$-C_{12} $>C_{12}$-C_{16} $>C_{16}$-C_{21} $>C_{21}$-C_{35}	$>C_7$-C_8 $>C_8$-C_{10} $>C_{10}$-C_{12} $>C_{12}$-C_{16} $>C_{16}$-C_{21} $>C_{21}$-C_{35}

The TX 1005 and TX1006 results at the Site are presented in Tables 3.1, and are considered representative of the TPH fractions at this Site.

Since the magnitude of a risk-based cleanup level for TPH is dependent on mass fractions of aliphatic and aromatic boiling point ranges, the TX1006 results were used to determine the mass fraction represented by each of the seven aliphatic and six aromatic boiling point ranges. These mass fractions were calculated by dividing the concentration of each boiling point range by the total concentration in the TPH mixture (Table 5.19). Once calculated, the mass fractions are paired with Toxicity Reference Values (TRVs) for each boiling point range, exposure assumptions per an exposure pathway, and the NMED’s target hazard threshold of 1 (see Tables 5.10 through 5.15).

The lower of TPH Texas Method 1005 (TX1005)-based or the TPH Texas Method 1006 (TX1006)-based SSCL is chosen as the final TPH soil. The resulting SSCLs are compared to the TPH results at the Site (see Section 5.9).

5.7.5 Exposure Factors and Assumptions

Exposure factors and assumptions used as input for the intake equations are summarized in Tables 5.2 through 5.9. The most recent NMED and USEPA exposure factors are used in current HHRA (NMED, 2015 and USEPA, 2015).

A construction/utility/outdoor worker is likely to be a realistic receptor at the Site. In comparison, an indoor worker and resident are not part of the current land use at the Site and, thus, are evaluated here only from the theoretical perspective.

Similar to the worker scenario, trespasser (young adult) exposure is assumed to occur via dermal contact with affected media, incidental ingestion of such media, and inhalation of particulate matter present in ambient air.

For all exposure pathways where carcinogenic COPCs are considered, an averaging time (AT) of 70 years is used to prorate the total cumulative intake over a lifetime per NMED and USEPA guidance (NMED, 2015 and USEPA, 2004). Where non-carcinogenic COPCs are considered, the AT is selected based on the endpoint being assessed, also per the cited NMED and USEPA guidance.

5.8 Toxicity Assessment

The toxicity assessment weighs the available evidence regarding the nature and magnitude of adverse effects associated with each COPC (i.e., it helps to identify the relevant toxicity values). Toxicity values were primarily obtained from the NMED (2015), USEPA May 2016 RSLs (USEPA, 2016), and TCEQ (2000). The toxicity data applied in the HHRA for non-carcinogenic TPHs are presented in Tables 5.8 and 5.9.

5.8.1 Oral-to-Dermal Toxicity Factor Adjustment

Typically, the toxicity values are based on the administered dose (i.e., oral intake, injection, etc.). To characterize risk from the dermal exposure pathway, adjustment of the oral toxicity factor to represent an absorbed dose rather than an administered dose was necessary per the USEPA guidance (USEPA, 2004). In the case of the COPCs at the Site, all adjustment factors are conservatively set to 100 percent, indicating complete absorption.

5.9 Risk Assessment

This section compares the derived SSCLs to the exposure media results at individual sampling locations at the Site to identify any specific areas with elevated concentrations of COPCs (via point-to-point comparisons). Next, the SSCLs are compared to average exposure levels (i.e., RMEs and CTEs) across the entire parcel (per standard risk assessment practice; see Section 5.9.2). The risk results from the latter step, the exposure averaging analysis (based on RME results), are used to formulate final risk statements for this parcel.

5.9.1 Point-to-Point Comparisons

COPC exceedances above the corresponding SSCLs at individual sampling locations provide useful information regarding the locations of areas with elevated concentrations at the Site. The presence of these areas is not necessarily indicative of human health risks. Rather, that further analysis of overall exposures (i.e., the exposure averaging analysis) is needed for this parcel. The latter is conducted in Section 5.9.2.

The comparisons of the detected COPC concentrations in soil to the corresponding SSCLs lead to the following observations for chemicals identified as the potential risk drivers at the Site.

5.9.1.1 Total Petroleum Hydrocarbons (TPHs)

There were no TPH exceedances at the Site compared to the commercial/industrial SSCLs of 15,537 mg/kg, developed with the approach described in Section 5.7.4. The TPH Purgeable GRO fraction in one sample (SC-5 collected from the Base in February 2015 in the depth of 19 ft bgs, 3,800 mg/kg) exceeded the residential SSCLs of 3,712 mg/kg (Table 3.1).

5.9.2 Exposure Averaging Evaluation

The HHRA evaluates the potential for adverse impacts on human health after taking more realistic exposure conditions into consideration. To this end, and consistent with NMED/USEPA guidance, mean concentrations of COPCs across the parcel (also referred to as the exposure point concentrations [EPCs]) were calculated using ProUCL software[15].

For soil, the EPC calculations are contained in Appendix C, and comparisons of the residential and commercial/industrial SSCLs to the RME and CTE estimates are shown in Table 5.19. The EPC exceedances are discussed below.

Total Petroleum Hydrocarbons (TPHs)

Under both CTE and RME averaging scenarios, no TPH exceedances were identified at the Site compared to the residential SSCLs of 3,712 mg/kg, developed with the approach described in Section 5.7.4 (Table 5.19). As such, TPH in soil at the Site is removed from the COPC list for further consideration in the HHRA. Please note that they were initially included because soil concentrations exceeded the conservative screening levels summarized in Section 5.5.1.

5.10 Conclusions

The risk analysis for soil relative to the residential and commercial/industrial exposure scenarios indicates that the principal constituent groups at the Site with concentrations in excess of the conservative screening levels include BTEX and TPH.

BTEX was not detected at concentrations exceeding the residential and commercial/industrial soil screening levels, but was identified as a COPC due to the exceedance of the soil screening levels for protection of groundwater. The SSCLs for protection of groundwater at the Site were not developed for BTEX because leaching to very deep groundwater (> 200 ft bgs) is not a concern. Therefore, BTEX was removed from the COPC list for further consideration in current HHRA.

TPH exceeded the conservative residential and commercial/industrial soil screening levels and, as such, was identified as a COPC at the Site and carried forward in the quantitative HHRA, which included the application of the soil SSCLs. These SSCLs were derived under the residential and commercial/industrial scenarios following the TPHCWG. The soil TPH SSCLs were applied to the soil sampling data by comparisons to point-to-point concentrations, as well as to exposure averaging (as appropriate and necessary), to draw risk conclusions regarding individual sampling locations and Site-wide risks as summarized below.

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[15] http://www.epa.gov/osp/hstl/tsc/software.html

5.10.1 Individual Sampling Locations

The point-to-point comparisons showed that TPH levels at the Site, as compared to the commercial/industrial SSCLs and the TPH Purgeable GRO fraction, in one sample (SC-5 collected from the base in February 2015 at 19 ft bgs) exceeded the residential SSCL.

5.10.2 Site-Wide Risk Drivers

Comparison of the Site-wide COPC average concentrations under the RME and CTE exposure scenarios to the residential soil SSCLs identified no TPH exceedances at the Site. Therefore, no Site-wide risk drivers were identified.

5.10.3 HHRA Risk Statement

In summary, the existing data indicate that soil is generally free from COPC impacts throughout the Site (i.e., site wide). This risk statement is inclusive of, and considers, all of the COPCs, pathways, routes, and receptors applicable to the Site.

Although one location exhibited TPH concentrations above the residential soil SSCL, the TPH soil residential SSCL was not exceeded under the RME and CTE exposure scenarios. Additionally, the observed soil impacts were found at considerable depth and beyond the reach of sensitive receptors. Therefore, the SSCL exceedance for TPH does not result in additional remedial/risk management actions. As such, no further action (NFA) is recommended for the Site.

6. Ecological Risk Assessment

6.1 Introduction

6.1.1 Overview

Guidance published by the USEPA outlines an 8-Step process for evaluating the potential for risk to ecological receptors (USEPA, 1997). A screening-level ERA (SLERA) consists of Steps 1 and 2 of the 8-Step process and it is completed in this section. Background information on the Site history, geology, hydrology, and use is included in Section 2 and is similar to the information in previous regulatory submissions (e.g., GHD, 2015 and 2016). Accordingly, the reader is referred to those sources for additional details. As indicated in Section 3, the dataset for the current ERA consists of analytical results data obtained by Animas Environmental Services, LLC (AES) and GHD. Findings from the ERA, and any subsequent phases of the ERA process will be used to support the risk management decisions at the Site.

6.1.2 Purpose and Objective

The objective of an SLERA is to identify those chemical constituents that have the potential for impacting one or more groups of ecological receptors, and eliminate from further evaluation those constituents that have a limited potential to pose risk. This step is accomplished by comparing the maximum concentrations detected in environmental media to conservative ecological screening values (ESVs) that are protective of all receptor groups. The identification of the constituents of potential ecological concern (COPECs) allows the subsequent steps of the ERA process, including any additional data collection, to focus on those constituents and exposure pathways with the greatest potential to pose risk.

After the SLERA, is Step 3 of the 8-Step process, which is the problem formulation phase for the baseline ERA (BERA). In Step 3, chemical constituents identified in the SLERA as COPECs are refined by evaluating the assumptions for exposure and toxicological responses of ecological receptors to the COPECs. The refinement process incorporates numerous factors not considered at the screening level, such as site-specific background concentrations, individual receptor groups, reasonable maximum exposure (RME) concentrations (i.e., 95 percent upper confidence limits (UCLs), alternative Eco toxicological benchmarks, and food chain modeling. The primary objective of the refinement process is to eliminate from further consideration those constituents that have a limited potential for impacts on biota. Current ERA includes the Step 3 component as discussed in Section 6.5.

Consistent with the objectives identified above, the goal of the ERA for the Site is to identify those chemical constituents detected in surface soil (i.e., soil in the depth interval of 0 to 5 ft bgs for most ecological receptors, and soil in the depth interval of 0 to 10 ft bgs for burrowing ecological receptors), that have a reasonable potential to pose risk to ecological receptors.

6.2 Step 1: Screening Level Problem Formulation

6.2.1 Ecological Setting

The Site is located on a cliff/rise in arid desert land. Running north to west is an ephemeral stream bed which forms a confluence with the ephemeral river several miles from the Site.

6.2.2 Habitat

The primary cover types at the Site are sparse arid and desert grasses, shrubs, and trees. Much of the land has areas free of vegetation and is characterized by bare sandy soil.

6.2.3 Waterways

The immediate vicinity of the Site contains a surface wash that conveys storm water during infrequent rain events. The wash does not support any aquatic vegetation, fish, or benthos as it is dry for most of the year. Further away is an ephemeral stream bed that is at the base of approximately 100-ft the cliff on which the Site is located. The stream runs several miles south until it reaches the confluence with the ephemeral river in Encierro Canyon that runs along County Road 492.

6.2.4 Wildlife

The New Mexico Department of Game and Fish (NMGF) reported 719 species in Rio Arriba County (Appendix 6-1). Of these species, 33 are fish, 11 are amphibians, 28 are reptiles, 249 are birds, 88 are mammals, 22 are molluscs, 2 are crustaceans, 19 are Ephemeroptera (mayflies), 14 are Odonata (dragonflies), 63 are Orthoptera (grasshoppers and crickets), 18 are Coleoptera (beetles), 156 are Lepidoptera (moths and butterflies), 9 are spiders, and 7 are miscellaneous arachnids. In addition, 20 threatened and endangered species are located in Rio Arriba County (Appendix 6-2). Of these species, 12 are considered threatened, 8 are endangered, and 4 are found on critical habitats. The Federal and State-listed species of concern found in Rio Arriba County are listed below.

Species	Status of species
Spotted Bat (Euderma masculatum)	Threatened
Canada Lynx (Lynx canadensis)	Threatened
Pacific Marten (Martes caurina)	Threatened
Meadow Jumping Mouse (Zapus hudsonius luteus)	Endangered
White Tailed Ptarmigan (Lagopus leucura)	Endangered
Brown Pelican (Pelecanus occidentalis)	Endangered
Common Black Hawk (Buteogallus anthracinus)	Threatened
Bald Eagle (Haliaeetus leucocephalus)	Threatened
Peregrin Falcon (Falcon peregrinus)	Threatened
Arctic Peregrin Falcon (Falco peregrinus tundris)	Threatened
Least Tem (Stemula antillarum)	Endangered
Yellow Billed Cuckoo (Western Pop) (Coccyzus americanus occidentalis)	Threatened
Boreal Owl (Aegolius funereus)	Threatened
Mexican Spotted Owl (Strix occidentalis lucida)	Threatened

Species	Status of species
Southwest Willow Flycatcher (Empidonax traillii extimus)	Endangered
Gray Vireo (Vireo vicinior)	Threatened
Baird's Sparrow (Ammodramus bairdii)	Threatened
Boreal toad (Anaxyrus boreas boreas)	Endangered
Jemez Mountains Salamander (Plethodon neomexicanus)	Endangered
Roundtail Chub (Upper Basin Populations) (Gila robusta)	Endangered

Field observations at the Site have not confirmed the presence any of these species in the area.

6.2.5 Potentially-Complete Exposure Pathways

According to guidance for ERA (USEPA, 1997; NMED, 2015), a complete exposure pathway must have the following components:

1. An anthropogenic source of a chemical constituent;
2. A mechanism for transport of the constituent from the source to one or more ecological receptors; and
3. Exposure of ecological receptors to the constituent (i.e., exposure route).

Mechanisms for the transport of constituents from the source to ecological receptors are discussed in Section 2.2.7. The potential exposure routes include direct contact (i.e., absorption via integument), ingestion, and inhalation.

Because of the nature of the release of COPECs at the Site, the potentially-complete exposure routes for surface soil at the Site are:

- Absorption via integument and ingestion by soil invertebrates;
- Root absorption of constituents in soil by flora;
- Direct contact with soil by plants and fauna;
- Incidental ingestion of soil and bioaccumulative chemicals of concern (BCOCs) by insectivores and omnivores via food web transfer;
- Incidental ingestion of soil and constituents taken up by, and bioaccumulated in, plant tissue by herbivores and omnivores via food web transfer; and
- Ingestion of soil and BCOCs by carnivores via food web transfer.

A CEM of the potentially-complete exposure pathways is provided as Figure 6.1.

6.2.6 Incomplete Exposure Pathways

In an ERA, the inhalation exposure route is generally not considered to be significant. Accordingly, this SLERA does not consider inhalation. Moreover, while Figure 6.1 includes a potential exposure pathway to aquatic and benthic receptors due to COPEC migration to surface water and sediments, the Site does not support aquatic life so this exposure pathway is incomplete.

6.2.7 Assessment and Measurement Endpoints

6.2.7.1 Assessment Endpoints

Table 6.1 identifies the assessment endpoints for the ERA. The assessment endpoints for soil are species richness and productivity of the terrestrial plant and soil invertebrate communities, as well as the relative and absolute densities of avian and mammalian insectivores, herbivores, omnivores, and carnivores.

BCOCs are constituents that have the potential to bioaccumulate and bioconcentrate in food webs. Constituents classified as BCOCs may pose risk to upper trophic level consumers via food items directly exposed to Site-related COPECs in soil. Correspondingly, the assessment endpoints for this SLERA include predatory birds and mammals, which potentially forage at the Site. However, BCOCs for soil (TCEQ, 2006) are not included in the list of COPEC at the Site, so BCOCs will not be considered in the current ERA.

Although present, or potentially-present in the Site, herpetiles (amphibians and reptiles) are not evaluated directly due to a paucity of ecotoxicological data adequate to evaluate the potential for risk at the screening level. For this ERA, as well as the subsequent analyses, ESVs for soil are deemed protective of herpetiles.

The selected assessment endpoints are intentionally broad. Once the final COPECs are identified (i.e., completion of Step 3), Site-specific assessment endpoints will be developed for specific receptor groups, if further assessment is required.

6.2.7.2 Measurement Endpoints

For the screening assessment, the maximum detected concentrations of each constituent detected in soil are used as measurement endpoints for primary receptors (i.e., receptors directly exposed to environmental media). To evaluate the potential for risk, the maximum detected concentrations are compared to ESVs, which are conservative benchmark concentrations that are protective of all receptor groups identified in the assessment endpoints (i.e., terrestrial plants, soil invertebrates, and avian& mammalian wildlife).

Table 6.1 identifies the measurement endpoints associated with each of the assessment endpoints listed in Section 6.3.4.1. A more detailed discussion of ESVs is provided in Section 6.4.2.2.

6.2.8 Samples Used in the Ecological Risk Assessment

Figure 6.2 identifies the locations of surface soil samples evaluated in this ERA. According to the USEPA guidance, for the evaluation of risks to ecological receptors, only the samples collected from the surficial soil layer (i.e., 0 to 2 ft bgs, or less) are to be included in the ERA dataset since ecological receptors are generally not exposed to soil deeper than 2 ft bgs. However, NMED guidance (NMED 2015), which is the primary reference document used in the current ERA, indicates that surficial soil layer is considered 0 to 5 ft bgs for most ecological receptors, and 0 to 10 ft bgs for burrowing ecological receptors (e.g., prairie dogs). Accordingly, the corresponding dataset consists of 6 samples collected in February and April 2015, and 14 samples collected in February and April 2016.

Surface soil samples were analyzed for VOCs (BTEX), SVOCs (PAHs), and TPH. For duplicate samples, the higher of the concentrations for a sample location and sampling event was conservatively used in the evaluation. The complete dataset evaluated in this ERA is provided in Appendix 6-3.

6.2.9 Ecological Screening Values

To ensure that the potential for risk is not incorrectly dismissed, screening levels are very conservative. That is, assumptions regarding exposure and toxicological effects are biased toward identifying risk. Because the ESVs are conservative, it can be concluded with a high level of certainty that constituents with concentrations below their ESVs do not pose risk to ecological receptors. On the other hand, constituents with maximum concentrations that exceed their ESVs do not necessarily indicate risk or adverse impacts to ecological receptors. Rather, this indicates that a potential for risk may exist and that further assessment should be undertaken to verify or strengthen the conclusions of the SLERA.

ESVs were acquired from a variety of sources recognized by the USEPA and state regulatory agencies. Sources of ESVs were searched using the Ecological Benchmark Tool developed and maintained by the Oak Ridge National Laboratory (ORNL). The Ecological Benchmark Tool can be accessed through the ORNL's website (ORNL, 2014)[16].

A hierarchical approach was used in the selection of appropriate ESVs. The first tier in the hierarchy considered the ecological soil screening levels (ECO-SSLs) developed by USEPA (2010). Whenever multiple benchmarks were available within a tier, the lowest value was selected as the ESV to maintain a level of conservatism commensurate with a screening-level assessment.

The ORNL database does not have ecological benchmarks for all constituents for which the Site data are available. A decision as to the potential for these constituents to pose risk should be based on current or past use/generation of a constituent on the Site, the likelihood of exposure, and best scientific judgment of the risk assessor and risk manager. For this SLERA, constituents that do not have an ESV and were not detected, were eliminated from further consideration. However, those constituents that do not have ESVs, but were detected in one or more samples were retained as COPECs. These constituents will be evaluated in subsequent steps of the ERA process using literature and/or best professional judgment as to their potential to produce risk to ecological receptors at the Site.

The first tier in the selection of ESVs for soil consisted of the ECO-SSLs identified by the USEPA (2010)[17]. The rationale for using ECO-SSLs as the first tier is that they have a strong technical basis and have recently been developed or revised by the USEPA. If multiple ECO-SSLs were available for a given constituent (i.e., developed for terrestrial plants, soil invertebrates, avian wildlife, or mammalian wildlife), then the lowest of the available ECO-SSLs was selected as the ESV. If an ECO-SSL was not available, the second tier in the hierarchy included the ecological screening benchmarks identified for earthworms and plants by TCEQ (2006)[18]. If benchmarks were

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[16] https://rais.ornl.gov/tools/eco_search.php

[17] https://www.epa.gov/risk/ecological-soil-screening-level-eco-ssl-guidance-and-documents

[18] http://www.tceq.state.tx.us/remediation/trrp/guidance.html

available for both earthworms and plants, the lower of the two benchmarks was selected as the ESV per the conservative nature of the screening-level assessment.

For the third tier, all other available ecological screening benchmarks in the Ecological Benchmark Tool database were considered. When more than one benchmark was available, the lowest of the available benchmarks was selected as the ESV per the rationale stated above.

Tier I Benchmarks

The lowest of the following benchmarks was selected as the ESV:

- USEPA ECO-SSL for avian receptors (USEPA, multiple source documents);
- USEPA ECO-SSL for soil invertebrates (USEPA, multiple source documents);
- USEPA ECO-SSL for mammalian receptors (USEPA, multiple source documents); and
- USEPA ECO-SSL for plants (USEPA, multiple source documents).

Tier II Benchmarks

The lowest of the following benchmarks was selected as the ESV:

- TCEQ ecological screening benchmark for earthworms (TCEQ, 2006); and
- TCEQ ecological screening benchmark for plants (TCEQ, 2006).

Tier III Benchmarks

The lowest benchmark from the following sources was selected as the ESV:

- USEPA Region 4 soil screening benchmark (USEPA, 2001); and
- USEPA Region 5 Ecological Screening Level (ESL) (USEPA, 2003).

Table 6.2 identifies the ESVs for surface soil.

6.3 Step 2: Screening-Level Exposure Estimate and Risk Calculation

6.3.1 Exposure Estimates

A screening quotient (SQ), calculated as the maximum detected concentration divided by the ESV, was used to determine if the constituent has the potential to pose risk to ecological receptors. A SQ greater than 1 identifies a potential for risk. Thus, those Site constituents with a SQ greater than 1 were identified as COPECs and were carried forward to Step 3 of the risk assessment process for further evaluation and refinement in Section 6.6.

This project poses a unique challenge for the ERA. Ground surface samples were not taken prior to excavating the Site, thus, there were no true surficial soil samples to analyze. In lieu of surficial soil samples, a conservative assumption was made that samples at the base of the excavation and the samples in the sidewalls would be considered the same as surficial soil samples (i.e., 0 to 19 ft bgs [base] = 0 ft bgs [surficial]). All additional samples below the base depth (i.e., >19 ft bgs) were considered at the corresponding depth relative to surface (e.g., 5 ft bgs at the base = 5 ft bgs at the surface). This is an extra level of conservativism due to the fact that no ecological receptor will be exposed to the soil subsurface once the excavation is filled (and has been) with clean soil.

6.3.2 Risk Calculation

6.3.2.1 Constituents Detected

Table 6.4 identifies the constituents that were detected in surface soil above the laboratory detection limits. For each constituent, Table 6.4 identifies the number of samples analyzed, number of samples with detected concentrations, frequency of detection (DF, also cited as acronym FOD in this report), minimum and maximum detected concentrations, 95 percent upper confidence limit (UCL) concentrations on the mean (calculated using ProUCL, Version 5.0 [USEPA, 2014b]), sample location with the maximum detected concentration, ESV, SQ, and status as a BCOC and a COPEC.

BTEX

Benzene, ethylbenzene, and xylene were the BTEX constituents detected at various sampling locations (toluene was not detected). The SQ for benzene is 152, the SQ for ethylbenzene is 540, and the SQ for xylene is 5,400. Therefore, all three constituents were screened into the next ERA step. Toluene has SQ of 0.65 and is not a BCOC and, thus, was eliminated as a COPEC.

Polycyclic Aromatic Hydrocarbons

PAHs were not analyzed in samples at 0 to 10 ft bgs, so PAHs were eliminated as COPECs.

Petroleum Hydrocarbons

The samples of “surface” soil from the Site were analyzed for petroleum hydrocarbons using two analytical methods: M8015B and SW8015. The GRO (C6-C10), DRO (C10-C28), and MRO were detected by the M8015B and SW8015 methods (Table 3.1).

ESVs for petroleum hydrocarbons are limited. The Canadian Council of Ministers of the Environment (CCME) identifies benchmarks for four carbon fractions: C6-C10, C10-C16, C16-C34, and >C34 for coarse-grained and fine-grained soils and four land uses (agricultural, residential/parkland, commercial, and industrial). These are the so-called “Canada-Wide Standards” (CCME, 2008).

The GRO fraction, but not the DRO or MRO fractions analyzed in this study is comparable to the Canadian ESVs. The GRO fraction (C6-C10) is the most prevalent due to the relatively recent nature of the spill. The ESV for C6-C10 fraction is 210 mg/kg for agricultural and residential land uses. The fractions expected to be present on the Site over the longer term are those with a higher number of carbons (C16-C34 and >C34), as the fractions with shorter carbon chains (C6-C10 and C10-C16) weather relatively quickly in the environment (DiToro et al., 2007). The ESV for the C16-C34 fraction is 1,300 mg/kg for agricultural and residential land uses, and the ESV for the >C34 fraction is 5,600 mg/kg for agricultural and residential land uses.

The Atlantic Partnership for RBCA (risk based corrective action) Implementation (PIRI) has published ESVs for the protection of plants and invertebrates via direct contact and for the protection of wildlife (PIRI, 2012). The carbon fractions identified by PIRI (2012) are the same fractions identified in the Canada-Wide Standards (i.e., C6-C10, C10-C16, C16-C34, and >C34). Similarly, PIRI identifies ESVs for agricultural, residential/parkland, commercial, and industrial land uses. The PIRI ESVs for the protection of plants and invertebrates are the same as the Canada-Wide Standards for fine-grained soil. The ESVs for the protection of wildlife, which are based on agricultural land use, are 11,000 mg/kg for the C6-C10, 9,800 mg/kg for the C10-C16, 16,000 mg/kg for the C16-C34, and 8,400 mg/kg for the >C34 fraction.

The maximum detected concentration of any fraction analyzed by any analytical method is 3,800 mg/kg (SC-5 on 2/17/2015), which is the SW8015 GRO (C6-C10) fraction. This maximum concentration is above the Canada-Wide Standard for plants and invertebrates for the C6-C10 fraction, but below all PIRI ESVs for the protection of wildlife. There has been noticeable weathering and attenuation of the GRO (C6-C10) fraction since the February 2015 sampling. The range of GRO (C6-C10) fraction concentrations in the most recent sampling (April 2016) is non-detect to 2,800 mg/kg. It is assumed that concentrations of the GRO (C6-C10) fraction will continue to weather and attenuate to non-detect levels. Moreover, the detected TPH are found in deep soil, covered by clean fill, and beyond the reach of most ecological receptors. Therefore, TPHs are eliminated as COPECs.

6.3.3 Preliminary Constituents of Potential Ecological Concern

An individual constituent, or a constituent group, is retained as a COPEC, through the SLERA process, if:

1. The SQ is greater than 1 (i.e., the maximum concentration exceeds its ESV);
2. The constituent/group was not detected and the LODs for greater than 90 percent of the samples exceeds its ESV; or
3. The constituent/group was detected and an ESV was not identified.

Based on the first criterion, three individual constituents were retained as COPECs through the SLERA process (Table 6.5). The second and third criteria were not applicable to the dataset for this report. The three individual constituents are benzene, ethylbenzene, and xylene, and they are forwarded to Step 3 for further refinement as discussed below.

6.4 Step 3: Refinement of Constituents of Potential Ecological Concern

6.4.1 Overview

This section presents the results of the initial phase of Step 3 of the 8-Step process for conducting ERA (per USEPA, 1997), which refines COPECs by considering specific receptor groups, alternative ecological benchmarks, Site-specific conditions (e.g., background concentrations), food chain modeling-based risk assessment, and more ecologically-realistic estimates of exposure concentrations.

6.4.2 Refinement of Receptor Groups

6.4.2.1 Methodology

The refinement process considers ecological benchmarks for the following four receptor groups:

- Terrestrial plants;
- Soil invertebrates;
- Avian receptors; and
- Mammalian receptors.

The USEPA (2010) has developed ECO-SSLs for the above receptor groups. Other sources of ecological benchmarks specific to terrestrial plants, soil invertebrates, and avian and mammalian wildlife include ORNL (Efroymson et al., 1997a; 1997b), CCME (2007; 2010), and USEPA, Region 5 (USEPA, 2003). For those constituents with multiple benchmarks, the most appropriate benchmark was selected as the refinement benchmark (RB). The benchmarks selected as RBs were used to eliminate, or retain, individual constituents and constituent groups identified as preliminary COPECs.

The selection of the RBs generally considers Site-specific background concentrations. Data for the background samples are used to calculate background threshold values (BTVs) using ProUCL, Version 5.0 (USEPA, 2014b). Any benchmarks below a Site-specific BTV are eliminated from consideration. The rationale is that ecological benchmarks are intentionally conservative and, in some cases, are below natural or site background concentrations, which is not realistic.

This Site posed additional challenges with this step of the risk assessment. First, background samples were not available for the Site, so BTVs could not be generated for the data set. Second, there were no benchmark values available for BTEX from USEPA, CCME, or USEPA Region 5. This is mainly because BTEX constituents weather rapidly, volatilize, and readily biodegrade under aerobic conditions (ITRC, 2014) which makes environmental concentrations short-lived, with limited opportunity for exerting toxic effects. Furthermore, it is difficult to conduct toxicity tests with BTEX constituents due to high losses of BTEX applied to soil samples for preparation of toxicity tests (Salanitro et al., 1997).

Due to the lack of benchmark data, Tier 1 screening levels will be used as refinement benchmarks for the following six ecological receptors deemed important by NMED (2015):

1. Terrestrial plant community;
2. Deer mouse;
3. Horned lark;
4. Kit fox (typically evaluated at sites greater than 267 acres);
5. Pronghorn antelope (typically evaluated at sites greater than 342 acres); and
6. Red-tailed hawk (typically evaluated at sites greater than 177 acres).

The above key receptors encompass primary producers, as well as the three levels of consumers (primary, secondary, and tertiary). The key receptors are described in further detail below.

Deer Mouse

The deer mouse (*Peromyscus maniculatus*) is a common rodent throughout much of North America that can thrive in a variety of habitats. The deer mouse was selected as a representative receptor because it is prevalent in New Mexico and represents one of the several species of omnivorous rodents that may be present at the Site. Small rodents are also a major food source for larger omnivorous and carnivorous species. The deer mouse has a relatively small home range and could, therefore, be exposed to COPECs at the Site.

Horned Lark

The horned lark (*Eremophila alpestris*) is a common terrestrial bird. It spends much of its time on the ground and its diet consists mainly of insects and seeds. The horned lark was chosen as te representative receptor because it is prevalent in New Mexico and represents one of the many small terrestrial bird species that could be present at the Site. Since the horned lark spends most of its time on the ground, it also provides a conservative measure of effect since it has a higher rate of incidental ingestion of soil than other song birds. The horned lark is also a major food source for omnivorous intermediate species, and top avian carnivores. The horned lark is evaluated based on an omnivorous diet of invertebrates and plant matter. This receptor has a relatively small home range and could, therefore, be exposed to COPECs at the Site.

Kit Fox

The kit fox (*Vulpes macrotis*) is native to the western United States and Mexico. Its diet consists of mostly small mammals. Although the kit fox's diet may also consist of plant matter during certain times of the year, the kit fox will be evaluated as a carnivore, with diet consisting of 100% prey items. It was selected as a key receptor because it is sensitive species, is common in New Mexico, and the surrounding area likely provides suitable habitat for this animal. The kit fox also is representative of a mammalian carnivore within the food web. The kit fox is typically evaluated at sites that are larger than 276 acres. Since kit fox has a large home range size (2,767 acres) (Zoellick & Smith, 1992), it is assumed that risks are negligible from exposure to COPECs at sites that are less than 10% of the receptors home range. Unless the area use factor (AUF) is at least 10%, food items potentially contaminated with COPECs and incidental soil ingestion at a site would not contribute significantly to the receptor's diet and exposure to COPECs (see Site-relevant discussion in Section 6.4.2.2 for this receptor).

Red-Tailed Hawk

The red-tailed hawk (*Buteo jamaicensis*) was selected as a top carnivore avian key receptor. The red-tailed hawk is widespread throughout New Mexico and is one of the most common birds of prey. It hunts primarily rodents, rabbits, birds, and reptiles. The red-tailed hawk was chosen as a key receptor since it is a common species through New Mexico. The red-tailed hawk is typically evaluated at sites that are larger than 177 acres. Since the red-tailed hawk has a large home range size (1,770 acres) (US EPA, 1993b), risks to the red-tailed hawk from exposure to COPECs at sites smaller than 177 acres (10% of the home range) would be negligible (see Site-relevant discussion in Section 6.4.2.2 for this receptor).

Pronghorn Antelope

The pronghorn (*Antilocapra Americana*) is a popular big game species that occurs in western Canada, United States, and northern Mexico. Its diet consists mainly of sagebrush and other shrubs, grasses, and forbs. The pronghorn was selected as a key receptor representative of large herbivorous species of wildlife. The pronghorn is typically evaluated at sites that are larger than 342 acres. Since the pronghorn has a large home range size (3,422 acres) (Reynolds, 1984), risks to the pronghorn from exposure to ConocoPhillips at sites smaller than 342 acres (10% of the home range) would be negligible (see Site-relevant discussion in Section 6.4.2.2 for this receptor).

6.4.2.2 Selection of Refined Ecological Site Receptors and Exposure Conditions

The following assumptions are made with the refinement benchmark assessment:

- Maximum concentration values and 95% UCL values are used for all COPECs and ecological receptors at each sampling location. Sampling locations that are 0 to 5 ft bgs will be used for most terrestrial receptors, and sampling locations that are 0 to 10 ft bgs will be used for burrowing receptors (e.g., prairie dogs);
- 100% of the diet is assumed to contain the maximum concentration of each COPEC detected in the site media;
- Minimum reported body weights are applied;
- Maximum dietary intake rates are used;
- It is assumed that 100% of the diet consists of direct ingestion of contaminated soil;
- It is assumed that the bioavailability is 100% at each site; and
- Foraging ranges are initial set equal to the size of the Site. This means that the AUF in the Site is set to a value of one. However, the kit fox, pronghorn antelope, and red-tailed hawk have ranges that are much greater than the size of the Site. Therefore, the BTEX constituents will be removed as COPECs for these three receptors.

6.4.2.3 Refinement Benchmarks and Screening Process

Table 6.6 identifies the RBs for the terrestrial plant community, deer mouse, and horned lark. For plants and soil invertebrates, a refinement quotient (RQ) was calculated in two ways: (1) by dividing the maximum concentration of a constituent by its RB, and (2) by dividing the 95 percent UCL on the mean of a constituent by its RB. A RQ less than, or equal to 1 indicates no potential for risk, whereas RQs greater than 1 indicate that risks cannot be dismissed with current information. In addition to calculating a RQ, concentrations in all samples were compared to its RB. The rationale is that plants and soil invertebrates lack mobility, and consideration of an area-wide statistic of central tendency (e.g., 95 percent UCL on the mean) provides limited information on the potential for risk or impact. Furthermore, exceedance of a RB at a limited number of sampling locations does not necessary indicate a significant potential for risk or impact to terrestrial plant or soil invertebrate communities. Based on these considerations, a constituent was retained as a COPEC if its concentrations in more than 20 percent of the samples exceeded its RB.

For avian and mammalian receptors, exposure concentrations were the 95 percent UCL on the mean concentrations (Appendices 6.4 and 6.5). Avian and mammalian receptors are mobile and forage at a number of locations. This has the effect of spatial and temporal averaging of exposures in impacted, as well as, unimpacted areas. The 95 percent UCL on the mean represents a concentration that conservatively integrates exposure throughout the assessment area. The 95 percent UCL on the mean for each COPEC was divided by its RB to produce a RQ. A RQ equal to, or less than 1, identifies a potential for risk below the threshold of concern and, therefore, the constituent is eliminated as a COPEC. A RQ greater than 1 identifies a potential for risk and further evaluation is undertaken using food chain models.

6.4.3 Refined Risk Estimates

6.4.3.1 Terrestrial Plants

Table 6.7 summarizes the evaluation of risk to terrestrial plants. Information presented includes the RBs, number of samples, number of samples with detected concentrations, FOD, maximum concentration, RQ, number and percentage of samples with concentrations that exceed the RBs, as well as the rationale for retaining or eliminating a constituent as a COPEC.

The RQ for xylene at both depths (i.e., 0 to 5 ft bgs and 0 to 10 ft bgs) is 2.7, yet the percent of samples greater than RB is only 19% at 0 to 5 ft bgs and 15% at 0 to 10 ft bgs. Therefore, xylene is eliminated as a COPEC for terrestrial plants. Benzene and ethylbenzene do not have an RB or a Tier 1 screening level, but both are eliminated as a COPEC for terrestrial plants due to rapid weathering and biodegradation. Furthermore, it is GHD’s experience (also shared by the general risk assessment community) that ecological benchmarks for plants are poorly correlated with species richness and diversity of plant communities. In the absence of toxicological data, observation of areas with stressed vegetation (e.g., stunted growth, chlorosis) provides direct evidence of risk or impact to plant communities. The Site observations did not reveal vegetation with these stress characteristics. Based on the presented lines of evidence, benzene and ethylbenzene are eliminated as COPECs for terrestrial plants.

6.4.4 Avian Wildlife

Table 6.8 summarizes the evaluation of risks to avian wildlife. The RQ for xylene at 0 to 5 ft bgs is 0.14, and the RQ for xylene at 0 to 10 ft bgs is 0.20. Therefore, xylene is eliminated as a COPEC for avian wildlife. Benzene and ethylbenzene do not have an RB or a Tier 1 screening level, but both are eliminated as a COPEC for avian wildlife based on two lines of evidence. The first line of evidence is the low frequency of detection for both constituents. Benzene was detected in only 19% of samples collected from the Site, and ethylbenzene was detected in only 38% of samples collected from the Site. The second line of evidence is the fact that BTEX constituents undergo rapid weathering and biodegradation and they are generally considered not toxic in laboratory experiments. Based on these lines of evidence, benzene and ethylbenzene are eliminated as COPECs for avian wildlife.

6.4.5 Mammalian Wildlife

Table 6.9 summarizes the evaluation of risks to mammalian wildlife. The RQ for benzene at both depths (i.e., 0 to 5 ft bgs and 0 to 10 ft bgs) is 0.01. Therefore, benzene is eliminated as a COPEC for mammalian wildlife. The RQ for xylene at 0 to 5 ft bgs is 3.7 and the RQ for xylene at 0 to 10 ft bgs is 5.2. Ethylbenzene does not have an RB or a Tier 1 screening level. Both ethylbenzene and xylene are eliminated as a COPEC for mammalian wildlife based on three lines of evidence. The first line of evidence is the relatively low frequency of detection for both constituents. Both ethylbenzene and xylene were detected in only 35 to 38% of sample locations, respectively. The second line of evidence is the low percentage of samples greater than the RB. For xylene, both depths had low percentages of samples greater than the RB (19% at 0 to 5 ft bgs and 15% at 0 to 10 ft bgs). The third line of evidence is the fact that BTEX constituents are rapidly weathered and biodegraded (ITRC, 2014), and they are generally considered not toxic in laboratory experiments. Based on these lines of evidence, ethylbenzene and xylene are eliminated as COPECs for mammalian wildlife.

6.5 Ecological Risk Assessment Conclusions

Based on the ERA analyses, none of the chemical constituents detected in the soils at the Site are considered as constituents of ecological concern (COECs). As such, no further actions are planned for the Site to address ecological receptors.

7. Uncertainty Analysis

There are sources of uncertainty in all aspects of the risk assessment process. There are uncertainties associated with sampling data, exposure assessment, and toxicity assessment. In response, the USEPA applies a conservative approach in developing guidance for risk assessments to prevent the underestimation of risk. Accordingly, the current HHRA and ERA err on the conservative side of the risk continuum, as described below.

Uncertainties associated with the exposure model stem from the input parameters used to estimate intake. However, most model parameters were "default," as adopted directly from USEPA RAGS (USEPA, 1989; USEPA, 2002; USEPA, 2004; USEPA, 2006; and USEPA, 2014) and NMED documentation (NMED, 2015). Therefore, the likelihood of missing an actual risk is low. Furthermore, because the input parameters are conservative in nature, actual exposures (and any risks) are likely to be lower than those suggested in this HHRA and ERA. Also, a conservative assumption is made that there is no exposure dilution (e.g., all ingested soil is contaminated). As a result, the collective tally of conservative input parameters leads to the likely overestimation of any risks.

This HHRA evaluated the soil-to-groundwater pathway via the application of leaching models with NMED generic hydraulic condition parameters, which yield soil concentrations protective of the groundwater receptor. The resulting soil limits, although potentially useful, are fraught with uncertainty as any model outcomes are. The groundwater analytical data at the Site were not collected and the Site-specific leaching models were not applied because no sufficient site-specific data on hydrologic conditions were available to calculate a site-specific DAF. The soil-to-groundwater pathway is considered incomplete based on: 1) the depth to groundwater at the Site is very large (estimated at approximately 200 ft bgs); 2) BTEX is volatile and readily biodegradable by natural attenuation.

The lack of surficial soil (0-2 ft bgs) at the Site meant that this HHRA and ERA evaluated sample locations at the base of the excavation (i.e., 19 ft bgs) as if they were surficial samples. While this is a conservative approach because, when filled with clean soil, the excavation base soil will not be exposed to human or wildlife receptors.

8. Summary of Conclusions

GHD has prepared an integrated Human Health Risk Assessment (HHRA) and Ecological Risk Assessment (ERA) for the San Juan exploration pad 28-6 #155 N, which experienced an accidental release of approximately 186 bbls of natural gas condensate. A series of Site investigation and soil removal actions were completed, including the collection of soil samples for the analysis of hydrocarbon constituents to support the HHRA and ERA. The objective of the HHRA/ERA was to utilize the existing State and Federal risk assessment guidance to determine the potential for adverse effects on various receptors post-spill and subsequent to cleanup operations at the Site.

The 1993 OCD Remediation Guidelines require that corrective actions be taken to assure the protection of fresh waters, public health, and the environment. The removal of 2,102 cubic yards of hydrocarbon impacted soils in early 2015 was completed to fulfill this requirement. Subsequent soil boring and sandstone coring assessments in 2016 were conducted to delineate potential remaining hydrocarbons, and samples were collected and used in the comprehensive HHRA and ERA completed herein. The results of the HHRA and ERA are conclusive in that any remaining hydrocarbons in Site soils do not pose any reasonable probability of injury or detriment to public health, fresh waters, animal or plan life, or property, or unreasonably interfere with public welfare or use of the property, currently or in future.

8.1 Human Health Risk Assessment Results

The risk analysis for soil relative to the residential and commercial/industrial exposure scenarios indicates that the principal constituent groups at the Site with concentrations in excess of the conservative screening levels included BTEX and TPH. The BTEX constituent group was not detected at concentrations exceeding the residential and commercial/industrial soil screening levels, but was identified as a COPC due to the exceedance of the soil screening levels for the protection of groundwater. However, the SSCLs for protection of groundwater at the Site were not developed for BTEX because its potential to leach into very deep groundwater (>200 ft bgs) is not a concern. Furthermore, the Site is in an arid area with little or no precipitation. Therefore, BTEX was removed from the COPC list for further consideration in the HHRA.

TPH exceeded the conservative residential and commercial/industrial soil screening levels and, as such, was identified as a COPC at the Site and carried forward to the quantitative HHRA, where soil TPH SSCLs were derived under the residential and commercial/industrial scenarios and applied to the soil sampling data via comparisons to point-to-point concentrations, as well as to averages.

While the point-to-point comparisons showed that the TPH levels in one sample (SC-5 at 19 tf bgs) exceeded the residential SSCL, no Site-wide EPCs, even those under the most conservative RME scenario, were above any of the SSCLs. Therefore, no Site-wide risk drivers were identified at the Site.

To-date, default criteria were determined by the OCD according to ranking found in the 1993 OCD Remediation Guidelines. According to that document, the ranking criteria of depth to groundwater, distance to a wellhead protection area, and distance to a surface water body are used to determine the default remedial concentrations in soil. These criteria do not take into account the well-established methods of site-specific fate and transport analysis, as well as the toxicity of petroleum hydrocarbons and, therefore, do not realistically evaluate the potential for actual risks to human health and the environment at the Site. Specifically, the soil criterion of 100 ppm TPH included in the OCD Guidelines significantly overstates the real Site risks. Using the standard quantitative TPH assessment methodology originated by the TPHCWG, and subsequently adopted by several States and multistakeholder organizations such as the Interstate Technology & Regulatory Council (ITRC), the current quantitative risk assessment estimates a residential soil SSCL of 3,710 mg/kg, and a commercial/industrial soil SSCL of 15,500 mg/kg. These SSCLs are comparable to those accepted at other hydrocarbon sites across US and none of the Site-wide exposure estimates exceeded these limits.

8.2 Ecological Risk Assessment Results

ERA of the soil analytical results relative to the conservative screening benchmarks for ecological receptors identified three BTEX constituents (COPECs) consisting of benzene, ethylbenzene, and xylene) as part of Steps 1 and 2 of the SLERA screening process.

Subsequent ERA efforts consisted of performing Step 3 of the 8-Step process for conducting ERAs, which refined COPECs to yield more precise identification of potential risk drivers. This process considered refined ecological benchmarks for three main ecological groups including terrestrial plants, avian receptors, and mammalian receptors. Within these groups, terrestrial plants, small-ranging bird (horned lark), and small-ranging mammal (deer mouse) were selected as the representative species appropriate for the Site. Moreover, these species are deemed important by NMED.

For plants, the RQ for xylene was 2.7, but the percent of samples greater than the RB was only 19% at 0 to 5 ft bgs and 15% at 0 to 10 ft bgs, thus xylene was eliminated as a COPEC. Benzene and ethylbenzene do not have an RB or a Tier 1 screening level, but were eliminated as a COPEC for terrestrial plants due to rapid weathering and biodegradation. Furthermore, no stressed vegetation was observed. Therefore, all COPECs were eliminated for plants.

For birds, the RQs for xylene were below 1, thus this chemical was eliminated as a COPEC. Benzene and ethylbenzene do not have an RB or a Tier 1 screening level, but were eliminated as a COPEC for avian wildlife based on low frequency of detection, rapid weathering, and low toxicity. Therefore, all COPECs were eliminated for birds.

For mammals, the RQs for benzene were below 1, thus this chemical was eliminated as a COPEC. The RQ for xylene at 0 to 5 ft bgs was 3.7 and the RQ for xylene at 0 to 10 ft bgs was 5.2. Ethylbenzene did not have an RB or a Tier 1 screening level. Both ethylbenzene and xylene were eliminated as COPECs based on low frequency of detection, low percentage of samples greater than the RB, rapid weathering, and low toxicity. Therefore, ethylbenzene and xylene were eliminated as COPECs for mammals.

Based on the results of the ERA, none of the chemical constituents detected in Site soil were considered as constituents of ecological concern (COECs).

9. Recommendations

In summary, the existing data indicate that soil is generally free from COPC and COPEC impacts throughout the Site (i.e., Site wide). This risk statement is inclusive of, and considers, all of the COPCs and COPECs, pathways, routes, and receptors applicable to the Site. Although one location exhibited TPH concentrations above the residential soil SSCL, the TPH soil residential SSCL was not exceeded under the RME and CTE exposure scenarios. Additionally, the observed soil impacts were found at considerable depth (19 ft bgs) and beyond the reach of sensitive receptors. Therefore, the SSCL exceedance for TPH does not result in additional remedial/risk management actions. Current quantitative risk assessment goes beyond the off-the-shelf application of any default screening/cleanup levels and considers the potential for actual risks to human health and the environment. Since no such risks were identified, a no further action (NFA) designation is recommended for the Site.

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Appendix A – Final Excavation Report by Animas Environmental Services, 2015

Animas Environmental Services, LLC

July 24, 2015

Lindsay Dumas
ConocoPhillips
San Juan Business Unit
(505) 599-4089

Via electronic mail to:
SJBUE-Team@ConocoPhillips.com

RE: Final Excavation Report
San Juan 28-6 #155N
Rio Arriba County, New Mexico

Dear Ms. Dumas:

On February 17 and April 30, 2015, Animas Environmental Services, LLC (AES) completed an environmental clearance of the final excavation limits at the ConocoPhillips (COPC) San Juan 28-6 #155N, located in Rio Arriba County, New Mexico. The 186 barrel (bbl) condensate release resulted from corrosion of the production tank. The final excavation was completed by COPC contractors prior to AES' arrival at the location on April 30, 2015.

1.0 Site Information

1.1 Location

Site Name – San Juan 30-6 #155N
Location – SW¼ NW¼, Section 28, T27N, R6W, Rio Arriba County, New Mexico
Well Head Latitude/Longitude – N36.63291 and W107.48120, respectively
Release Location Latitude/Longitude – N36.63311 and W107.48151, respectively
Land Jurisdiction – Bureau of Land Management (BLM)
Figure 1. Topographic Site Location Map
Figure 2. Aerial Site Map, February 2015

604 W. Piñon St.
Farmington, NM 87401
505-564-2281

1911 Main, Ste 280
Durango, CO 81301
970-403-3084

www.animasenvironmental.com

1.2 NMOCD Ranking

In accordance with New Mexico Oil Conservation Division (NMOCD) release protocols, action levels were established per NMOCD *Guidelines for Remediation of Leaks, Spills, and Releases* (August 1993) prior to site work. The release was given a ranking score of 20 based on the following factors:

- **Depth to Groundwater:** Based on elevation, topographic interpretation and visual reconnaissance, depth to groundwater is interpreted to be greater than 100 feet below ground surface (bgs). (0 points)
- **Wellhead Protection Area:** The release location is not within a wellhead protection area. (0 points)
- **Distance to Surface Water Body:** Approximately 110 feet to the north is an unnamed wash that drains into Encierro Canyon wash and ultimately to the San Juan River. (20 points)

1.3 Assessment

AES was initially contacted by Lindsay Dumas of COPC on January 27, 2015, and on February 17, 2015, Stephanie Hinds and Dylan Davis of AES completed excavation field work. Field sampling activities included collection of five confirmation soil samples from the walls and base of the excavation. The area of the final excavation measured approximately 64 feet by 71 feet by 19 feet in depth. The depth of the excavation was limited due to a confining sandstone unit at 19 feet bgs. A final confirmation soil sample (SC-5 (2)) was collected from the base on April 30, 2015, following application of potassium permanganate. Sample locations and final excavation extents are presented on Figure 3.

2.0 Soil Sampling

A total of 6 composite samples (SC-1 through SC-5 and SC-5 (2)) were collected during the assessments. All soil samples were field screened for volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH). All composite samples collected during the excavation clearance were submitted for confirmation laboratory analysis.

2.1 Field Sampling

2.1.1 Volatile Organic Compounds

Field screening for VOC vapors was conducted with a photo-ionization detector (PID) organic vapor meter (OVM). Before beginning field screening, the PID-OVM was first calibrated with 100 parts per million (ppm) isobutylene gas.

2.1.2 Total Petroleum Hydrocarbons

Field TPH samples were analyzed per U.S. Environmental Protection Agency (USEPA) Method 418.1 using a Buck Scientific Model HC-404 Total Hydrocarbon Analyzer Infrared Spectrometer (Buck). A 3-point calibration was completed prior to conducting soil analyses. Field analytical protocol followed AES's *Standard Operating Procedure: Field Analysis Total Petroleum Hydrocarbons per EPA Method 418.1*.

2.2 Laboratory Analyses

The soil samples collected for laboratory analysis were placed into new, clean, laboratory-supplied containers, which were then labeled, placed on ice, and logged onto a sample chain of custody record. Samples were maintained on ice until delivery to the analytical laboratory, Hall Environmental Analysis Laboratory (Hall) in Albuquerque, New Mexico. All soil samples were laboratory analyzed for:

- Benzene, toluene, ethylbenzene, and xylene (BTEX) per USEPA Method 8021B; and
- TPH for gasoline range organics (GRO), diesel range organics (DRO), and motor oil range organics (MRO) per USEPA Method 8015D.

2.3 Field and Laboratory Analytical Results

On February 17, 2015, excavation field screening results for VOCs via OVM ranged from 2.5 ppm in SC-4 up to 2,536 ppm in SC-5. Field TPH concentrations ranged from less than 20.0 mg/kg in SC-1 through SC-4 up to greater than 2,500 mg/kg in SC-5. On April 30, 2015, excavation field screening results from SC-5 (2) for VOCs via OVM were 38.5 ppm, and field TPH concentrations were 38.8 mg/kg. Results are included below in Table 1 and on Figure 3. The AES Field Sampling Reports are attached.

Table 1. Soil Field VOCs and TPH Results
San Juan 28-6 #155N Final Excavation, February and April 2015

Sample ID	***Date Sampled***	***Sample Depth (ft bgs)***	***VOCs via OVM (ppm)***	***TPH 418.1 (mg/kg)***
*NMOCD Action Level**			*100*	*100*
SC-1	2/17/15	1 to 19	74.2	<20.0
SC-2	2/17/15	1 to 19	48.0	<20.0
SC-3	2/17/15	1 to 19	20.2	<20.0
SC-4	2/17/15	1 to 19	2.5	<20.0
SC-5	2/17/15	19	**2,536**	**>2,500**
SC-5 (2)	4/30/15	19	38.5	38.8

*Action level determined by the NMOCD ranking score per *NMOCD Guidelines for Remediation of Leaks, Spills, and Releases* (August 1993)

Laboratory analyses were used to confirm field sampling results from the final excavation extents. Benzene and total BTEX concentrations in all final samples were reported below laboratory detection limits. Final TPH concentrations as GRO/DRO/MRO were reported below laboratory detection limits in all samples, with the exception of SC-5 (2) which was reported at 20 mg/kg. Results are presented in Table 2 and on Figure 3. The laboratory analytical reports are attached.

Table 2. Laboratory Analytical Results – Benzene, Total BTEX, and TPH
San Juan 28-6 #155N Final Excavation, February and April 2015

Sample ID	***Date Sampled***	***Sample Depth (ft bgs)***	***Benzene (mg/kg)***	***Total BTEX (mg/kg)***	***GRO (mg/kg)***	***DRO (mg/kg)***	***MRO (mg/kg)***
*NMOCD Action Level**			*10*	*50*		*100*	
SC-1	2/17/15	1 to 19	<0.032	<0.160	<3.2	<10	<50
SC-2	2/17/15	1 to 19	<0.038	<0.190	<3.8	<10	<50
SC-3	2/17/15	1 to 19	<0.044	<0.220	<4.4	<10	<50
SC-4	2/17/15	1 to 19	<0.031	<0.155	<3.1	<10	<50
SC-5	2/17/15	19	7.6	**434.6**	**3,800**	**640**	**<50**
SC-5 (2)	4/30/15	19	<0.038	<0.190	<3.8	20	<49

*Action level determined by the NMOCD ranking score per *NMOCD Guidelines for Remediation of Leaks, Spills, and Releases* (August 1993)

3.0 Conclusions and Recommendations

On February 17 and April 30, 2015, AES completed final clearance of the excavation area associated with petroleum contaminated soils at the San Juan 28-6 #155N. Action levels for releases are determined by the NMOCD ranking score per *NMOCD Guidelines for Remediation of Leaks, Spills, and Releases* (August 1993), and the site was assigned a rank of 20.

On February 17, 2015, final excavation of the impacted area was completed. Field sampling results of the excavation extents showed that VOC and TPH concentrations were below applicable NMOCD action levels for the final walls and base of the excavation, with the exception of SC-5 (base) which had a VOC concentration of 2,536 ppm and a TPH concentration greater than 2,500 mg/kg. Laboratory analytical results reported benzene, total BTEX, and TPH concentrations in SC-1 through SC-4 below

NMOCD action levels, while SC-5 remained above the applicable NMOCD action levels. An additional confirmation sample (SC-5 (2)) was collected on April 30, 2015. Field sampling and laboratory results for SC-5 (2) reported VOC, benzene, total BTEX and TPH concentrations below applicable NMOCD action levels for the base of the excavation.

Based on final field sampling and laboratory analytical results of the excavation of petroleum contaminated soils at the San Juan 28-6 #155N, VOC, benzene, total BTEX, and TPH concentrations were below applicable NMOCD action levels for each of the sidewalls and base of the excavation. No further work is recommended.

If you have any questions about this report or site conditions, please do not hesitate to contact Emilee Skyles at (505) 564-2281.

Sincerely,

David J Reese

David J. Reese
Environmental Scientist

Emilee Skyles
Geologist/Project Lead

Elizabeth V McNally

Elizabeth McNally, PE

Attachments:

- Figure 1. Topographic Site Location Map
- Figure 2. Aerial Site Map, February 2015
- Figure 3. Final Excavation Sample Locations and Results, February and April 2015
- AES Field Sampling Report 021715
- AES Field Sampling Report 043015
- Hall Laboratory Analytical Report 1502720
- Hall Laboratory Analytical Report 1505007

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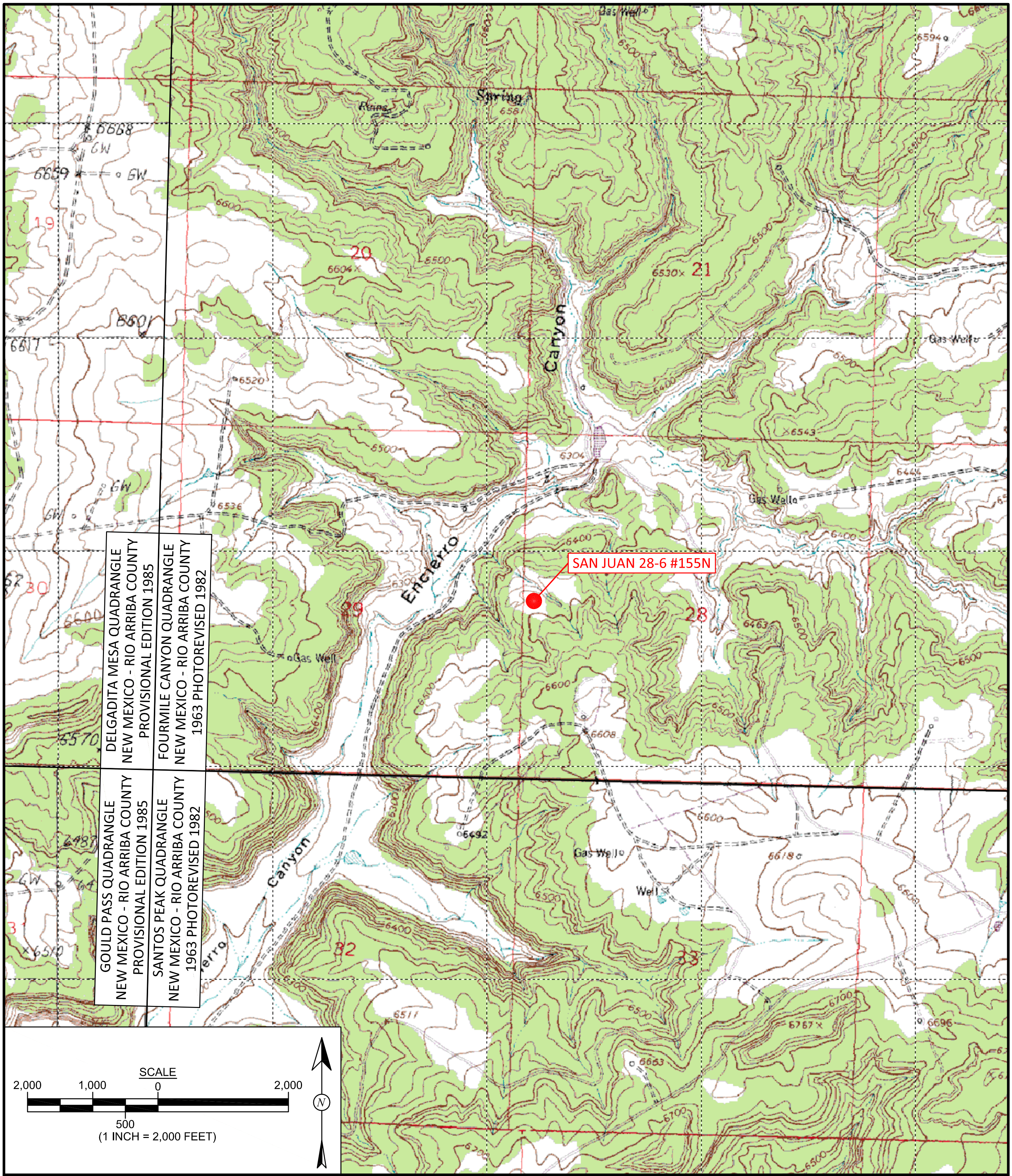


AES
Animas Environmental Services, LLC

DRAWN BY:
S. Glasses

DATE DRAWN:
February 25, 2015

REVISIONS BY:
C. Lameman

DATE REVISED:
February 25, 2015

CHECKED BY:
E. Skyles

DATE CHECKED:
February 25, 2015

APPROVED BY:
E. McNally

DATE APPROVED:
February 25, 2015

FIGURE 1

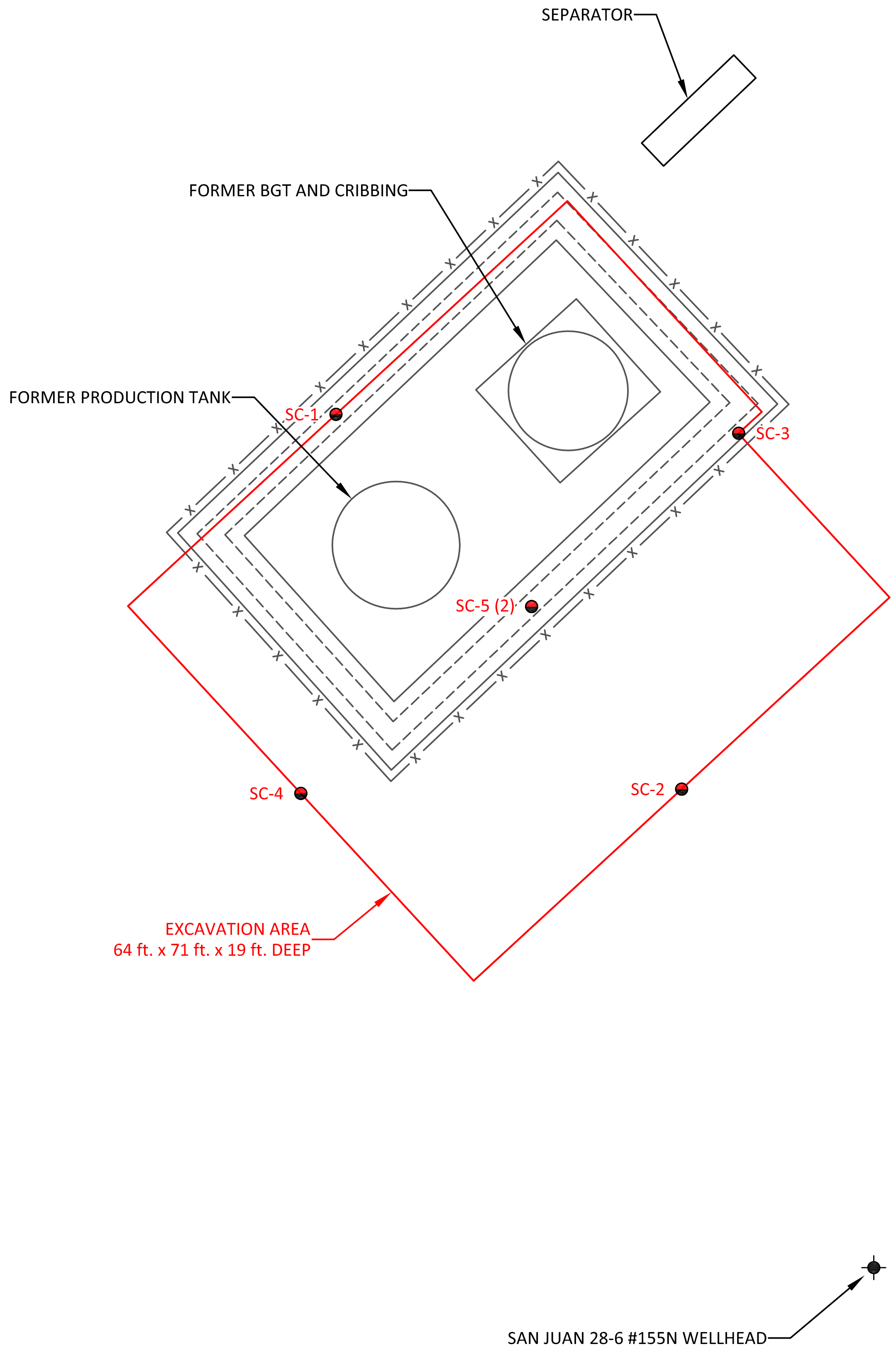
TOPOGRAPHIC SITE LOCATION MAP
FEBRUARY 2015

ConocoPhillips
SAN JUAN 28-6 #155N
SW¼ NW¼, SECTION 28, T27N, R6W
RIO ARRIBA COUNTY, NEW MEXICO
N36.63291, W107.48120

AERIAL SOURCE: © 2014 GOOGLE EARTH PRO, AERIAL DATE: MAY 2, 2013

AES
Animas Environmental Services, LLC

DRAWN BY: S. Glasses	**DATE DRAWN:** February 27, 2015	**FIGURE 2**
REVISIONS BY: C. Lameman	**DATE REVISED:** February 27, 2015	**AERIAL SITE MAP** **FEBRUARY 2015** ConocoPhillips SAN JUAN 28-6 #155N SW¼ NW¼, SECTION 28, T27N, R6W RIO ARRIBA COUNTY, NEW MEXICO N36.63291, W107.48120
CHECKED BY: E. Skyles	**DATE CHECKED:** February 27, 2015	
APPROVED BY: E. McNally	**DATE APPROVED:** February 27, 2015	



Field Sampling Results				
Sample ID	***Date***	***Depth (ft)***	***OVM-PID (ppm)***	***TPH (mg/kg)***
NMOCD ACTION LEVEL			***100***	***100***
SC-1	2/17/15	1 to 19	74.2	<20.0
SC-2	2/17/15	1 to 19	48.0	<20.0
SC-3	2/17/15	1 to 19	20.2	<20.0
SC-4	2/17/15	1 to 19	2.5	<20.0
SC-5 (2)	4/30/15	19	38.5	38.8
ALL SAMPLES ARE COMPOSITE SAMPLES.				

Laboratory Analytical Results							
Sample ID	***Date***	***Depth (ft)***	***Benzene (mg/kg)***	***Total BTEX (mg/kg)***	***TPH - GRO (mg/kg)***	***TPH - DRO (mg/kg)***	***TPH - DRO (mg/kg)***
NMOCD ACTION LEVEL			***10***	***50***	***100***		
SC-1	2/17/15	1 to 19	<0.032	<0.160	<3.2	<10	<50
SC-2	2/17/15	1 to 19	<0.038	<0.190	<3.8	<10	<50
SC-3	2/17/15	1 to 19	<0.044	<0.220	<4.4	<10	<50
SC-4	2/17/15	1 to 19	<0.031	<0.155	<3.1	<9.9	<50
SC-5 (2)	4/30/15	19	<0.038	<0.190	<3.8	20	<49
ALL SAMPLES WERE ANALYZED PER USEPA METHOD 8021B AND 8015D.							

FIGURE 3

FINAL EXCAVATION SAMPLE LOCATIONS AND RESULTS FEBRUARY AND APRIL 2015

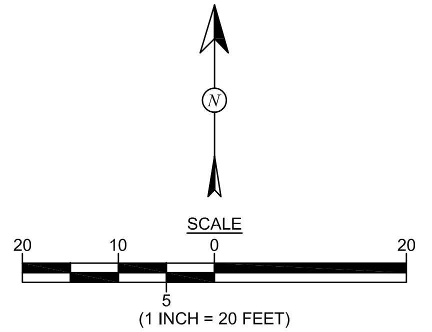
ConocoPhillips
SAN JUAN 28-6 #155N
SW¼ NW¼, SECTION 28, T27N, R6W
RIO ARRIBA COUNTY, NEW MEXICO
N36.63291, W107.48120

AES
Animas Environmental Services, LLC

DRAWN BY: S. Glasses	**DATE DRAWN:** February 18, 2015
REVISIONS BY: C. Lameman	**DATE REVISED:** May 6, 2015
CHECKED BY: E. Skyles	**DATE CHECKED:** May 6, 2015
APPROVED BY: E. McNally	**DATE APPROVED:** May 6, 2015

LEGEND

●	SAMPLE LOCATIONS
☰	SECONDARY CONTAINMENT BERM
— x —	FENCE



AES Field Sampling Report

Client: ConocoPhillips

Project Location: San Juan 28-6 #155N

Date: 2/17/2015

Matrix: Soil

Sample ID	Collection Date	Collection Time	Sample Location	OVM (ppm)	Field TPH* (mg/kg)	Field TPH Analysis Time	TPH PQL (mg/kg)	DF	TPH Analysts Initials
SC-1	2/17/2015	14:10	North Wall	74.2	0.00	14:30	20.0	1	SAH
SC-2	2/17/2015	12:30	South Wall	48.0	0.00	13:27	20.0	1	SAH
SC-3	2/17/2015	12:35	East Wall	20.2	0.00	13:31	20.0	1	SAH
SC-4	2/17/2015	14:00	West Wall	2.5	0.00	14:22	20.0	1	SAH
SC-5	2/17/2015	12:45	Base	2,536	>2,500	13:14	20.0	1	SAH

DF	Dilution Factor
NA	Not Analyzed
PQL	Practical Quantitation Limit

**TPH concentrations recorded may be below PQL.*

Total Petroleum Hydrocarbons - USEPA 418.1

Analyst: Stephanie A. Hinds

AES Field Sampling Report

Animas Environmental Services, LLC

Client: ConocoPhillips

Project Location: San Juan 28-6 #155N

Date: 4/30/2015

Matrix: Soil

Sample ID	Collection Date	Collection Time	Sample Location	OVM (ppm)	Field TPH* (mg/kg)	Field TPH Analysis Time	TPH PQL (mg/kg)	DF	TPH Analysts Initials
SC-5 (2)	4/30/2015	9:20	Base	38.5	38.8	9:55	20.0	1	CL

DF	Dilution Factor
NA	Not Analyzed
PQL	Practical Quantitation Limit

**TPH concentrations recorded may be below PQL.*

Total Petroleum Hydrocarbons - USEPA 418.1

Analyst:

**HALL
ENVIRONMENTAL
ANALYSIS
LABORATORY**

*Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com*

February 20, 2015

Emilee Skyles
Animas Environmental
604 Pinon Street
Farmington, NM 87401
TEL: (505) 564-2281
FAX

RE: COP SJ 28-6 #155N OrderNo.: 1502720

Dear Emilee Skyles:

Hall Environmental Analysis Laboratory received 5 sample(s) on 2/18/2015 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. In order to properly interpret your results it is imperative that you review this report in its entirety. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. When necessary, data qualifers are provided on both the sample analysis report and the QC summary report, both sections should be reviewed. All samples are reported, as received, unless otherwise indicated. Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH and residual chlorine are qualified as being analyzed outside of the recommended holding time.

Please don't hesitate to contact HEAL for any additional information or clarifications.

ADHS Cert #AZ0682 -- NMED-DWB Cert #NM9425 -- NMED-Micro Cert #NM0190

Sincerely,

Andy

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1502720**
Date Reported: **2/20/2015**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Animas Environmental
Client Sample ID: SC-1
Project: COP SJ 28-6 #155N
Collection Date: 2/17/2015 2:10:00 PM
Lab ID: 1502720-001
Matrix: MEOH (SOIL)
Received Date: 2/18/2015 8:00:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: DIESEL RANGE ORGANICS						Analyst:	**JME**
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	2/18/2015 10:22:52 AM	17795
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	2/18/2015 10:22:52 AM	17795
Surr: DNOP	99.8	63.5-128		%REC	1	2/18/2015 10:22:52 AM	17795
EPA METHOD 8015D: GASOLINE RANGE						Analyst:	**NSB**
Gasoline Range Organics (GRO)	ND	3.2		mg/Kg	1	2/18/2015 10:19:26 AM	R24377
Surr: BFB	99.3	80-120		%REC	1	2/18/2015 10:19:26 AM	R24377
EPA METHOD 8021B: VOLATILES						Analyst:	**NSB**
Benzene	ND	0.032		mg/Kg	1	2/18/2015 10:19:26 AM	R24377
Toluene	ND	0.032		mg/Kg	1	2/18/2015 10:19:26 AM	R24377
Ethylbenzene	ND	0.032		mg/Kg	1	2/18/2015 10:19:26 AM	R24377
Xylenes, Total	ND	0.064		mg/Kg	1	2/18/2015 10:19:26 AM	R24377
Surr: 4-Bromofluorobenzene	100	80-120		%REC	1	2/18/2015 10:19:26 AM	R24377

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

CLIENT: Animas Environmental
Project: COP SJ 28-6 #155N
Lab ID: 1502720-002
Matrix: MEOH (SOIL)
Client Sample ID: SC-2
Collection Date: 2/17/2015 12:30:00 PM
Received Date: 2/18/2015 8:00:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: DIESEL RANGE ORGANICS						Analyst: **JME**	
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	2/18/2015 10:49:56 AM	17795
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	2/18/2015 10:49:56 AM	17795
Surr: DNOP	103	63.5-128		%REC	1	2/18/2015 10:49:56 AM	17795
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	3.8		mg/Kg	1	2/18/2015 10:48:11 AM	R24377
Surr: BFB	94.2	80-120		%REC	1	2/18/2015 10:48:11 AM	R24377
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.038		mg/Kg	1	2/18/2015 10:48:11 AM	R24377
Toluene	ND	0.038		mg/Kg	1	2/18/2015 10:48:11 AM	R24377
Ethylbenzene	ND	0.038		mg/Kg	1	2/18/2015 10:48:11 AM	R24377
Xylenes, Total	ND	0.076		mg/Kg	1	2/18/2015 10:48:11 AM	R24377
Surr: 4-Bromofluorobenzene	102	80-120		%REC	1	2/18/2015 10:48:11 AM	R24377

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

CLIENT: Animas Environmental
Client Sample ID: SC-3
Project: COP SJ 28-6 #155N
Collection Date: 2/17/2015 12:35:00 PM
Lab ID: 1502720-003
Matrix: MEOH (SOIL)
Received Date: 2/18/2015 8:00:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: DIESEL RANGE ORGANICS							Analyst: **JME**
Diesel Range Organics (DRO)	ND	10		mg/Kg	1	2/18/2015 11:16:47 AM	17795
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	2/18/2015 11:16:47 AM	17795
Surr: DNOP	105	63.5-128		%REC	1	2/18/2015 11:16:47 AM	17795
EPA METHOD 8015D: GASOLINE RANGE							Analyst: **NSB**
Gasoline Range Organics (GRO)	ND	4.4		mg/Kg	1	2/18/2015 11:16:53 AM	R24377
Surr: BFB	91.9	80-120		%REC	1	2/18/2015 11:16:53 AM	R24377
EPA METHOD 8021B: VOLATILES							Analyst: **NSB**
Benzene	ND	0.044		mg/Kg	1	2/18/2015 11:16:53 AM	R24377
Toluene	ND	0.044		mg/Kg	1	2/18/2015 11:16:53 AM	R24377
Ethylbenzene	ND	0.044		mg/Kg	1	2/18/2015 11:16:53 AM	R24377
Xylenes, Total	ND	0.088		mg/Kg	1	2/18/2015 11:16:53 AM	R24377
Surr: 4-Bromofluorobenzene	99.5	80-120		%REC	1	2/18/2015 11:16:53 AM	R24377

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

CLIENT: Animas Environmental
Client Sample ID: SC-4
Project: COP SJ 28-6 #155N
Collection Date: 2/17/2015 2:00:00 PM
Lab ID: 1502720-004
Matrix: MEOH (SOIL)
Received Date: 2/18/2015 8:00:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: DIESEL RANGE ORGANICS						Analyst: **JME**	
Diesel Range Organics (DRO)	ND	9.9		mg/Kg	1	2/18/2015 11:43:46 AM	17795
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	2/18/2015 11:43:46 AM	17795
Surr: DNOP	110	63.5-128		%REC	1	2/18/2015 11:43:46 AM	17795
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	3.1		mg/Kg	1	2/18/2015 11:45:37 AM	R24377
Surr: BFB	93.0	80-120		%REC	1	2/18/2015 11:45:37 AM	R24377
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.031		mg/Kg	1	2/18/2015 11:45:37 AM	R24377
Toluene	ND	0.031		mg/Kg	1	2/18/2015 11:45:37 AM	R24377
Ethylbenzene	ND	0.031		mg/Kg	1	2/18/2015 11:45:37 AM	R24377
Xylenes, Total	ND	0.062		mg/Kg	1	2/18/2015 11:45:37 AM	R24377
Surr: 4-Bromofluorobenzene	100	80-120		%REC	1	2/18/2015 11:45:37 AM	R24377

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

CLIENT: Animas Environmental
Project: COP SJ 28-6 #155N
Lab ID: 1502720-005
Matrix: MEOH (SOIL)
Client Sample ID: SC-5
Collection Date: 2/17/2015 12:45:00 PM
Received Date: 2/18/2015 8:00:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015D: DIESEL RANGE ORGANICS						Analyst:	**JME**
Diesel Range Organics (DRO)	640	10		mg/Kg	1	2/18/2015 12:11:05 PM	17795
Motor Oil Range Organics (MRO)	ND	50		mg/Kg	1	2/18/2015 12:11:05 PM	17795
Surr: DNOP	110	63.5-128		%REC	1	2/18/2015 12:11:05 PM	17795
EPA METHOD 8015D: GASOLINE RANGE						Analyst:	**NSB**
Gasoline Range Organics (GRO)	3800	390		mg/Kg	100	2/18/2015 12:14:25 PM	R24377
Surr: BFB	163	80-120	S	%REC	100	2/18/2015 12:14:25 PM	R24377
EPA METHOD 8021B: VOLATILES						Analyst:	**NSB**
Benzene	7.6	0.39		mg/Kg	10	2/18/2015 9:50:38 AM	R24377
Toluene	130	3.9		mg/Kg	100	2/19/2015 7:28:20 PM	17797
Ethylbenzene	27	0.39		mg/Kg	10	2/18/2015 9:50:38 AM	R24377
Xylenes, Total	270	7.8		mg/Kg	100	2/18/2015 12:14:25 PM	R24377
Surr: 4-Bromofluorobenzene	213	80-120	S	%REC	10	2/18/2015 9:50:38 AM	R24377

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1502720**

20-Feb-15

Client: Animas Environmental

Project: COP SJ 28-6 #155N

Sample ID **MB-17795** SampType: **MBLK** TestCode: **EPA Method 8015D: Diesel Range Organics**

Client ID: **PBS** Batch ID: **17795** RunNo: **24371**

Prep Date: **2/18/2015** Analysis Date: **2/18/2015** SeqNo: **718279** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	10								
Motor Oil Range Organics (MRO)	ND	50								
Surr: DNOP	9.7		10.00		97.1	63.5	128			

Sample ID **LCS-17795** SampType: **LCS** TestCode: **EPA Method 8015D: Diesel Range Organics**

Client ID: **LCSS** Batch ID: **17795** RunNo: **24371**

Prep Date: **2/18/2015** Analysis Date: **2/18/2015** SeqNo: **718280** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	48	10	50.00	0	96.5	67.8	130			
Surr: DNOP	4.6		5.000		91.0	63.5	128			

Sample ID **1502720-001AMS** SampType: **MS** TestCode: **EPA Method 8015D: Diesel Range Organics**

Client ID: **SC-1** Batch ID: **17795** RunNo: **24371**

Prep Date: **2/18/2015** Analysis Date: **2/18/2015** SeqNo: **718410** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	58	9.9	49.70	0	118	29.2	176			
Surr: DNOP	5.5		4.970		110	63.5	128			

Sample ID **1502720-001AMSD** SampType: **MSD** TestCode: **EPA Method 8015D: Diesel Range Organics**

Client ID: **SC-1** Batch ID: **17795** RunNo: **24371**

Prep Date: **2/18/2015** Analysis Date: **2/18/2015** SeqNo: **718411** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	58	9.8	49.16	0	118	29.2	176	0.697	23	
Surr: DNOP	5.6		4.916		115	63.5	128	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1502720**

20-Feb-15

Client: Animas Environmental

Project: COP SJ 28-6 #155N

Sample ID **5ML RB** SampType: **MBLK** TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **PBS** Batch ID: **R24377** RunNo: **24377**
Prep Date: Analysis Date: **2/18/2015** SeqNo: **718563** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	5.0								
Surr: BFB	910		1000		91.1	80	120			

Sample ID **2.5UG GRO LCS** SampType: **LCS** TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **LCSS** Batch ID: **R24377** RunNo: **24377**
Prep Date: Analysis Date: **2/18/2015** SeqNo: **718564** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	27	5.0	25.00	0	110	64	130			
Surr: BFB	1000		1000		101	80	120			

Sample ID **1502720-001AMS** SampType: **MS** TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **SC-1** Batch ID: **R24377** RunNo: **24377**
Prep Date: Analysis Date: **2/18/2015** SeqNo: **718567** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	17	3.2	15.94	2.794	91.5	47.9	144			
Surr: BFB	630		637.8		98.7	80	120			

Sample ID **1502720-001AMSD** SampType: **MSD** TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **SC-1** Batch ID: **R24377** RunNo: **24377**
Prep Date: Analysis Date: **2/18/2015** SeqNo: **718568** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	17	3.2	15.94	2.794	92.1	47.9	144	0.512	29.9	
Surr: BFB	640		637.8		100	80	120	0	0	

Sample ID **MB-17797** SampType: **MBLK** TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **PBS** Batch ID: **17797** RunNo: **24415**
Prep Date: **2/18/2015** Analysis Date: **2/19/2015** SeqNo: **719115** Units: **%REC**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: BFB	890		1000		89.3	80	120			

Sample ID **LCS-17797** SampType: **LCS** TestCode: **EPA Method 8015D: Gasoline Range**
Client ID: **LCSS** Batch ID: **17797** RunNo: **24415**
Prep Date: **2/18/2015** Analysis Date: **2/19/2015** SeqNo: **719116** Units: **%REC**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Surr: BFB	1000		1000		102	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1502720**

20-Feb-15

Client: Animas Environmental

Project: COP SJ 28-6 #155N

Sample ID **5ML RB** SampType: **MBLK** TestCode: **EPA Method 8021B: Volatiles**
Client ID: **PBS** Batch ID: **R24377** RunNo: **24377**
Prep Date: Analysis Date: **2/18/2015** SeqNo: **718586** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.050								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 4-Bromofluorobenzene	1.0		1.000		100	80	120			

Sample ID **100NG BTEX LCS** SampType: **LCS** TestCode: **EPA Method 8021B: Volatiles**
Client ID: **LCSS** Batch ID: **R24377** RunNo: **24377**
Prep Date: Analysis Date: **2/18/2015** SeqNo: **718587** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.2	0.050	1.000	0	116	80	120			
Toluene	1.2	0.050	1.000	0	121	80	120			S
Ethylbenzene	1.2	0.050	1.000	0	116	80	120			
Xylenes, Total	3.4	0.10	3.000	0	114	80	120			
Surr: 4-Bromofluorobenzene	1.1		1.000		106	80	120			

Sample ID **1502720-002AMS** SampType: **MS** TestCode: **EPA Method 8021B: Volatiles**
Client ID: **SC-2** Batch ID: **R24377** RunNo: **24377**
Prep Date: Analysis Date: **2/18/2015** SeqNo: **718591** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.90	0.038	0.7599	0.01053	117	69.2	126			
Toluene	0.90	0.038	0.7599	0.03245	114	65.6	128			
Ethylbenzene	0.87	0.038	0.7599	0.009005	114	65.5	138			
Xylenes, Total	2.6	0.076	2.280	0.05980	111	63	139			
Surr: 4-Bromofluorobenzene	0.81		0.7599		107	80	120			

Sample ID **1502720-002AMSD** SampType: **MSD** TestCode: **EPA Method 8021B: Volatiles**
Client ID: **SC-2** Batch ID: **R24377** RunNo: **24377**
Prep Date: Analysis Date: **2/18/2015** SeqNo: **718592** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.84	0.038	0.7599	0.01053	109	69.2	126	6.99	18.5	
Toluene	0.83	0.038	0.7599	0.03245	105	65.6	128	7.60	20.6	
Ethylbenzene	0.84	0.038	0.7599	0.009005	109	65.5	138	4.37	20.1	
Xylenes, Total	2.5	0.076	2.280	0.05980	106	63	139	4.12	21.1	
Surr: 4-Bromofluorobenzene	0.81		0.7599		107	80	120	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

QC SUMMARY REPORT

Hall Environmental Analysis Laboratory, Inc.

WO#: **1502720**

20-Feb-15

Client: Animas Environmental

Project: COP SJ 28-6 #155N

Sample ID **MB-17797** SampType: **MBLK** TestCode: **EPA Method 8021B: Volatiles**

Client ID: **PBS** Batch ID: **17797** RunNo: **24415**

Prep Date: **2/18/2015** Analysis Date: **2/19/2015** SeqNo: **719143** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Toluene	ND	0.050								
Surr: 4-Bromofluorobenzene	0.98		1.000		98.1	80	120			

Sample ID **LCS-17797** SampType: **LCS** TestCode: **EPA Method 8021B: Volatiles**

Client ID: **LCSS** Batch ID: **17797** RunNo: **24415**

Prep Date: **2/18/2015** Analysis Date: **2/19/2015** SeqNo: **719144** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Toluene	1.0	0.050	1.000	0	103	80	120			
Surr: 4-Bromofluorobenzene	1.1		1.000		107	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

HALL ENVIRONMENTAL ANALYSIS LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: Animas Environmental

Work Order Number: 1502720

RcptNo: 1

Received by/date: Lm 02/18/15

Logged By: Ashley Gallegos 2/18/2015 8:00:00 AM

Completed By: Ashley Gallegos 2/18/2015 8:17:11 AM

Reviewed By: CS 02/18/15

Chain of Custody

1. Custody seals intact on sample bottles? Yes ☐ No ☐ Not Present ☑
2. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
3. How was the sample delivered? Courier

Log In

4. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C Yes ☑ No ☐ NA ☐
6. Sample(s) in proper container(s)? Yes ☑ No ☐
7. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
8. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
9. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
10. VOA vials have zero headspace? Yes ☐ No ☐ No VOA Vials ☑
11. Were any sample containers received broken? Yes ☐ No ☑
12. Does paperwork match bottle labels? Yes ☑ No ☐
    (Note discrepancies on chain of custody)
13. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
14. Is it clear what analyses were requested? Yes ☑ No ☐
15. Were all holding times able to be met? Yes ☑ No ☐
    (If no, notify customer for authorization.)

\# of preserved bottles checked for pH: ______
(<2 or >12 unless noted)
Adjusted? ______
Checked by: ______

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: ______ Date ______
By Whom: ______ Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding: ______
Client Instructions: ______

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	1.7	Good	Yes			

Chain-of-Custody Record

Client: Animas Environmental Services

Mailing Address: 604 W. Pinon
Farmington, NM 87401

Phone #: (505) 564-2281

email or Fax#: eskyles@animasenvironmental.com

QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)

Accreditation
☐ NELAP ☐ Other ______

☐ EDD (Type) ______

Turn-Around Time:
☐ Standard ☒ Rush same day

Project Name:
CoP SJ 28-6 # 155 ~~M~~ N mg 02/18/15 Per Stephanie Hinds

Project #:

Project Manager:
E. Skyles

Sampler: S. Hinds

On Ice: ☒ Yes ☐ No

Sample Temperature: 1.7

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 1502720	BTEX + ~~MTBE + TMB's~~ (8021) SH	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)					Air Bubbles (Y or N)
/17/15	14:10	soil	SC-1	MeOH kit 1-4oz	MeOH cool	-001	X		X													
/17/15	12:30	soil	SC-2	↓	↓	-002	X		X													
/17/15	12:35	soil	SC-3	↓	↓	-003	X		X													
2/17/15	14:00	soil	SC-4	↓	↓	-004	X		X													
2/17/15	12:45	soil	SC-5	↓	↓	-005	X		X													

Date:	Time:	Relinquished by:	Received by:	Date	Time
/17/15	1644	Stephanie Hinds	Christie Walt	2/17/15	1644
/17/15	1750	Christie Walt		02/18/15	0800

Remarks: Bill to ConocoPhillips.
WO: 20605998 User ID: KGARCIA
Activity Code: D150 Ordered by: Lindsay Dumas
Supervisor: Mike Smith Area: 24

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL
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LABORATORY

Hall Environmental Analysis Laboratory
4901 Hawkins NE
Albuquerque, NM 87109
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Website: www.hallenvironmental.com

July 14, 2015

Emilee Skyles
Animas Environmental
604 Pinon Street
Farmington, NM 87401
TEL: (505) 564-2281
FAX

RE: CoP San Juan 28-6 # 155N OrderNo.: 1505007

Dear Emilee Skyles:

Hall Environmental Analysis Laboratory received 1 sample(s) on 5/1/2015 for the analyses presented in the following report.

This report is a revised report and it replaces the original report issued May 04, 2015.

These were analyzed according to EPA procedures or equivalent. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites. See the sample checklist and/or the Chain of Custody for information regarding the sample receipt temperature and preservation. Data qualifiers or a narrative will be provided if the sample analysis or analytical quality control parameters require a flag. All samples are reported as received unless otherwise indicated.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy

Andy Freeman
Laboratory Manager
4901 Hawkins NE
Albuquerque, NM 87109

Analytical Report
Lab Order **1505007**
Date Reported: **7/14/2015**

Hall Environmental Analysis Laboratory, Inc.

CLIENT: Animas Environmental
Project: CoP San Juan 28-6 # 155N
Lab ID: 1505007-001
Matrix: MEOH (SOIL)

Client Sample ID: SC-5 (2)
Collection Date: 4/30/2015 9:20:00 AM
Received Date: 5/1/2015 5:50:00 AM

Analyses	Result	RL	Qual	Units	DF	Date Analyzed	Batch
EPA METHOD 8015M/D: DIESEL RANGE ORGANICS						Analyst: **KJH**	
Diesel Range Organics (DRO)	20	9.9		mg/Kg	1	5/1/2015 10:09:37 AM	19002
Motor Oil Range Organics (MRO)	ND	49		mg/Kg	1	5/1/2015 10:09:37 AM	19002
Surr: DNOP	85.3	57.9-140		%REC	1	5/1/2015 10:09:37 AM	19002
EPA METHOD 8015D: GASOLINE RANGE						Analyst: **NSB**	
Gasoline Range Organics (GRO)	ND	3.8		mg/Kg	1	5/1/2015 10:14:22 AM	R25904
Surr: BFB	95.0	80-120		%REC	1	5/1/2015 10:14:22 AM	R25904
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**	
Benzene	ND	0.038		mg/Kg	1	5/1/2015 10:14:22 AM	R25904
Toluene	ND	0.038		mg/Kg	1	5/1/2015 10:14:22 AM	R25904
Ethylbenzene	ND	0.038		mg/Kg	1	5/1/2015 10:14:22 AM	R25904
Xylenes, Total	ND	0.076		mg/Kg	1	5/1/2015 10:14:22 AM	R25904
Surr: 4-Bromofluorobenzene	105	80-120		%REC	1	5/1/2015 10:14:22 AM	R25904

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

Client: Animas Environmental

Project: CoP San Juan 28-6 # 155N

Sample ID **MB-19002** SampType: **MBLK** TestCode: **EPA Method 8015M/D: Diesel Range Organics**

Client ID: **PBS** Batch ID: **19002** RunNo: **25902**

Prep Date: **5/1/2015** Analysis Date: **5/1/2015** SeqNo: **767806** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	ND	10								
Motor Oil Range Organics (MRO)	ND	50								
Surr: DNOP	9.2		10.00		91.8	57.9	140			

Sample ID **LCS-19002** SampType: **LCS** TestCode: **EPA Method 8015M/D: Diesel Range Organics**

Client ID: **LCSS** Batch ID: **19002** RunNo: **25902**

Prep Date: **5/1/2015** Analysis Date: **5/1/2015** SeqNo: **767807** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Diesel Range Organics (DRO)	46	10	50.00	0	92.8	67.8	130			
Surr: DNOP	5.2		5.000		105	57.9	140			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

QC SUMMARY REPORT

WO#: **1505007**

Hall Environmental Analysis Laboratory, Inc.

14-Jul-15

Client: Animas Environmental

Project: CoP San Juan 28-6 # 155N

Sample ID **5ML RB** SampType: **MBLK** TestCode: **EPA Method 8015D: Gasoline Range**

Client ID: **PBS** Batch ID: **R25904** RunNo: **25904**

Prep Date: Analysis Date: **5/1/2015** SeqNo: **768086** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	ND	5.0								
Surr: BFB	900		1000		90.3	80	120			

Sample ID **2.5UG GRO LCS** SampType: **LCS** TestCode: **EPA Method 8015D: Gasoline Range**

Client ID: **LCSS** Batch ID: **R25904** RunNo: **25904**

Prep Date: Analysis Date: **5/1/2015** SeqNo: **768087** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Gasoline Range Organics (GRO)	25	5.0	25.00	0	101	64	130			
Surr: BFB	980		1000		98.2	80	120			

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

QC SUMMARY REPORT

WO#: **1505007**

Hall Environmental Analysis Laboratory, Inc.

14-Jul-15

Client: Animas Environmental

Project: CoP San Juan 28-6 # 155N

Sample ID **5ML RB** SampType: **MBLK** TestCode: **EPA Method 8021B: Volatiles**
Client ID: **PBS** Batch ID: **R25904** RunNo: **25904**
Prep Date: Analysis Date: **5/1/2015** SeqNo: **768099** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	ND	0.050								
Toluene	ND	0.050								
Ethylbenzene	ND	0.050								
Xylenes, Total	ND	0.10								
Surr: 4-Bromofluorobenzene	1.0		1.000		103	80	120			

Sample ID **100NG BTEX LCS** SampType: **LCS** TestCode: **EPA Method 8021B: Volatiles**
Client ID: **LCSS** Batch ID: **R25904** RunNo: **25904**
Prep Date: Analysis Date: **5/1/2015** SeqNo: **768100** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	1.1	0.050	1.000	0	107	76.6	128			
Toluene	1.1	0.050	1.000	0	110	75	124			
Ethylbenzene	1.1	0.050	1.000	0	111	79.5	126			
Xylenes, Total	3.3	0.10	3.000	0	109	78.8	124			
Surr: 4-Bromofluorobenzene	1.1		1.000		111	80	120			

Sample ID **1505007-001AMS** SampType: **MS** TestCode: **EPA Method 8021B: Volatiles**
Client ID: **SC-5 (2)** Batch ID: **R25904** RunNo: **25904**
Prep Date: Analysis Date: **5/1/2015** SeqNo: **768101** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.86	0.038	0.7645	0	113	69.2	126			
Toluene	0.87	0.038	0.7645	0	113	65.6	128			
Ethylbenzene	0.88	0.038	0.7645	0.006215	114	65.5	138			
Xylenes, Total	2.6	0.076	2.294	0	114	63	139			
Surr: 4-Bromofluorobenzene	0.86		0.7645		113	80	120			

Sample ID **1505007-001AMSD** SampType: **MSD** TestCode: **EPA Method 8021B: Volatiles**
Client ID: **SC-5 (2)** Batch ID: **R25904** RunNo: **25904**
Prep Date: Analysis Date: **5/1/2015** SeqNo: **768103** Units: **mg/Kg**

Analyte	Result	PQL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Benzene	0.83	0.038	0.7645	0	109	69.2	126	3.91	18.5	
Toluene	0.83	0.038	0.7645	0	108	65.6	128	4.33	20.6	
Ethylbenzene	0.85	0.038	0.7645	0.006215	111	65.5	138	2.55	20.1	
Xylenes, Total	2.5	0.076	2.294	0	111	63	139	2.95	21.1	
Surr: 4-Bromofluorobenzene	0.83		0.7645		109	80	120	0	0	

Qualifiers:

*	Value exceeds Maximum Contaminant Level.	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
O	RSD is greater than RSDlimit	P	Sample pH Not In Range
R	RPD outside accepted recovery limits	RL	Reporting Detection Limit
S	Spike Recovery outside accepted recovery limits		

HALL ENVIRONMENTAL ANALYSIS LABORATORY

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Albuquerque, NM 87109
TEL: 505-345-3975 FAX: 505-345-4107
Website: www.hallenvironmental.com

Sample Log-In Check List

Client Name: Animas Environmental   Work Order Number: 1505007   RcptNo: 1

Received by/date: 05/01/15

Logged By: Lindsay Mangin   5/1/2015 5:50:00 AM

Completed By: Lindsay Mangin   5/1/2015 7:19:02 AM

Reviewed By: AT 05/01/15

Chain of Custody

1. Custody seals intact on sample bottles? Yes ☐ No ☐ Not Present ☑
2. Is Chain of Custody complete? Yes ☑ No ☐ Not Present ☐
3. How was the sample delivered? Courier

Log In

4. Was an attempt made to cool the samples? Yes ☑ No ☐ NA ☐
5. Were all samples received at a temperature of >0° C to 6.0°C Yes ☑ No ☐ NA ☐
6. Sample(s) in proper container(s)? Yes ☑ No ☐
7. Sufficient sample volume for indicated test(s)? Yes ☑ No ☐
8. Are samples (except VOA and ONG) properly preserved? Yes ☑ No ☐
9. Was preservative added to bottles? Yes ☐ No ☑ NA ☐
10. VOA vials have zero headspace? Yes ☐ No ☐ No VOA Vials ☑
11. Were any sample containers received broken? Yes ☐ No ☑
12. Does paperwork match bottle labels? Yes ☑ No ☐
    (Note discrepancies on chain of custody)
13. Are matrices correctly identified on Chain of Custody? Yes ☑ No ☐
14. Is it clear what analyses were requested? Yes ☑ No ☐
15. Were all holding times able to be met? Yes ☑ No ☐
    (If no, notify customer for authorization.)

\# of preserved bottles checked for pH: ________
(<2 or >12 unless noted)
Adjusted? ________
Checked by: ________

Special Handling (if applicable)

16. Was client notified of all discrepancies with this order? Yes ☐ No ☐ NA ☑

Person Notified: ________   Date ________
By Whom: ________   Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person
Regarding: ________
Client Instructions: ________

17. Additional remarks:

18. Cooler Information

Cooler No	Temp °C	Condition	Seal Intact	Seal No	Seal Date	Signed By
1	3.1	Good	Yes			

Chain-of-Custody Record

Client: Animas Environmental Services

Mailing Address: 604 W. Pinon St.
Farmington NM 87401

Phone #: 505-564-2281

email or Fax#: eskyles@animasenvironmental.com

QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)

Accreditation
☐ NELAP ☐ Other ________

☐ EDD (Type) ________

Turn-Around Time:
~~☒ Standard~~ ☒ Rush Same Day

Project Name:
CoP San Juan 28-6 # 155N

Project #:

Project Manager:
E. Skyles

Sampler: C. Lameman

On Ice: ☒ Yes ☐ No

Sample Temperature: 3.1

HALL ENVIRONMENTAL ANALYSIS LABORATORY

www.hallenvironmental.com

4901 Hawkins NE - Albuquerque, NM 87109

Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Request ID	05/01/15 Container Type and # A MeOH Kit	Preservative Type	HEAL No. 1505007	BTEX + ~~MTBE + TMB's~~ (8021)	BTEX + MTBE + TPH (Gas only)	TPH 8015B (GRO / DRO / MRO)	TPH (Method 418.1)	EDB (Method 504.1)	PAH's (8310 or 8270 SIMS)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)					Air Bubbles (Y or N)
4-30-15	0920	Soil	SC-5	2-4oz jar	Cool	-001	X		X													

Date:	Time:	Relinquished by:	Received by:	Date	Time
4/30/15	1722		Christie Walters	4/30/15	1722
4/30/15	1819	Christie Walters		05/01/15	0550

Remarks: Bill to ConocoPhillips

WO#: 20605998
Supervisor: Mike Smith
User: KGARCIA

Area: 24
Act. Code: D150
Ordered by: Lindsay Dumas

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

Appendix B – Data Validation Memos

Memorandum

August 8, 2016

To: Jeff Walker Ref. No.: 11119528

From: Angela Bown/cs/1-NF Tel: 513-942-4750

CC: Christine Mathews

Subject: **Analytical Results and Reduced Validation**
Soil Assessment Sampling
Conoco Phillips – San Juan 28-6 Unit 155N
Rio Arriba County, New Mexico
April and June 2016

1. Introduction

This document details a reduced validation of analytical results for soil samples collected in support of the soil assessment sampling at the Conoco Phillips - San Juan 28-6 Unit 155N site during April and June 2016. Samples were submitted to Hall Environmental Analysis Laboratory (HEAL) located in Albuquerque, New Mexico and Pace Analytical (Pace) located in Lenexa, Kansas, respectively. A sample collection and analysis summary is presented in Table 1. The validated analytical results are summarized in Table 2A and Table 2B. A summary of the analytical methodology is presented in Table 3.

Standard GHD report deliverables were submitted by the laboratory. The final results and supporting quality assurance/quality control (QA/QC) data were assessed. Evaluation of the data was based on information obtained from the chain of custody forms, finished report forms, method blank data, recovery data from surrogate spikes/laboratory control samples (LCS)/matrix spikes (MS).

The QA/QC criteria by which these data have been assessed are outlined in the analytical methods referenced in Table 3 and applicable guidance from the document entitled, "USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review", USEPA 540-R-08-01, June 2008.

This item will subsequently be referred to as the "Guidelines" in this Memorandum.

2. Sample Holding Time and Preservation

The sample holding time criteria and sample preservation requirements for the analyses are summarized in Table 3. Sample chain of custody documents and analytical reports were used to determine sample holding times. All samples were prepared and analyzed within the required holding times.

All samples were properly preserved, delivered on ice, and stored by the laboratory at the required temperature (0-6°C). It should be noted that all samples were collected in bulk jars including samples analyzed for volatile organic compounds (VOCs) and gasoline range organics (GRO).

3. Laboratory Method Blank Analyses

Method blanks are prepared from a purified matrix and analyzed with investigative samples to determine the existence and magnitude of sample contamination introduced during the analytical procedures.

For this study, laboratory method blanks were analyzed at a minimum frequency of 1 per 20 investigative samples and/or 1 per analytical batch.

All method blank results were non-detect indicating that laboratory contamination was not a factor for this investigation.

4. Surrogate Spike Recoveries

In accordance with the methods employed, all samples, blanks, and QC samples analyzed for organics are spiked with surrogate compounds prior to sample extraction and/or analysis. Surrogate recoveries provide a means to evaluate the effects of laboratory performance on individual sample matrices.

All samples submitted for organic determinations were spiked with the appropriate number of surrogate compounds prior to sample extraction and/or analysis.

Each individual surrogate compound is expected to meet the laboratory control limits with the exception of SVOC analyses. According to the "Guidelines" for SVOC analyses, up to one outlying surrogate in the base/neutral or acid fractions is acceptable as long as the recovery is at least 10 percent.

Surrogate recoveries were assessed against laboratory control limits. Table 4 presents the sample results that were qualified due to outlying surrogate recoveries.

5. Laboratory Control Sample Analyses

LCS and/or laboratory control sample duplicates (LCSD) are prepared and analyzed as samples to assess the analytical efficiencies of the methods employed, independent of sample matrix effects. The relative percent difference (RPD) of the LCS/LCSD recoveries is used to evaluate analytical precision.

For this study, LCS/LCSD were analyzed at a minimum frequency of 1 per 20 investigative samples and/or 1 per analytical batch.

The LCS/LCSD contained all compounds of interest (the compounds specified in the method). All LCS recoveries and RPDs were within the laboratory control limits demonstrating acceptable analytical accuracy and precision.

6. Matrix Spike/Matrix Spike Duplicate (MS/MSD) Analyses

To evaluate the effects of sample matrices on the preparation process, measurement procedures, and accuracy of a particular analysis, samples are spiked with a known concentration of the analyte of concern and analyzed as MS/MSD samples. The RPD between the MS and MSD is used to assess analytical precision.

If the original sample concentration is significantly greater than the spike concentration, the recovery is not assessed.

If only the MS or MSD recovery was outside of control limits, no qualification of the data was performed based on the acceptable recovery of the companion spike and the acceptable RPD.

MS/MSD analyses were performed as specified in Table 1.

The MS/MSD samples were spiked with all compounds of interest. All percent recoveries and RPD values were within the laboratory control limits or did not warrant qualification of the associated sample results.

7. Field QA/QC Samples

The field QA/QC consisted of one field duplicate sample set.

Field Duplicate Sample Analysis

To assess the analytical and sampling protocol precision, one field duplicate sample set was collected and submitted "blind" to the laboratory, as specified in Table 1. The RPDs associated with these duplicate samples must be less than 100 percent for soil samples. If the reported concentration in either the investigative sample or its duplicate is less than five times the reporting limit (RL), the evaluation criterion is two times the RL value for soil samples.

All field duplicate results were within acceptable agreement demonstrating acceptable sampling and analytical precision.

8. Analyte Reporting

No positive analyte detections less than the RL but greater than the laboratory’s method detection limit (MDL) were reported. Non-detect results were presented as non-detect at the RL in Table 2A and 2B.

Soil sample results reported by HEAL were on a wet weight basis (see Table 2A).

Soil sample results reported by Pace were on a dry weight basis (see Table 2B).

9. Conclusion

Based on the assessment detailed in the foregoing, the data summarized in Table 2A and 2B are acceptable with the specific qualifications noted herein.

Table 1

Sample Collection and Analysis Summary
Soil Assessment Sampling
Conoco Phillips - San Juan 28-6 Unit 155N
Rio Arriba County, New Mexico
April and June 2016

						Analysis/Parameters						
Sample Identification	**Location**	**Matrix**	**Sample Depth (ft. bgs.)**	**Collection Date (mm/dd/yyyy)**	**Collection Time (hr:min)**	**Select VOCs**	**TPH-GRO**	**TPH-DRO**	**SVOCs-SIM**	**T1005**	**T1006**	**Comments**
11119528-042116-CH-1-20	Boring CH-1	Soil	20	04/21/2016	14:00	X	X	X				MS/MSD
11119528-042116-CH-1-30	Boring CH-1	Soil	30	04/21/2016	15:30	X	X	X				MS/MSD
11119528-042216-CH-1-40	Boring CH-1	Soil	40	04/22/2016	16:00	X	X	X				MS/MSD
11119528-042116-CH-2-5	Boring CH-2	Soil	5	04/21/2016	16:25	X	X	X				
11119528-042116-CH-2-15	Boring CH-2	Soil	15	04/21/2016	18:00	X	X	X				
11119528-042216-CH-3-5	Boring CH-3	Soil	5	04/22/2016	09:00	X	X	X				
11119528-042216-CH-3-10	Boring CH-3	Soil	10	04/22/2016	09:30	X	X	X				
11119528-042216-CH-4-5	Boring CH-4	Soil	5	04/22/2016	10:15	X	X	X				
11119528-042216-CH-4-15	Boring CH-4	Soil	15	04/22/2016	11:00	X	X	X				
11119528-042216-CH-5-10	Boring CH-5	Soil	10	04/22/2016	12:45	X	X	X				
11119528-042216-CH-5-15	Boring CH-5	Soil	10	04/22/2016	13:30	X	X	X				
11119528-042216-CH-6-5	Boring CH-5	Soil	5	04/22/2016	14:50	X	X	X				
11119528-042216-CH-6-10	Boring CH-5	Soil	10	04/22/2016	15:45	X	X	X				
SL-11119528-070616-JW-B7-32	CH-7	Soil	32	07/06/2016	07:45	X		X	X	X		
SL-11119528-070616-JW-B8-37	CH-8	Soil	37	07/06/2016	13:00	X		X	X	X		
SL-11119528-070616-JW-B9-42.5	CH-9	Soil	42.5	07/06/2016	16:40	X		X	X	X		
SL-11119528-070716-JW-B10-42.5	CH-10	Soil	42.5	07/06/2016	09:10	X		X	X	X		
11119528-B-11@22.5	CH-11	Soil	22.5	07/06/2016	11:00	X		X	X	X	X	MS/MSD
11119528-B-11@22.5 DUP	CH-11	Soil	22.5	07/06/2016	11:00						X	FD(11119528-B-11@22.5)

Notes:

DRO	- Diesel Range Organics
DUP	- Laboratory Duplicate
FD	- Field Duplicate Sample of sample in parenthesis
ft. bgs.	- Feet below ground surface
GRO	- Gasoline Range Organics
MS/MSD	- Matrix Spike/Matrix Spike Duplicate
SVOC	- Semi-volatile Organic Compounds
TPH	- Total Petroleum Hydrocarbons.
SIM	- Selected Ion Monitoring
VOC	- Volatile Organic Compounds
T1005	- "Total Petroleum Hydrocarbons," Texas Natural Resource Conservation Commission Method 1005, Revision 03, June 1, 2001
T1006	- "Characterization of Nc$_6$ to Nc$_{35}$ Petroleum Hydrocarbons in Environmental Samples: Aliphatic Hydrocarbons, Aromatic Hydrocarbons, Approximate Boiling Point/Carbon Number Distribution," Texas Natural Resource Conservation Commission Draft Method 1006.

Table 2A

Analytical Results Summary
Soil Assessment Sampling
Conoco Phillips - San Juan 28-6 Unit 155N
Riio Arriba County, New Mexico
April and June 2016

	Location ID:	**CH-1**	**CH-1**	**CH-1**
	Sample Name:	**S-11119528-042116-CH-1-20**	**S-11119528-042116-CH-1-30**	**S-11119528-042216-CH-1-40**
	Sample Date:	**04/21/2016**	**04/21/2016**	**04/22/2016**
	Depth:	**20 ft BGS**	**30 ft BGS**	**40 ft BGS**
Parameters	**Unit**			
Volatile Organic Compounds				
Benzene	mg/kg	0.23 U	0.62	0.024 U
Ethylbenzene	mg/kg	4.5	5.0	0.047 U
Toluene	mg/kg	11	20	0.047 U
Xylenes (total)	mg/kg	49	68	0.094 U
Total Petroleum Hydrocarbons (TPH)				
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	240	220	9.6 U
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	47 U	48 U	48 U
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	610 J	820 J	4.7 U

Notes:

J - Estimated concentration
U - Not present at or above the associated value

Table 2A

Analytical Results Summary
Soil Assessment Sampling
Conoco Phillips - San Juan 28-6 Unit 155N
Riio Arriba County, New Mexico
April and June 2016

Location ID:		**CH-2**	**CH-2**	**CH-3**
Sample Name:		**S-11119528-042116-CH-2-5**	**S-11119528-042116-CH-2-15**	**S-11119528-042216-CH-3-5**
Sample Date:		**04/21/2016**	**04/21/2016**	**04/22/2016**
Depth:		**5 ft BGS**	**15 ft BGS**	**5 ft BGS**
Parameters	**Unit**			
Volatile Organic Compounds				
Benzene	mg/kg	0.21	0.023 U	0.024 U
Ethylbenzene	mg/kg	8.1	0.046 U	0.049 U
Toluene	mg/kg	34	0.046 U	0.049 U
Xylenes (total)	mg/kg	120	0.092 U	0.097 U
Total Petroleum Hydrocarbons (TPH)				
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	310	15	9.6 U
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	47 U	49 U	48 U
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	1500 J	4.6 U	4.9 U

Notes:

J - Estimated concentration
U - Not present at or above the associated value

Table 2A

Analytical Results Summary
Soil Assessment Sampling
Conoco Phillips - San Juan 28-6 Unit 155N
Riio Arriba County, New Mexico
April and June 2016

	Location ID:	CH-3	CH-4	CH-4
	Sample Name:	S-11119528-042216-CH-3-10	S-11119528-042216-CH-4-5	S-11119528-042216-CH-4-15
	Sample Date:	04/22/2016	04/22/2016	04/22/2016
	Depth:	10 ft BGS	5 ft BGS	15 ft BGS
Parameters	**Unit**			
Volatile Organic Compounds				
Benzene	mg/kg	0.024 U	0.38 J	0.025 U
Ethylbenzene	mg/kg	0.049 U	2.2 J	0.050 U
Toluene	mg/kg	0.049 U	22	0.050 U
Xylenes (total)	mg/kg	0.098 U	140	0.10 U
Total Petroleum Hydrocarbons (TPH)				
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	9.8 U	500	9.4 U
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	49 U	48 U	47 U
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	4.9 U	2800 J	5.0 U

Notes:

J - Estimated concentration
U - Not present at or above the associated value

Table 2A

Analytical Results Summary
Soil Assessment Sampling
Conoco Phillips - San Juan 28-6 Unit 155N
Riio Arriba County, New Mexico
April and June 2016

	Location ID:	**CH-5**	**CH-5**	**CH-5**	**CH-5**
	Sample Name:	**S-11119528-042216-CH-6-5**	**S-11119528-042216-CH-5-10**	**S-11119528-042216-CH-5-15**	**S-11119528-042216-CH-6-10**
	Sample Date:	**04/22/2016**	**04/22/2016**	**04/22/2016**	**04/22/2016**
	Depth:	**5 ft BGS**	**10 ft BGS**	**10 ft BGS**	**10 ft BGS**
Parameters	**Unit**				
Volatile Organic Compounds					
Benzene	mg/kg	0.024 U	0.12 U	0.024 U	0.024 U
Ethylbenzene	mg/kg	0.048 U	0.84	0.049 U	0.047 U
Toluene	mg/kg	0.15	0.46	0.049 U	0.047 U
Xylenes (total)	mg/kg	0.38	13	0.098 U	0.094 U
Total Petroleum Hydrocarbons (TPH)					
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	9.2 U	280	15	9.4 U
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	46 U	47 U	48 U	47 U
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	4.8 U	240 J	4.9 U	4.7 U

Notes:

J - Estimated concentration
U - Not present at or above the associated value

Table 2B

Analytical Results Summary
Soil Assessment Sampling
Conoco Phillips - San Juan 28-6 Unit 155N
Rio Arriba County, New Mexico
April and June 2016

Location ID:		**CH-7**	**CH-8**	**CH-9**
Sample Name:		**SL-11119528-070616-JW-B7-32**	**SL-11119528-070616-JW-B8-37**	**SL-11119528-070616-JW-B9-42.5**
Sample Date:		**07/06/2016**	**07/06/2016**	**07/06/2016**
Depth:		**32 ft BGS**	**37 ft BGS**	**42.5 ft BGS**
Parameters	**Unit**			
Volatile Organic Compounds				
Benzene	mg/kg	0.0052 U	0.0052 U	0.0060 U
Ethylbenzene	mg/kg	0.0052 U	0.0052 U	0.0060 U
Toluene	mg/kg	0.0052 U	0.0052 U	0.017
Total Petroleum Hydrocarbons (C6-C10) GRO	mg/kg	0.52 U	0.52 U	0.60 U
Xylenes (total)	mg/kg	0.010 U	0.010 U	0.012 U
Semivolatile Organic Compounds, SIM				
Acenaphthene	µg/kg	3.4 U	3.3 U	4.0 U
Acenaphthylene	µg/kg	3.4 U	3.3 U	4.0 U
Anthracene	µg/kg	3.4 U	3.3 U	4.0 U
Benzo(a)anthracene	µg/kg	3.4 U	3.3 U	4.0 U
Benzo(a)pyrene	µg/kg	3.4 U	3.3 U	4.0 U
Benzo(b)fluoranthene	µg/kg	3.4 U	3.3 U	4.0 U
Benzo(g,h,i)perylene	µg/kg	3.4 U	3.3 U	4.0 U
Benzo(k)fluoranthene	µg/kg	3.4 U	3.3 U	4.0 U
Chrysene	µg/kg	3.4 U	3.3 U	4.0 U
Dibenz(a,h)anthracene	µg/kg	3.4 U	3.3 U	4.0 U
Fluoranthene	µg/kg	3.4 U	3.3 U	4.0 U
Fluorene	µg/kg	3.4 U	3.3 U	4.0 U
Indeno(1,2,3-cd)pyrene	µg/kg	3.4 U	3.3 U	4.0 U
Naphthalene	µg/kg	3.4 U	3.3 U	4.0 U
Phenanthrene	µg/kg	3.4 U	3.3 U	4.0 U
Pyrene	µg/kg	3.4 U	3.3 U	4.0 U
Total Petroleum Hydrocarbons (TPH)				
Total Petroleum Hydrocarbons (>C10-C12) Aliphatic	mg/kg	--	--	--
Total Petroleum Hydrocarbons (>C10-C12) Aromatic	mg/kg	--	--	--
Total Petroleum Hydrocarbons (>C12-C16) Aliphatic	mg/kg	--	--	--
Total Petroleum Hydrocarbons (>C12-C16) Aromatic	mg/kg	--	--	--
Total Petroleum Hydrocarbons (>C12-C28)	mg/kg	20.6 U	20.0 U	23.9 U
Total Petroleum Hydrocarbons (>C16-C21) Aliphatic	mg/kg	--	--	--
Total Petroleum Hydrocarbons (>C16-C21) Aromatic	mg/kg	--	--	--
Total Petroleum Hydrocarbons (>C21-C35) Aliphatic	mg/kg	--	--	--
Total Petroleum Hydrocarbons (>C28-C35)	mg/kg	20.6 U	20.0 U	23.9 U
Total Petroleum Hydrocarbons (>C6-C35) Aliphatics & Aromatics	mg/kg	--	--	--
Total Petroleum Hydrocarbons (>C6-C8) Aliphatic	mg/kg	--	--	--

Table 2B

Analytical Results Summary
Soil Assessment Sampling
Conoco Phillips - San Juan 28-6 Unit 155N
Rio Arriba County, New Mexico
April and June 2016

	Location ID:	CH-7	CH-8	CH-9
	Sample Name:	SL-11119528-070616-JW-B7-32	SL-11119528-070616-JW-B8-37	SL-11119528-070616-JW-B9-42.5
	Sample Date:	07/06/2016	07/06/2016	07/06/2016
	Depth:	32 ft BGS	37 ft BGS	42.5 ft BGS
Parameters	**Unit**			
Total Petroleum Hydrocarbons (TPH)				
Total Petroleum Hydrocarbons (>C7-C8) Aromatic	mg/kg	--	--	--
Total Petroleum Hydrocarbons (>C8-C10) Aliphatic	mg/kg	--	--	--
Total Petroleum Hydrocarbons (>C8-C10) Aromatic	mg/kg	--	--	--
Total Petroleum Hydrocarbons (C10-C28) DRO	mg/kg	--	--	--
Total Petroleum Hydrocarbons (C21-C35) Aromatic	mg/kg	--	--	--
Total Petroleum Hydrocarbons (C6) Aliphatic	mg/kg	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	20.6 U	20.0 U	23.9 U
Total Petroleum Hydrocarbons (C6-C35)	mg/kg	20.6 U	20.0 U	23.9 U
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	11.8	11.0	11.6 U
General Chemistry				
Percent moisture	%	3.9	2.2	17.1

Notes:

U - Not present at or above the associated value
-- - Not applicable
SIM - Selective Ion Monitoring

Table 2B

Analytical Results Summary
Soil Assessment Sampling
Conoco Phillips - San Juan 28-6 Unit 155N
Rio Arriba County, New Mexico
April and June 2016

Location ID:		**CH-10**	**CH-11**	**CH-11**
Sample Name:		**SL-11119528-070716-JW-B10-42.5**	**11119528-B-11@22.5**	**11119528-B-11@22.5 DUP**
Sample Date:		**07/06/2016**	**07/06/2016**	**07/06/2016**
Depth:		**42.5 ft BGS**	**22.5 ft BGS**	**22.5 ft BGS**
				Duplicate
Parameters	**Unit**			
Volatile Organic Compounds				
Benzene	mg/kg	0.0052 U	0.0055 U	--
Ethylbenzene	mg/kg	0.0052 U	0.0055 U	--
Toluene	mg/kg	0.0052 U	0.0055 U	--
Total Petroleum Hydrocarbons (C6-C10) GRO	mg/kg	0.52 U	0.55 U	--
Xylenes (total)	mg/kg	0.010 U	0.011 U	--
Semivolatile Organic Compounds, SIM				
Acenaphthene	µg/kg	3.4 U	3.6 U	--
Acenaphthylene	µg/kg	3.4 U	3.6 U	--
Anthracene	µg/kg	3.4 U	3.6 U	--
Benzo(a)anthracene	µg/kg	3.4 U	3.6 U	--
Benzo(a)pyrene	µg/kg	3.4 U	3.6 U	--
Benzo(b)fluoranthene	µg/kg	3.4 U	3.6 U	--
Benzo(g,h,i)perylene	µg/kg	3.4 U	3.6 U	--
Benzo(k)fluoranthene	µg/kg	3.4 U	3.6 U	--
Chrysene	µg/kg	3.4 U	3.6 U	--
Dibenz(a,h)anthracene	µg/kg	3.4 U	3.6 U	--
Fluoranthene	µg/kg	3.4 U	3.6 U	--
Fluorene	µg/kg	3.4 U	3.6 U	--
Indeno(1,2,3-cd)pyrene	µg/kg	3.4 U	3.6 U	--
Naphthalene	µg/kg	8.2	3.6 U	--
Phenanthrene	µg/kg	3.4 U	3.6 U	--
Pyrene	µg/kg	3.4 U	3.6 U	--
Total Petroleum Hydrocarbons (TPH)				
Total Petroleum Hydrocarbons (>C10-C12) Aliphatic	mg/kg	--	20.0 U	27.7 U
Total Petroleum Hydrocarbons (>C10-C12) Aromatic	mg/kg	--	20.0 U	27.7 U
Total Petroleum Hydrocarbons (>C12-C16) Aliphatic	mg/kg	--	20.0 U	27.7 U
Total Petroleum Hydrocarbons (>C12-C16) Aromatic	mg/kg	--	20.0 U	27.7 U
Total Petroleum Hydrocarbons (>C12-C28)	mg/kg	20.5 U	47.7 U	--
Total Petroleum Hydrocarbons (>C16-C21) Aliphatic	mg/kg	--	20.0 U	27.7 U
Total Petroleum Hydrocarbons (>C16-C21) Aromatic	mg/kg	--	20.0 U	27.7 U
Total Petroleum Hydrocarbons (>C21-C35) Aliphatic	mg/kg	--	40.0 U	55.4 U
Total Petroleum Hydrocarbons (>C28-C35)	mg/kg	20.5 U	47.7 U	--
Total Petroleum Hydrocarbons (>C6-C35) Aliphatics & Aromatics	mg/kg	--	4.6 U	6.4 U
Total Petroleum Hydrocarbons (>C6-C8) Aliphatic	mg/kg	--	40.0 U	55.4 U

Table 2B

Analytical Results Summary
Soil Assessment Sampling
Conoco Phillips - San Juan 28-6 Unit 155N
Rio Arriba County, New Mexico
April and June 2016

Location ID:		CH-10	CH-11	CH-11
Sample Name:		SL-11119528-070716-JW-B10-42.5	11119528-B-11@22.5	11119528-B-11@22.5 DUP
Sample Date:		07/06/2016	07/06/2016	07/06/2016
Depth:		42.5 ft BGS	22.5 ft BGS	22.5 ft BGS Duplicate
Parameters	**Unit**			
Total Petroleum Hydrocarbons (TPH)				
Total Petroleum Hydrocarbons (>C7-C8) Aromatic	mg/kg	--	4.6 U	6.4 U
Total Petroleum Hydrocarbons (>C8-C10) Aliphatic	mg/kg	--	20.0 U	27.7 U
Total Petroleum Hydrocarbons (>C8-C10) Aromatic	mg/kg	--	30.7 U	42.6 U
Total Petroleum Hydrocarbons (C10-C28) DRO	mg/kg	--	10.9 U	--
Total Petroleum Hydrocarbons (C21-C35) Aromatic	mg/kg	--	40.0 U	55.4 U
Total Petroleum Hydrocarbons (C6) Aliphatic	mg/kg	--	20.0 U	27.7 U
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	20.5 U	47.7 U	--
Total Petroleum Hydrocarbons (C6-C35)	mg/kg	20.5 U	47.7 U	--
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	10 U	10.9 U	--
General Chemistry				
Percent moisture	%	4.5	10.0	4.6

Notes:

U - Not present at or above the associated value
-- - Not applicable
SIM - Selective Ion Monitoring

Table 3

Analytical Methods
Soil Assessment Sampling
Conoco Phillips - San Juan 28-6 Unit 155N
Rio Arriba County, New Mexico
April and June 2016

Parameter	Method	Matrix	Holding Time Collection to Extraction (Days)	Collection or Extraction to Analysis (Days)
Select Volatile Organic Compounds (VOCs)	SW-846 8260B [1]	Soil	-	14
Semi-Volatile Organic Compounds (SVOCs) by SIM	SW-846 8270C [1]	Soil	14	40
Total Petroleum Hydrocarbons-Diesel Range Organics (TPH-DRO)	SW-846 8015M/D [1]	Soil	14	40
Total Petroleum Hydrocarbons-Gasoline Range Organics (TPH-GRO)	SW-846 8015D [1]	Soil	-	14
Total Petroleum Hydrocarbons (TPH)	TX 1005 [2]	Soil	14	14
Total Petroleum Hydrocarbons (TPH)	TX 1006 [3]	Soil	14	28

Notes:

[1] - "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods", SW-846, Third Edition, 1986, with subsequent revisions

[2] - "Total Petroleum Hydrocarbons," Texas Natural Resource Conservation Commission Method 1005, Revision 03, June 1, 2001

[3] - "Characterization of Nc_6 to Nc_{35} Petroleum Hydrocarbons in Environmental Samples: Aliphatic Hydrocarbons, Aromatic Hydrocarbons, Approximate Boiling Point/Carbon Number Distribution," Texas Natural Resource Conservation Commission Draft Method 1006

SIM - Selected Ion Monitoring

Table 4

Qualified Sample Data Due to Outlying of Surrogate Recoveries
Soil Assessment Sampling
Conoco Phillips - San Juan 28-6 Unit 155N
Rio Arriba County, New Mexico
April and June 2016

Parameter	Sample ID	Surrogate	Surrogate % Recovery	Control Limits % Recovery	Analyte	Qualified Result		Units
TPH	S-11119528-042116-CH-1-20	4-Bromofluorobenzene	132	80-120	TPH-GRO	610	J	mg/Kg
TPH	S-11119528-042116-CH-1-30	4-Bromofluorobenzene	143	80-120	TPH-GRO	820	J	mg/Kg
TPH	S-11119528-042116-CH-2-5	4-Bromofluorobenzene	444	80-120	TPH-GRO	1500	J	mg/Kg
TPH	S-11119528-042216-CH-4-5	4-Bromofluorobenzene	470	80-120	TPH-GRO	2800	J	mg/Kg
VOCs	S-11119528-042216-CH-4-5	4-Bromofluorobenzene	258	70-130	Benzene	0.38	J	mg/Kg
		Dibromofluoromethane	0	70-130	Ethylbenzene	2.2	J	mg/Kg
TPH	S-11119528-042216-CH-5-10	4-Bromofluorobenzene	167	80-120	TPH-GRO	240	J	mg/Kg

Notes:

J	- Estimated concentration
GRO	- Gasoline Range Organics
TPH	- Total Petroleum Hydrocarbons
VOC	- Volatile Organic Compounds

Appendix C – Derivation of Exposure Point Concentrations for Human Health Risk Assessment

Table C1. ProUCL Input file for HHRA.

Location	Sample ID	Date	Depth	TPH-DRO	D_TPH-DRO	TPH-GRO	D_TPH-GRO
North Wall	SC-1	2/17/2015	1-19 ft BGS	10	0	3.2	0
South Wall	SC-2	2/17/2015	1-19 ft BGS	10	0	3.2	0
East Wall	SC-3	2/17/2015	1-19 ft BGS	10	0	4.4	0
West Wall	SC-4	2/17/2015	1-19 ft BGS	9.9	0	3.1	0
Base	SC-5	2/17/2015	1-19 ft BGS	640	1	3800	1
Base (2)	SC-5 (2)	4/30/2015	1-19 ft BGS	20	1	3.8	0
S-1	S-1	2/12/2016	-	19	1	27	1
S-2	S-2	2/12/2016	-	130	1	220	1
S-3	S-3	2/12/2016	-	19	1	40	1
S-4	S-4	2/12/2016	-	59	1	91	1
S-5	S-5	2/12/2016	-	36	1	150	1
S-6	S-6	2/12/2016	-	66	1	240	1
CH-1	S-11119528-042116-CH-1-20	4/21/2016	20 ft BGS	240	1	610	1
CH-1	S-11119528-042116-CH-1-30	4/21/2016	30 ft BGS	220	1	820	1
CH-1	S-11119528-042216-CH-1-40	4/22/2016	40 ft BGS	9.6	0	4.7	0
CH-2	S-11119528-042116-CH-2-5	4/21/2016	5 ft BGS	310	1	1500	1
CH-2	S-11119528-042116-CH-2-15	4/21/2016	15 ft BGS	15	1	4.6	0
CH-3	S-11119528-042216-CH-3-5	4/22/2016	5 ft BGS	9.6	0	4.9	0
CH-3	S-11119528-042216-CH-3-10	4/22/2016	10 ft BGS	9.8	0	4.9	0
CH-4	S-11119528-042216-CH-4-5	4/22/2016	5 ft BGS	500	1	2800	1
CH-4	S-11119528-042216-CH-4-15	4/22/2016	15 ft BGS	9.4	0	5	0
CH-5	S-11119528-042216-CH-6-5	4/22/2016	5 ft BGS	9.2	0	4.8	0
CH-5	S-11119528-042216-CH-5-10	4/22/2016	10 ft BGS	280	1	240	1
CH-5	S-11119528-042216-CH-5-15	4/22/2016	10 ft BGS	15	1	4.9	0
CH-5	S-11119528-042216-CH-6-10	4/22/2016	10 ft BGS	9.4	0	4.7	0
CH-7	SL-11119528-070616-JW-B7-32	7/6/2016	32 ft BGS	11.8	1	N/A	0
CH-8	SL-11119528-070616-JW-B8-37	7/6/2016	37 ft BGS	11	1	N/A	0
CH-9	SL-11119528-070616-JW-B9-42.5	7/6/2016	42.5 ft BGS	11.6	0	N/A	0
CH-10	SL-11119528-070716-JW-B10-42.5	7/6/2016	42.5 ft BGS	10	0	N/A	0
CH-11	11119528-B-11@22.5	7/6/2016	22.5 ft BGS	10.9	0	N/A	0
CH-11	11119528-B-11@22.5 DUP	7/6/2016	22.5 ft BGS	N/A	0	N/A	0

Table C2. ProUCL output data for TPH-DRO.

```
                                  UCL Statistics for Data Sets with Non-Detects


              User Selected Options
           Date/Time of Computation   ProUCL 5.18/10/2016 6:24:27 PM
                          From File   ProUCL Input Data for COPECs.xls
                     Full Precision   OFF
             Confidence Coefficient   95%
     Number of Bootstrap Operations   2000

TPH-DRO


                                              General Statistics
                Total Number of Observations    30                  Number of Distinct Observations    23
                                                                     Number of Missing Observations     1
                         Number of Detects      17                           Number of Non-Detects     13
                Number of Distinct Detects      15                  Number of Distinct Non-Detects      8
                           Minimum Detect       11                             Minimum Non-Detect      9.2
                           Maximum Detect      640                             Maximum Non-Detect     11.6
                          Variance Detects   35801                            Percent Non-Detects     43.33%
                              Mean Detects   152.5                                     SD Detects   189.2
                            Median Detects      59                                     CV Detects     1.241
                          Skewness Detects       1.505                           Kurtosis Detects     1.659
                    Mean of Logged Detects       4.165                        SD of Logged Detects     1.431


                                         Normal GOF Test on Detects Only
                 Shapiro Wilk Test Statistic     0.772                   Shapiro Wilk GOF Test
              5% Shapiro Wilk Critical Value     0.892   Detected Data Not Normal at 5% Significance Level
                    Lilliefors Test Statistic    0.264                    Lilliefors GOF Test
                 5% Lilliefors Critical Value    0.207   Detected Data Not Normal at 5% Significance Level
                                   Detected Data Not Normal at 5% Significance Level


           Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs
                                      KM Mean    90.38                      KM Standard Error of Mean    29.24
                                        KM SD   155.3                               95% KM (BCA) UCL   142.1
                               95% KM (t) UCL   140.1               95% KM (Percentile Bootstrap) UCL   139.6
                               95% KM (z) UCL   138.5                          95% KM Bootstrap t UCL   166.4
                       90% KM Chebyshev UCL     178.1                          95% KM Chebyshev UCL     217.8
                     97.5% KM Chebyshev UCL     273                            99% KM Chebyshev UCL     381.3


                                   Gamma GOF Tests on Detected Observations Only
                         A-D Test Statistic      0.828                  Anderson-Darling GOF Test
                       5% A-D Critical Value     0.781   Detected Data Not Gamma Distributed at 5% Significance Level
                         K-S Test Statistic      0.213                    Kolmogorov-Smirnov GOF
                       5% K-S Critical Value     0.218  Detected data appear Gamma Distributed at 5% Significance Level
                          Detected data follow Appr. Gamma Distribution at 5% Significance Level
```

Gamma Statistics on Detected Data Only

k hat (MLE)	0.701	k star (bias corrected MLE)	0.617
Theta hat (MLE)	217.5	Theta star (bias corrected MLE)	247.3
nu hat (MLE)	23.84	nu star (bias corrected)	20.96
Mean (detects)	152.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	86.4
Maximum	640	Median	13.4
SD	160.2	CV	1.854
k hat (MLE)	0.182	k star (bias corrected MLE)	0.186
Theta hat (MLE)	473.9	Theta star (bias corrected MLE)	463.7
nu hat (MLE)	10.94	nu star (bias corrected)	11.18
Adjusted Level of Significance (β)	0.041		
Approximate Chi Square Value (11.18, α)	4.691	Adjusted Chi Square Value (11.18, β)	4.45
95% Gamma Approximate UCL (use when n>=50)	205.9	95% Gamma Adjusted UCL (use when n<50)	217

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	90.38	SD (KM)	155.3
Variance (KM)	24133	SE of Mean (KM)	29.24
k hat (KM)	0.339	k star (KM)	0.327
nu hat (KM)	20.31	nu star (KM)	19.61
theta hat (KM)	267	theta star (KM)	276.5
80% gamma percentile (KM)	141.3	90% gamma percentile (KM)	263.6
95% gamma percentile (KM)	402.1	99% gamma percentile (KM)	758.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (19.61, α)	10.57	Adjusted Chi Square Value (19.61, β)	10.18
95% Gamma Approximate KM-UCL (use when n>=50)	167.8	95% Gamma Adjusted KM-UCL (use when n<50)	174.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.892	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.205	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.207	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	87.28	Mean in Log Scale	2.601
SD in Original Scale	159.7	SD in Log Scale	2.145
95% t UCL (assumes normality of ROS data)	136.8	95% Percentile Bootstrap UCL	139.5
95% BCA Bootstrap UCL	145	95% Bootstrap t UCL	159.1
95% H-UCL (Log ROS)	707.4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.322	KM Geo Mean	27.73
KM SD (logged)	1.422	95% Critical H Value (KM-Log)	3.05
KM Standard Error of Mean (logged)	0.268	95% H-UCL (KM -Log)	170.4
KM SD (logged)	1.422	95% Critical H Value (KM-Log)	3.05
KM Standard Error of Mean (logged)	0.268		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	88.55	Mean in Log Scale	3.055
SD in Original Scale	159	SD in Log Scale	1.673
95% t UCL (Assumes normality)	137.9	95% H-Stat UCL	249.3

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

a Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	174.1

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table C3. ProUCL output data for TPH-DRO.

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.18/10/2016 6:25:08 PM
From File	ProUCL Input Data for COPECs.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

TPH-GRO

General Statistics

Total Number of Observations	25	Number of Distinct Observations	20
		Number of Missing Observations	6
Number of Detects	12	Number of Non-Detects	13
Number of Distinct Detects	11	Number of Distinct Non-Detects	9
Minimum Detect	27	Minimum Non-Detect	3.1
Maximum Detect	3800	Maximum Non-Detect	5
Variance Detects	1501554	Percent Non-Detects	52%
Mean Detects	878.2	SD Detects	1225
Median Detects	240	CV Detects	1.395
Skewness Detects	1.742	Kurtosis Detects	2.178
Mean of Logged Detects	5.79	SD of Logged Detects	1.579

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.723	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.282	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	423.1	KM Standard Error of Mean	192.8
KM SD	922.9	95% KM (BCA) UCL	779.4
95% KM (t) UCL	753	95% KM (Percentile Bootstrap) UCL	761
95% KM (z) UCL	740.3	95% KM Bootstrap t UCL	1244
90% KM Chebyshev UCL	1002	95% KM Chebyshev UCL	1264
97.5% KM Chebyshev UCL	1627	99% KM Chebyshev UCL	2341

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.415	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.775	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.257	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.622	k star (bias corrected MLE)	0.522
Theta hat (MLE)	1412	Theta star (bias corrected MLE)	1682
nu hat (MLE)	14.93	nu star (bias corrected)	12.53

Mean (detects)	878.2

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	421.5
Maximum	3800	Median	0.01
SD	942.7	CV	2.236
k hat (MLE)	0.138	k star (bias corrected MLE)	0.148
Theta hat (MLE)	3065	Theta star (bias corrected MLE)	2854
nu hat (MLE)	6.875	nu star (bias corrected)	7.384
Adjusted Level of Significance (β)	0.0395		
Approximate Chi Square Value (7.38, α)	2.384	Adjusted Chi Square Value (7.38, β)	2.194
95% Gamma Approximate UCL (use when n>=50)	1306	95% Gamma Adjusted UCL (use when n<50)	1418

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	423.1	SD (KM)	922.9
Variance (KM)	851813	SE of Mean (KM)	192.8
k hat (KM)	0.21	k star (KM)	0.212
nu hat (KM)	10.51	nu star (KM)	10.58
theta hat (KM)	2013	theta star (KM)	1999
80% gamma percentile (KM)	573.6	90% gamma percentile (KM)	1279
95% gamma percentile (KM)	2148	99% gamma percentile (KM)	4517

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.58, α)	4.308	Adjusted Chi Square Value (10.58, β)	4.038
95% Gamma Approximate KM-UCL (use when n>=50)	1039	95% Gamma Adjusted KM-UCL (use when n<50)	1109

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.161	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	424.1	Mean in Log Scale	3.498
SD in Original Scale	941.5	SD in Log Scale	2.539
95% t UCL (assumes normality of ROS data)	746.3	95% Percentile Bootstrap UCL	752.5
95% BCA Bootstrap UCL	885.5	95% Bootstrap t UCL	1230
95% H-UCL (Log ROS)	10355		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.367	KM Geo Mean	29
KM SD (logged)	2.552	95% Critical H Value (KM-Log)	4.889
KM Standard Error of Mean (logged)	0.533	95% H-UCL (KM -Log)	9611
KM SD (logged)	2.552	95% Critical H Value (KM-Log)	4.889
KM Standard Error of Mean (logged)	0.533		

DL/2 Statistics

DL/2 Normal	**DL/2 Log-Transformed**

Mean in Original Scale	422.6	Mean in Log Scale	3.172
SD in Original Scale	942.2	SD in Log Scale	2.783
95% t UCL (Assumes normality)	745	95% H-Stat UCL	23034

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

a Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1) 1109

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix D1 – Report County Species List for Rio Arriba

APPENDIX D-1

REPORT COUNTY SPECIES LIST FOR RIO ARRIBA
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Species ID	Common Name	Scientific Name	County
10010	Largemouth Bass	Micropterus salmoides	Rio Arriba
10020	Smallmouth Bass	Micropterus dolomieui	Rio Arriba
10045	Bluegill	Lepomis macrochirus	Rio Arriba
10065	Black Bullhead	Ameiurus melas	Rio Arriba
10080	Common Carp	Cyprinus carpio	Rio Arriba
10090	River Carpsucker	Carpiodes carpio	Rio Arriba
10100	Channel Catfish	Ictalurus punctatus	Rio Arriba
10130	Flathead Chub	Platygobio gracilis	Rio Arriba
10140	Rio Grande Chub	Gila pandora	Rio Arriba
10145	Roundtail Chub (upper basin populations)	Gila robusta	Rio Arriba
10165	White Crappie	Pomoxis annularis	Rio Arriba
10175	Longnose Dace	Rhinichthys cataractae	Rio Arriba
10185	Speckled Dace (Non-Gila pop.)	Rhinichthys osculus	Rio Arriba
10260	Plains Killifish	Fundulus zebrinus	Rio Arriba
10285	Fathead Minnow	Pimephales promelas	Rio Arriba
10325	Western mosquitofish	Gambusia affinis	Rio Arriba
10335	Yellow Perch	Perca flavescens	Rio Arriba
10340	Northern Pike	Esox lucius	Rio Arriba
10375	Kokanee Salmon	Oncorhynchus nerka	Rio Arriba
10385	Mottled Sculpin	Cottus bairdi	Rio Arriba
10430	Red Shiner	Cyprinella lutrensis	Rio Arriba
10495	Bluehead Sucker	Catostomus discobolus discobolus	Rio Arriba
10505	Flannelmouth Sucker	Catostomus latipinnis	Rio Arriba
10515	Rio Grande Sucker	Catostomus plebeius	Rio Arriba
10525	White Sucker	Catostomus commersoni	Rio Arriba
10530	Green Sunfish	Lepomis cyanellus	Rio Arriba
10570	Brook Trout	Salvelinus fontinalis	Rio Arriba
10575	Brown Trout	Salmo trutta	Rio Arriba
10585	Rio Grande Cutthroat Trout	Oncorhynchus clarkii virginalis	Rio Arriba
10595	Cutthroat Trout	Oncorhynchus clarkii	Rio Arriba
10610	Lake Trout	Salvelinus namaycush	Rio Arriba
10615	Rainbow Trout	Oncorhynchus mykiss	Rio Arriba
10630	Walleye	Stizostedion vitreum	Rio Arriba
20005	Bullfrog	Lithobates catesbeianus	Rio Arriba
20015	Boreal Chorus Frog	Pseudacris maculata	Rio Arriba
20035	Northern Leopard Frog	Lithobates pipiens	Rio Arriba
20040	Plains Leopard Frog	Lithobates blairi	Rio Arriba

APPENDIX D-1

REPORT COUNTY SPECIES LIST FOR RIO ARRIBA
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Species ID	Common Name	Scientific Name	County
20060	Jemez Mountains Salamander	Plethodon neomexicanus	Rio Arriba
20070	Tiger Salamander	Ambystoma mavortium mavortium; nebulosum	Rio Arriba
20080	New Mexico Spadefoot	Spea multiplicata	Rio Arriba
20085	Plains Spadefoot	Spea bombifrons	Rio Arriba
20090	Boreal Toad	Anaxyrus boreas boreas	Rio Arriba
20100	Great Plains Toad	Anaxyrus cognatus	Rio Arriba
20130	Woodhouse's Toad	Anaxyrus woodhousii	Rio Arriba
30005	Coachwhip	Coluber flagellum	Rio Arriba
30030	Eastern Collared Lizard	Crotaphytus collaris	Rio Arriba
30045	Common Lesser Earless Lizard	Holbrookia maculata approximans; maculata; bunkeri	Rio Arriba
30057	Plateau Fence Lizard	Sceloporus tristichus	Rio Arriba
30065	Round-tailed Horned Lizard	Phrynosoma modestum	Rio Arriba
30085	Northern Sagebrush Lizard	Sceloporus graciosus	Rio Arriba
30090	Hernandez's Short-horned Lizard	Phrynosoma hernandesi	Rio Arriba
30095	Common Side-blotched Lizard	Uta stansburiana	Rio Arriba
30120	Northern Tree Lizard	Urosaurus ornatus	Rio Arriba
30160	Western Diamond-backed Rattlesnake	Crotalus atrox	Rio Arriba
30180	Prairie Rattlesnake	Crotalus viridis	Rio Arriba
30200	Many-lined Skink	Plestiodon multivirgatus	Rio Arriba
30230	Texas Blind Snake	Rena dissectus	Rio Arriba
30245	Great Plains Rat Snake	Pantherophis emoryi	Rio Arriba
30250	Black-necked Gartersnake	Thamnophis cyrtopsis	Rio Arriba
30259	New Mexico Gartersnake	Thamnophis sirtalis	Rio Arriba
30280	Wandering Gartersnake	Thamnophis elegans	Rio Arriba
30285	Glossy Snake	Arizona elegans	Rio Arriba
30290	Gophersnake	Pituophis catenifer	Rio Arriba
30295	Smooth Greensnake	Opheodrys vernalis	Rio Arriba
30310	Plains Hog-nosed Snake	Heterodon nasicus	Rio Arriba
30350	Milk Snake	Lampropeltis triangulum	Rio Arriba
30365	Mountain Patchnose Snake	Salvadora grahamiae	Rio Arriba
30435	Western Painted Turtle	Chrysemys picta	Rio Arriba
30450	Desert Striped Whipsnake	Coluber taeniatus	Rio Arriba
30475	New Mexico Whiptail	Aspidoscelis neomexicana	Rio Arriba
30485	Chihuahuan Spotted Whiptail	Aspidoscelis exsanguis	Rio Arriba
30515	Plateau Striped Whiptail	Aspidoscelis velox	Rio Arriba
40015	American Avocet	Recurvirostra americana	Rio Arriba

APPENDIX D-1

REPORT COUNTY SPECIES LIST FOR RIO ARRIBA

SAN JUAN 28-6 #155N, S28, T27N, R6W

ECOLOGICAL RISK ASSESSMENT

CONOCOPHILLIPS COMPANY

RIO ARRIBA COUNTY, NEW MEXICO

Species ID	Common Name	Scientific Name	County
40030	American Bittern	Botaurus lentiginosus	Rio Arriba
40035	Least Bittern	Ixobrychus exilis exilis	Rio Arriba
40040	Common Black Hawk	Buteogallus anthracinus	Rio Arriba
40045	Brewer's Blackbird	Euphagus cyanocephalus	Rio Arriba
40050	Red-winged Blackbird	Agelaius phoeniceus	Rio Arriba
40055	Rusty Blackbird	Euphagus carolinus	Rio Arriba
40060	Yellow-headed Blackbird	Xanthocephalus xanthocephalus	Rio Arriba
40065	Eastern Bluebird	Sialia sialis	Rio Arriba
40070	Mountain Bluebird	Sialia currucoides	Rio Arriba
40075	Western Bluebird	Sialia mexicana	Rio Arriba
40080	Bobolink	Dolichonyx oryzivorus	Rio Arriba
40100	Indigo Bunting	Passerina cyanea	Rio Arriba
40105	Lark Bunting	Calamospiza melanocorys	Rio Arriba
40110	Lazuli Bunting	Passerina amoena	Rio Arriba
40130	Bushtit	Psaltriparus minimus	Rio Arriba
40150	Gray Catbird	Dumetella carolinensis	Rio Arriba
40155	Yellow-breasted Chat	Icteria virens	Rio Arriba
40160	Black-capped Chickadee	Poecile atricapilla	Rio Arriba
40175	Mountain Chickadee	Poecile gambeli	Rio Arriba
40185	American Coot	Fulica americana	Rio Arriba
40190	Double-crested Cormorant	Phalacrocorax auritus	Rio Arriba
40205	Brown-headed Cowbird	Molothrus ater	Rio Arriba
40215	Sandhill Crane	Grus canadensis	Rio Arriba
40225	Brown Creeper	Certhia americana	Rio Arriba
40230	Red Crossbill	Loxia curvirostra	Rio Arriba
40240	American Crow	Corvus brachyrhynchos	Rio Arriba
40250	Yellow-billed Cuckoo (western pop)	Coccyzus americanus occidentalis	Rio Arriba
40255	Long-billed Curlew	Numenius americanus	Rio Arriba
40260	Dickcissel	Spiza americana	Rio Arriba
40265	American Dipper	Cinclus mexicanus	Rio Arriba
40275	Mourning Dove	Zenaida macroura	Rio Arriba
40304	Bufflehead Duck	Bucephala albeola	Rio Arriba
40306	Canvasback Duck	Aythya valisineria	Rio Arriba
40308	Gadwall Duck	Anas strepera	Rio Arriba
40312	Barrow's Goldeneye Duck	Bucephala islandica	Rio Arriba
40314	Common Goldeneye Duck	Bucephala clangula	Rio Arriba
40318	Mallard Duck	Anas platyrhynchos	Rio Arriba

APPENDIX D-1

REPORT COUNTY SPECIES LIST FOR RIO ARRIBA
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Species ID	Common Name	Scientific Name	County
40322	Common Merganser Duck	Mergus merganser	Rio Arriba
40324	Hooded Merganser Duck	Lophodytes cucullatus	Rio Arriba
40332	Northern Pintail	Anas acuta	Rio Arriba
40334	Redhead Duck	Aythya americana	Rio Arriba
40336	Ring-necked Duck	Aythya collaris	Rio Arriba
40338	Ruddy Duck	Oxyura jamaicensis	Rio Arriba
40342	Lesser Scaup Duck	Aythya affinis	Rio Arriba
40350	Northern Shoveler Duck	Anas clypeata	Rio Arriba
40352	Blue-winged Teal Duck	Anas discors	Rio Arriba
40354	Cinnamon Teal Duck	Anas cyanoptera	Rio Arriba
40356	Green-winged Teal Duck	Anas crecca	Rio Arriba
40362	American Wigeon Duck	Anas americana	Rio Arriba
40366	Wood Duck	Aix sponsa	Rio Arriba
40370	Bald Eagle	Haliaeetus leucocephalus	Rio Arriba
40372	Golden Eagle	Aquila chrysaetos	Rio Arriba
40378	Snowy Egret	Egretta thula	Rio Arriba
40384	Peregrine Falcon	Falco peregrinus	Rio Arriba
40385	Arctic Peregrine Falcon	Falco peregrinus tundrius	Rio Arriba
40390	Prairie Falcon	Falco mexicanus	Rio Arriba
40395	Cassin's Finch	Haemorhous cassinii	Rio Arriba
40400	House Finch	Haemorhous mexicanus	Rio Arriba
40410	Black Rosy-Finch	Leucosticte atrata	Rio Arriba
40415	Brown-capped Rosy-Finch	Leucosticte australis	Rio Arriba
40425	Northern Flicker	Colaptes auratus	Rio Arriba
40440	Ash-throated Flycatcher	Myiarchus cinerascens	Rio Arriba
40453	Cordilleran Flycatcher	Empidonax occidentalis	Rio Arriba
40455	Dusky Flycatcher	Empidonax oberholseri	Rio Arriba
40470	Gray Flycatcher	Empidonax wrightii	Rio Arriba
40480	Hammond's Flycatcher	Empidonax hammondii	Rio Arriba
40495	Olive-sided Flycatcher	Contopus cooperi	Rio Arriba
40520	Willow Flycatcher	Empidonax traillii brewsteri; adastus	Rio Arriba
40521	Southwestern Willow Flycatcher	Empidonax traillii extimus	Rio Arriba
40550	Blue-gray Gnatcatcher	Polioptila caerulea	Rio Arriba
40575	American Goldfinch	Spinus tristis	Rio Arriba
40585	Lesser Goldfinch	Spinus psaltria	Rio Arriba
40590	Canada Goose	Branta canadensis	Rio Arriba
40610	Northern Goshawk	Accipiter gentilis	Rio Arriba

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Species ID	Common Name	Scientific Name	County
40615	Common Grackle	Quiscalus quiscula	Rio Arriba
40620	Great-tailed Grackle	Quiscalus mexicanus	Rio Arriba
40625	Clark's Grebe	Aechmophorus clarkii	Rio Arriba
40630	Eared Grebe	Podiceps nigricollis	Rio Arriba
40635	Horned Grebe	Podiceps auritus	Rio Arriba
40645	Pied-billed Grebe	Podilymbus podiceps	Rio Arriba
40655	Western Grebe	Aechmophorus occidentalis	Rio Arriba
40660	Black-headed Grosbeak	Pheucticus melanocephalus	Rio Arriba
40665	Blue Grosbeak	Passerina caerulea	Rio Arriba
40670	Evening Grosbeak	Coccothraustes vespertinus	Rio Arriba
40675	Pine Grosbeak	Pinicola enucleator	Rio Arriba
40700	Dusky Grouse	Dendragapus obscurus	Rio Arriba
40725	Bonaparte's Gull	Choricocephalus philadelphia	Rio Arriba
40730	California Gull	Larus californicus	Rio Arriba
40770	Ring-billed Gull	Larus delawarensis	Rio Arriba
40790	Northern Harrier	Circus cyaneus	Rio Arriba
40795	Broad-winged Hawk	Buteo platypterus	Rio Arriba
40800	Cooper's Hawk	Accipiter cooperii	Rio Arriba
40805	Ferruginous Hawk	Buteo regalis	Rio Arriba
40825	Red-tailed Hawk	Buteo jamaicensis	Rio Arriba
40830	Rough-legged Hawk	Buteo lagopus	Rio Arriba
40835	Sharp-shinned Hawk	Accipiter striatus	Rio Arriba
40840	Swainson's Hawk	Buteo swainsoni	Rio Arriba
40850	Zone-tailed Hawk	Buteo albonotatus	Rio Arriba
40855	Great Blue Heron	Ardea herodias	Rio Arriba
40870	Black-crowned Night-Heron	Nycticorax nycticorax	Rio Arriba
40895	Black-chinned Hummingbird	Archilochus alexandri	Rio Arriba
40910	Broad-tailed Hummingbird	Selasphorus platycercus	Rio Arriba
40935	Magnificent Hummingbird	Eugenes fulgens	Rio Arriba
40945	Rufous Hummingbird	Selasphorus rufus	Rio Arriba
40970	White-faced Ibis	Plegadis chihi	Rio Arriba
40990	Blue Jay	Cyanocitta cristata	Rio Arriba
40995	Gray Jay	Perisoreus canadensis	Rio Arriba
41005	Pinyon Jay	Gymnorhinus cyanocephalus	Rio Arriba
41010	Western Scrub Jay	Aphelocoma californica	Rio Arriba
41015	Steller's Jay	Cyanocitta stelleri	Rio Arriba
41020	Dark-eyed Junco	Junco hyemalis	Rio Arriba

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Species ID	Common Name	Scientific Name	County
41030	American Kestrel	Falco sparverius	Rio Arriba
41035	Killdeer	Charadrius vociferus	Rio Arriba
41040	Cassin's Kingbird	Tyrannus vociferans	Rio Arriba
41050	Eastern Kingbird	Tyrannus tyrannus	Rio Arriba
41065	Western Kingbird	Tyrannus verticalis	Rio Arriba
41070	Belted Kingfisher	Megaceryle alcyon	Rio Arriba
41080	Golden-crowned Kinglet	Regulus satrapa	Rio Arriba
41085	Ruby-crowned Kinglet	Regulus calendula	Rio Arriba
41105	Mississippi Kite	Ictinia mississippiensis	Rio Arriba
41125	Horned Lark	Eremophila alpestris	Rio Arriba
41150	Common Loon	Gavia immer	Rio Arriba
41165	Black-billed Magpie	Pica hudsonia	Rio Arriba
41175	Purple Martin	Progne subis	Rio Arriba
41185	Western Meadowlark	Sturnella neglecta	Rio Arriba
41210	Northern Mockingbird	Mimus polyglottos	Rio Arriba
41225	Common Nighthawk	Chordeiles minor	Rio Arriba
41240	Clark's Nutcracker	Nucifraga columbiana	Rio Arriba
41245	Pygmy Nuthatch	Sitta pygmaea	Rio Arriba
41250	Red-breasted Nuthatch	Sitta canadensis	Rio Arriba
41255	White-breasted Nuthatch	Sitta carolinensis	Rio Arriba
41280	Bullock's Oriole	Icterus bullockii	Rio Arriba
41281	Baltimore Oriole	Icterus galbula	Rio Arriba
41290	Scott's Oriole	Icterus parisorum	Rio Arriba
41300	Osprey	Pandion haliaetus	Rio Arriba
41305	Ovenbird	Seiurus aurocapilla	Rio Arriba
41315	Boreal Owl	Aegolius funereus	Rio Arriba
41320	Burrowing Owl	Athene cunicularia	Rio Arriba
41330	Flammulated Owl	Psiloscops flammeolus	Rio Arriba
41335	Great Horned Owl	Bubo virginianus	Rio Arriba
41340	Long-eared Owl	Asio otus	Rio Arriba
41345	Northern Pygmy Owl	Glaucidium gnoma	Rio Arriba
41355	Western Screech-Owl	Megascops kennicottii	Rio Arriba
41375	Mexican Spotted Owl	Strix occidentalis lucida	Rio Arriba
41395	Northern Parula	Setophaga americana	Rio Arriba
41400	Brown Pelican	Pelecanus occidentalis	Rio Arriba
41405	American White Pelican	Pelecanus erythrorhynchos	Rio Arriba
41420	Western Wood Pewee	Contopus sordidulus	Rio Arriba

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Species ID	Common Name	Scientific Name	County
41440	Wilson's Phalarope	Phalaropus tricolor	Rio Arriba
41450	Black Phoebe	Sayornis nigricans	Rio Arriba
41455	Eastern Phoebe	Sayornis phoebe	Rio Arriba
41460	Say's Phoebe	Sayornis saya	Rio Arriba
41465	Band-tailed Pigeon	Patagioenas fasciata	Rio Arriba
41480	American Pipit	Anthus rubescens	Rio Arriba
41500	Mountain Plover	Charadrius montanus	Rio Arriba
41520	Common Poorwill	Phalaenoptilus nuttalli	Rio Arriba
41530	White-tailed Ptarmigan	Lagopus leucura	Rio Arriba
41540	Gambel's Quail	Callipepla gambelii	Rio Arriba
41550	Scaled Quail	Callipepla squamata	Rio Arriba
41565	Virginia Rail	Rallus limicola	Rio Arriba
41580	Common Raven	Corvus corax	Rio Arriba
41610	Greater Roadrunner	Geococcyx californianus	Rio Arriba
41615	American Robin	Turdus migratorius	Rio Arriba
41650	Least Sandpiper	Calidris minutilla	Rio Arriba
41670	Spotted Sandpiper	Actitis macularia	Rio Arriba
41680	Upland Sandpiper	Bartramia longicauda	Rio Arriba
41685	Western Sandpiper	Calidris mauri	Rio Arriba
41700	Red-naped Sapsucker	Sphyrapicus nuchalis	Rio Arriba
41705	Williamson's Sapsucker	Sphyrapicus thyroideus	Rio Arriba
41710	Yellow-bellied Sapsucker	Sphyrapicus varius	Rio Arriba
41750	Loggerhead Shrike	Lanius ludovicianus	Rio Arriba
41755	Northern Shrike	Lanius excubitor	Rio Arriba
41760	Pine Siskin	Spinus pinus	Rio Arriba
41770	Wilson's Snipe	Gallinago delicata	Rio Arriba
41775	Townsend's Solitaire	Myadestes townsendi	Rio Arriba
41780	Sora	Porzana carolina	Rio Arriba
41785	Baird's Sparrow	Ammodramus bairdii	Rio Arriba
41795	Black-throated Sparrow	Amphispiza bilineata	Rio Arriba
41805	Brewer's Sparrow	Spizella breweri	Rio Arriba
41815	Chipping Sparrow	Spizella passerina	Rio Arriba
41855	House Sparrow	Passer domesticus	Rio Arriba
41860	Lark Sparrow	Chondestes grammacus	Rio Arriba
41870	Lincoln's Sparrow	Melospiza lincolnii	Rio Arriba
41880	Sagebrush Sparrow	Artemisiospiza nevadensis	Rio Arriba

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Species ID	Common Name	Scientific Name	County
41885	Savannah Sparrow	Passerculus sandwichensis nevadensis; anthinus	Rio Arriba
41890	Song Sparrow	Melospiza melodia	Rio Arriba
41895	Swamp Sparrow	Melospiza georgiana	Rio Arriba
41905	Vesper Sparrow	Pooecetes gramineus	Rio Arriba
41910	White-crowned Sparrow	Zonotrichia leucophrys	Rio Arriba
41930	European Starling	Sturnus vulgaris	Rio Arriba
41945	Bank Swallow	Riparia riparia	Rio Arriba
41950	Barn Swallow	Hirundo rustica	Rio Arriba
41960	Cliff Swallow	Petrochelidon pyrrhonota	Rio Arriba
41965	N. Rough-winged Swallow	Stelgidopteryx serripennis	Rio Arriba
41970	Tree Swallow	Tachycineta bicolor	Rio Arriba
41975	Violet-green Swallow	Tachycineta thalassina	Rio Arriba
41990	Black Swift	Cypseloides niger	Rio Arriba
41995	Chimney Swift	Chaetura pelagica	Rio Arriba
42005	White-throated Swift	Aeronautes saxatalis	Rio Arriba
42010	Hepatic Tanager	Piranga flava	Rio Arriba
42020	Summer Tanager	Piranga rubra	Rio Arriba
42025	Western Tanager	Piranga ludoviciana	Rio Arriba
42050	Black Tern	Chlidonias niger	Rio Arriba
42070	Least Tern	Sternula antillarum	Rio Arriba
42075	Bendire's Thrasher	Toxostoma bendirei	Rio Arriba
42080	Brown Thrasher	Toxostoma rufum	Rio Arriba
42095	Sage Thrasher	Oreoscoptes montanus	Rio Arriba
42110	Hermit Thrush	Catharus guttatus	Rio Arriba
42115	Swainson's Thrush	Catharus ustulatus	Rio Arriba
42135	Juniper Titmouse	Baeolophus ridgwayi	Rio Arriba
42145	Canyon Towhee	Melozone fusca	Rio Arriba
42150	Green-tailed Towhee	Pipilo chlorurus	Rio Arriba
42155	Spotted Towhee	Pipilo maculatus	Rio Arriba
42200	Gray Vireo	Vireo vicinior	Rio Arriba
42215	Red-eyed Vireo	Vireo olivaceus	Rio Arriba
42220	Blue-headed Vireo	Vireo solitarius	Rio Arriba
42221	Cassin's Vireo	Vireo cassinii	Rio Arriba
42222	Plumbeous Vireo	Vireo plumbeus	Rio Arriba
42225	Warbling Vireo	Vireo gilvus	Rio Arriba
42245	Turkey Vulture	Cathartes aura	Rio Arriba

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Species ID	Common Name	Scientific Name	County
42320	Grace's Warbler	Setophaga graciae	Rio Arriba
42325	Black-throated Gray Warbler	Setophaga nigrescens	Rio Arriba
42330	Black-throated Green Warbler	Setophaga virens	Rio Arriba
42340	Hooded Warbler	Setophaga citrina	Rio Arriba
42355	Macgillivray's Warbler	Geothlypis tolmiei	Rio Arriba
42380	Orange-crowned Warbler	Oreothlypis celata	Rio Arriba
42385	Palm Warbler	Setophaga palmarum	Rio Arriba
42430	Virginia's Warbler	Oreothlypis virginiae	Rio Arriba
42435	Wilson's Warbler	Cardellina pusilla	Rio Arriba
42445	Yellow Warbler	Setophaga petechia	Rio Arriba
42450	Yellow-rumped Warbler	Setophaga coronata	Rio Arriba
42465	Northern Waterthrush	Parkesia noveboracensis	Rio Arriba
42470	Bohemian Waxwing	Bombycilla garrulus	Rio Arriba
42475	Cedar Waxwing	Bombycilla cedrorum	Rio Arriba
42485	Mexican Whip-poor-will	Antrostomus arizonae	Rio Arriba
42515	Downy Woodpecker	Picoides pubescens	Rio Arriba
42530	Hairy Woodpecker	Picoides villosus	Rio Arriba
42535	Ladder-backed Woodpecker	Picoides scalaris	Rio Arriba
42540	Lewis's Woodpecker	Melanerpes lewis	Rio Arriba
42555	Red-headed Woodpecker	Melanerpes erythrocephalus	Rio Arriba
42565	American Three-toed Woodpecker	Picoides dorsalis	Rio Arriba
42575	Bewick's Wren	Thryomanes bewickii	Rio Arriba
42585	Canyon Wren	Catherpes mexicanus	Rio Arriba
42595	House Wren	Troglodytes aedon	Rio Arriba
42600	Marsh Wren	Cistothorus palustris	Rio Arriba
42605	Rock Wren	Salpinctes obsoletus	Rio Arriba
42615	Winter Wren	Troglodytes hemialis	Rio Arriba
42630	Common Yellowthroat	Geothlypis trichas	Rio Arriba
50010	American Badger	Taxidea taxus	Rio Arriba
50025	Pale Townsend's Big-eared Bat	Corynorhinus townsendii	Rio Arriba
50030	Big Brown Bat	Eptesicus fuscus	Rio Arriba
50033	California Myotis	Myotis californicus	Rio Arriba
50037	Big Free-tailed Bat	Nyctinomops macrotis	Rio Arriba
50040	Brazilian Free-tailed Bat	Tadarida brasiliensis	Rio Arriba
50047	Fringed Myotis	Myotis thysanodes	Rio Arriba
50050	Hoary Bat	Lasiurus cinereus	Rio Arriba
50057	Long-eared Myotis	Myotis evotis	Rio Arriba

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Species ID	Common Name	Scientific Name	County
50059	Long-legged Myotis	Myotis volans	Rio Arriba
50080	Pallid Bat	Antrozous pallidus	Rio Arriba
50083	Canyon Bat	Parastrellus hesperus	Rio Arriba
50090	Silver-haired Bat	Lasionycteris noctivagans	Rio Arriba
50093	Western Small-footed Myotis	Myotis ciliolabrum	Rio Arriba
50095	Spotted Bat	Euderma maculatum	Rio Arriba
50103	Yuma Myotis	Myotis yumanensis	Rio Arriba
50105	Black Bear	Ursus americanus	Rio Arriba
50115	American Beaver	Castor canadensis	Rio Arriba
50130	Bobcat	Lynx rufus	Rio Arriba
50145	Colorado Chipmunk	Tamias quadrivittatus quadrivittatus; australis; oscuraensis	Rio Arriba
50160	Least Chipmunk	Tamias minimus atristriatus; operarius; chuskaensis	Rio Arriba
50185	Coyote	Canis latrans	Rio Arriba
50190	Mule Deer	Odocoileus hemionus	Rio Arriba
50194	White-tailed Deer (Texas)	Odocoileus virginianus texana	Rio Arriba
50197	Moose	Alces alces	Rio Arriba
50205	Gunnison's prairie dog (prairie subspecies)	Cynomys gunnisoni zuniensis	Rio Arriba
50206	Gunnison's Prairie Dog (montane subspecies)	Cynomys gunnisoni gunnisoni	Rio Arriba
50215	Elk	Cervus canadensis nelsoni	Rio Arriba
50230	Common Gray Fox	Urocyon cinereoargenteus	Rio Arriba
50235	Kit Fox	Vulpes macrotis	Rio Arriba
50240	Red Fox	Vulpes vulpes	Rio Arriba
50255	Botta's Pocket Gopher	Thomomys bottae actuosus; alienus; aureus; collis; connectens; cultellus; fulvus; guadalupensis; lachuguilla; mearnsi; morulus; opulentus; paguatae; pectoralis; peramplus; pervagus; planorum; rufidulus; ruidosae; others	Rio Arriba
50265	Northern Pocket Gopher	Thomomys talpoides fossor; kaibabensis	Rio Arriba
50287	Feral Horse	Equus caballus	Rio Arriba
50320	Mountain Lion	Puma concolor	Rio Arriba
50325	Canada Lynx	Lynx canadensis	Rio Arriba
50330	Yellow-bellied Marmot	Marmota flaviventris	Rio Arriba
50335	Pacific Marten	Martes caurina	Rio Arriba
50355	Brush Mouse	Peromyscus boylii	Rio Arriba
50365	Canyon Mouse	Peromyscus crinitus	Rio Arriba

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Species ID	Common Name	Scientific Name	County
50370	Deer Mouse	Peromyscus maniculatus	Rio Arriba
50380	N. Grasshopper Mouse	Onychomys leucogaster	Rio Arriba
50400	Western Harvest Mouse	Reithrodontomys megalotis megalotis; aztecus	Rio Arriba
50405	House Mouse	Mus musculus	Rio Arriba
50410	Meadow Jumping Mouse	Zapus hudsonius luteus	Rio Arriba
50415	Western Jumping Mouse	Zapus princeps	Rio Arriba
50425	Pinyon Mouse	Peromyscus truei	Rio Arriba
50460	Plains Pocket Mouse	Perognathus flavescens	Rio Arriba
50470	Silky Pocket Mouse	Perognathus flavus flavus; hopiensis	Rio Arriba
50480	Northern Rock Mouse	Peromyscus nasutus	Rio Arriba
50490	White-footed Mouse	Peromyscus leucopus	Rio Arriba
50495	Common Muskrat	Ondatra zibethicus pallidus; osoyooensis; cinnamominus	Rio Arriba
50565	American Pika	Ochotona princeps incana; saxatilis	Rio Arriba
50580	Common Porcupine	Erethizon dorsatum	Rio Arriba
50585	Pronghorn	Antilocapra americana americana	Rio Arriba
50587	Desert Cottontail Rabbit	Sylvilagus audubonii	Rio Arriba
50589	Nuttall's Cottontail Rabbit	Sylvilagus nuttallii	Rio Arriba
50590	Snowshoe Hare	Lepus americanus	Rio Arriba
50591	Black-tailed Jackrabbit	Lepus californicus	Rio Arriba
50593	White-tailed Jackrabbit	Lepus townsendii	Rio Arriba
50595	Common Raccoon	Procyon lotor	Rio Arriba
50635	Ord's Kangaroo Rat	Dipodomys ordii	Rio Arriba
50645	Bushy-tailed Wood Rat	Neotoma cinerea	Rio Arriba
50650	Mexican Wood Rat	Neotoma mexicana mexicana; inopinata; pinetorum; scopulorum	Rio Arriba
50655	S. Plains Wood Rat	Neotoma micropus canescens	Rio Arriba
50660	Stephen's Wood Rat	Neotoma stephensi	Rio Arriba
50665	White-throated Wood Rat	Neotoma albigula	Rio Arriba
50670	Ringtail	Bassariscus astutus	Rio Arriba
50680	Rocky Mtn. Bighorn Sheep	Ovis canadensis canadensis	Rio Arriba
50700	Dwarf Shrew	Sorex nanus	Rio Arriba
50710	Masked Shrew	Sorex cinereus	Rio Arriba
50715	Merriam's Shrew	Sorex merriami	Rio Arriba
50725	Dusky Shrew	Sorex monticola	Rio Arriba
50730	Western Water Shrew	Sorex navigator	Rio Arriba
50747	Western Spotted Skunk	Spilogale gracilis	Rio Arriba

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Species ID	Common Name	Scientific Name	County
50750	Striped Skunk	Mephitis mephitis	Rio Arriba
50755	Abert's Squirrel	Sciurus aberti aberti; chuscensis; ferreus	Rio Arriba
50785	Golden-mantled Ground Squirrel	Callospermophilus lateralis	Rio Arriba
50795	Spotted Ground Squirrel	Xerospermophilus spilosoma	Rio Arriba
50800	Thirteen-lined Ground Squirrel	Ictidomys tridecemlineatus arenicola; blanca; hollisteri	Rio Arriba
50810	Red Squirrel	Tamiasciurus hudsonicus fremonti; lychnuchus; mogollonensis	Rio Arriba
50815	Rock Squirrel	Otospermophilus variegatus grammurus	Rio Arriba
50820	Heather Vole	Phenacomys intermedius	Rio Arriba
50825	Long-tailed Vole	Microtus longicaudus longicaudus; alticola; baileyi; mordax	Rio Arriba
50840	Montane Vole	Microtus montanus fusus	Rio Arriba
50855	Southern Red-backed Vole	Myodes gapperi	Rio Arriba
50858	Ermine Weasel	Mustela erminea	Rio Arriba
50860	Long-tailed Weasel	Mustela frenata	Rio Arriba
60075	Rocky Mountainsnail	Oreohelix strigosa	Rio Arriba
60076	Socorro Mountainsnail	Oreohelix neomexicana	Rio Arriba
60379	Forest Disc Snail	Discus whitneyi	Rio Arriba
60385	Spruce Snail	Microphysula ingersolli	Rio Arriba
60390	Brown Hive Snail	Euconulus fulvus	Rio Arriba
60395	Quick Gloss Snail	Zonitoides arboreus	Rio Arriba
60400	Western Glass Snail	Vitrina pellucida	Rio Arriba
60405	Meadow Slug Snail	Deroceras laeve	Rio Arriba
60420	Rocky Mtn. Column Snail	Pupilla blandi	Rio Arriba
60430	Vertigo Snail	Vertigo arizonensis	Rio Arriba
60440	Silky Vallonia Snail	Vallonia cyclophorella	Rio Arriba
60445	Glossy Pillar Snail	Cionella lubrica	Rio Arriba
60450	Widespread Column Snail	Pupilla muscorum	Rio Arriba
60465	Ribbed Dagger Snail	Pupoides hordaceus	Rio Arriba
60500	Montane Snaggletooth Snail	Gastrocopta pilsbryana	Rio Arriba
60550	Vertigo Snail	Vertigo concinnula	Rio Arriba
60575	Multirib Vallonia Snail	Vallonia gracilicosta	Rio Arriba
60640	Mexican Coil Snail	Helicodiscus eigenmani	Rio Arriba
60750	Suboval Ambersnail	Catinella vermeta	Rio Arriba
60760	Amber Glass Snail	Nesovitrea hammonis	Rio Arriba
60765	Minute Gem Snail	Hawaiia minuscula	Rio Arriba
60785	Jemez Woodlandsnail	Ashmunella ashmuni	Rio Arriba

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Species ID	Common Name	Scientific Name	County
70255	Colorado Fairy Shrimp	Branchinecta coloradoensis	Rio Arriba
70260	Versatile Fairy Shrimp	Branchinecta lindahli	Rio Arriba
100010	False Ameletus Mayfly	Ameletus falsus	Rio Arriba
100200	Mayfly	Acentrella insignificans	Rio Arriba
100280	Mayfly	Baetis tricaudatus	Rio Arriba
100340	Mayfly	Callibaetis pictus	Rio Arriba
100500	Mayfly	Ephemera simulans	Rio Arriba
100610	Mayfly	Epeorus albertae	Rio Arriba
100630	Mayfly	Epeorus longimanus	Rio Arriba
100640	Mayfly	Epeorus margarita	Rio Arriba
100680	Mayfly	Nixe criddlei	Rio Arriba
100690	Mayfly	Nixe simplicioides	Rio Arriba
100740	Mayfly	Rhithrogena undulata	Rio Arriba
100960	Mayfly	Paraleptophlebia heteronea	Rio Arriba
100970	Mayfly	Paraleptophlebia memorialis	Rio Arriba
102120	Mayfly	Drunella doddsi	Rio Arriba
102150	Mayfly	Ephemerella inermis	Rio Arriba
102180	Mayfly	Serratella micheneri	Rio Arriba
102200	Mayfly	Timpanoga hecuba	Rio Arriba
102300	Mayfly	Leptohyphes apache	Rio Arriba
102340	Mayfly	Tricorythodes explicatus	Rio Arriba
115020	American Rubyspot	Hetaerina americana	Rio Arriba
115240	Spotted Spreadwing	Lestes congener	Rio Arriba
115250	Common Spreadwing	Lestes disjunctus	Rio Arriba
115270	Emerald Spreadwing	Lestes dryas	Rio Arriba
115420	Western Red Damsel	Amphiagrion abbreviatum	Rio Arriba
115430	Narrow-winged Damselfly	Amphiagrion saucium	Rio Arriba
115560	Springwater Dancer	Argia plana	Rio Arriba
115770	Boreal Bluet	Enallagma boreale	Rio Arriba
115790	Familiar Bluet	Enallagma civile	Rio Arriba
115810	Northern Bluet	Enallagma cyathigerum	Rio Arriba
115820	Arroyo Bluet	Enallagma praevarum	Rio Arriba
115850	Painted Damsel	Hesperagrion heterodoxum	Rio Arriba
115920	Plains Forktail	Ischnura damula	Rio Arriba
115930	Mexican Forktail	Ischnura demorsa	Rio Arriba
120080	Green Bird Grasshopper	Schistocerca alutacea shoshone	Rio Arriba
120170	Green Streak Grasshopper	Hesperotettix viridis	Rio Arriba

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Species ID	Common Name	Scientific Name	County
120180	Grasshopper	Hesperotettix speciosus	Rio Arriba
120250	Grasshopper	Melanoplus splendidus	Rio Arriba
120255	Grasshopper	Melanoplus cumbres	Rio Arriba
120260	Bruner's Spur-Throat Grasshopper	Melanoplus bruneri	Rio Arriba
120290	Differential Grasshopper	Melanoplus differentialis	Rio Arriba
120300	Two-Striped Grasshopper	Melanoplus bivittatus	Rio Arriba
120350	Northern Spur-Throat Grasshopper	Melanoplus borealis	Rio Arriba
120360	Grasshopper	Melanoplus lakinus	Rio Arriba
120370	Little Pasture Spur-Throat Grasshopper	Melanoplus confusus	Rio Arriba
120390	Tiny Spur-Throat Grasshopper	Melanoplus infantilis	Rio Arriba
120420	Red-Legged Grasshopper	Melanoplus femurrubrum	Rio Arriba
120430	Narrow-Winged Spur-Throat Grasshopper	Melanoplus angustipennis	Rio Arriba
120460	Bowditch's Spur-Throat Grasshopper	Melanoplus bowditchi	Rio Arriba
120490	Glaucous-Legged Grasshopper	Melanoplus glaucipes	Rio Arriba
120500	Flabellate Grasshopper	Melanoplus occidentalis	Rio Arriba
120510	Packard's Grasshopper	Melanoplus packardi	Rio Arriba
120520	Grasshopper	Melanoplus foedus	Rio Arriba
120530	Gladston's Spur-Throat Grasshopper	Melanoplus gladstoni	Rio Arriba
120540	Kennicott's Spur-Throat Grasshopper	Melanoplus kennicott's	Rio Arriba
120620	Grasshopper	Melanoplus bohemani	Rio Arriba
120640	Grasshopper	Mermiria texana	Rio Arriba
120710	Obscure Grasshopper	Opeia obscura	Rio Arriba
120720	Velvet-Striped Grasshopper	Eritettix simplex	Rio Arriba
120760	Spotted Wing Grasshopper	Cordillacris occipitalis	Rio Arriba
120880	Striped Slant-Faced Grasshopper	Amphitornus coloradus	Rio Arriba
120900	Club-Horned Grasshopper	Aeropedellus clavatus	Rio Arriba
120920	Rufous Grasshopper	Heliaula rufa	Rio Arriba
120930	Cream Grasshopper	Cibolacris parviceps	Rio Arriba
120950	White Cross Grasshopper	Aulocara femoratum	Rio Arriba
120960	Elliott Grasshopper	Aulocara elliotti	Rio Arriba
120990	Grasshopper	Psoloessa texana	Rio Arriba
121000	Brown Spotted Range Grasshopper	Psoloessa delicatula	Rio Arriba
121010	White Whiskers Grasshopper	Ageneotettix deorum	Rio Arriba
121040	Clear-Winged Grasshopper	Camnula pellucida	Rio Arriba
121050	Northern Green-Striped Locust Grasshopper	Chortophaga viridifasciata	Rio Arriba
121080	Dusky Grasshopper	Encoptolophus costalis	Rio Arriba

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Species ID	Common Name	Scientific Name	County
121100	Carolina Grasshopper	Dissosteira carolina	Rio Arriba
121120	Red-Winged Grasshopper	Arphia pseudonietana	Rio Arriba
121140	Speckled Rangeland Grasshopper	Arphia conspera	Rio Arriba
121200	Mottled Sand Grasshopper	Spharagemon collare	Rio Arriba
121210	Campestral Grasshopper	Spharagemon campestris	Rio Arriba
121280	Grasshopper	Hippopedon capito	Rio Arriba
121340	Kiowa Range Grasshopper	Trachyrhachys kiowa	Rio Arriba
121360	Platte Range Grasshopper	Mestobregna plattei	Rio Arriba
121370	Grasshopper	Mestobregna terricolor	Rio Arriba
121400	Arroyo Grasshopper	Heliastus benjamini	Rio Arriba
121410	Blue-Winged Grasshopper	Leprus intermedius	Rio Arriba
121430	Pronotal Range Grasshopper	Cratypedes neglectus	Rio Arriba
121440	Grasshopper	Xanthippus montanus	Rio Arriba
121450	Red Shanks Grasshopper	Xanthippus corallipes	Rio Arriba
121470	Wrangler Grasshopper	Circotettix rabula	Rio Arriba
121490	Groove-Headed Grasshopper	Conozoa sulcifrons	Rio Arriba
121500	Grasshopper	Conozoa texana	Rio Arriba
121530	Grasshopper	Trimerotropis barnumi	Rio Arriba
121540	Strenuous Grasshopper	Trimerotropis californica	Rio Arriba
121560	Crackling Forest Grasshopper	Trimerotropis verruculata	Rio Arriba
121590	Grasshopper	Trimerotropis inconspicua	Rio Arriba
121610	Thomas' Slender Grasshopper	Trimerotropis gracilis	Rio Arriba
121620	Grasshopper	Trimerotropis fratercula	Rio Arriba
121690	Barren Land Grasshopper	Trimerotropis pristrinaria	Rio Arriba
121700	Grasshopper	Trimerotropis modesta	Rio Arriba
190236	Tiger Beetle	Cicindela fulgida fulgida; pseudowillistoni	Rio Arriba
190240	Tiger Beetle	Cicindela hirticollis	Rio Arriba
190246	Tiger Beetle	Cicindela lengi lengi; jordai	Rio Arriba
190248	Dainty Tiger Beetle	Cicindela lepida	Rio Arriba
190252	Tiger Beetle	Cicindela longilabris laurentii	Rio Arriba
190256	Tiger Beetle	Cicindela marutha	Rio Arriba
190260	Tiger Beetle	Cicindela nigrocoerula	Rio Arriba
190262	Tiger Beetle	Cicindela obsoleta obsoleta; santaclarae	Rio Arriba
190266	Tiger Beetle	Cicindela oregona	Rio Arriba
190274	Tiger Beetle	Cicindela pulchra	Rio Arriba
190276	Tiger Beetle	Cicindela punctulata	Rio Arriba

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Species ID	Common Name	Scientific Name	County
190278	Tiger Beetle	Cicindela purpurea	Rio Arriba
190280	Tiger Beetle	Cicindela repanda	Rio Arriba
190286	Tiger Beetle	Cicindela sedecimpunctata	Rio Arriba
190290	Tiger Beetle	Cicindela sperata	Rio Arriba
190295	Variable Tiger Beetle	Cicindela terricola	Rio Arriba
190300	Tiger Beetle	Cicindela tranquebarica	Rio Arriba
190306	Nevada Tiger Beetle	Ellipsoptera nevadica tubensis	Rio Arriba
210025	Silver-Spotted Skipper	Epargyreus clarus clarus	Rio Arriba
210130	Short-Tailed Skipper	Zestusa dorus	Rio Arriba
210310	Northern Cloudywing Skipper	Thorybes pylades	Rio Arriba
210325	Mexican Cloudwing Skipper	Thorybes mexicanus	Rio Arriba
210535	Dreamy Duskywing Skipper	Erynnis icelus	Rio Arriba
210550	Sleepy Duskywing Skipper	Erynnis brizo	Rio Arriba
210580	Rocky Mtn Duskywing Skipper	Erynnis telemachus	Rio Arriba
210625	Horace's Duskywing Skipper	Erynnis horatius	Rio Arriba
210670	Pacuvius Duskywing Skipper	Erynnis pacuvius	Rio Arriba
210700	Afranius Duskywing Skipper	Erynnis afranius	Rio Arriba
210715	Persius Duskywing Skipper	Erynnis persius	Rio Arriba
210730	Loki Grizzled Skipper	Pyrgus centaureae	Rio Arriba
210745	Mountain Checkered Skipper	Pyrgus xanthus	Rio Arriba
210775	Common Checkered Skipper	Pyrgus communis	Rio Arriba
210850	Northern White Skipper	Heliopetes ericetorum	Rio Arriba
210940	Saltbush Sootywing Skipper	Hesperopsis alpheus	Rio Arriba
210970	Russet Skipperling Skipper	Piruna pirus	Rio Arriba
211105	Garita Skipperling Skipper	Oarisma garita	Rio Arriba
211195	Rhesus Skipper	Yvretta rhesus	Rio Arriba
211240	Morrison's Skipper	Stinga morrisoni	Rio Arriba
211255	Uncas Skipper	Hesperia uncas uncas	Rio Arriba
211285	Juba Skipper	Hesperia juba	Rio Arriba
211300	Colorado Branded Skipper	Hesperia comma colorado	Rio Arriba
211330	Apache Skipper	Hesperia woodgatei	Rio Arriba
211360	Pahaska Skipper	Hesperia pahaska pahaska	Rio Arriba
211390	Green Skipper	Hesperia viridis	Rio Arriba
211405	Nevada Skipper	Hesperia nevada	Rio Arriba
211420	Sandhill Skipper	Polites sabuleti	Rio Arriba
211450	Draco Skipper	Polites draco	Rio Arriba
211465	Tawny-Edged Skipper	Polites themistocles	Rio Arriba

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Species ID	Common Name	Scientific Name	County
211555	Napa Woodland Skipper	Ochlodes sylvanoides	Rio Arriba
211630	Taxiles Skipper	Poanes taxiles	Rio Arriba
211660	Kiowa Dun Skipper	Euphyes vestris	Rio Arriba
211720	Viereck's Skipper	Atrytonopsis vierecki	Rio Arriba
211750	Python Skipper	Atrytonopsis python	Rio Arriba
211795	Simius Roadside Skipper	Amblyscirtes simius	Rio Arriba
211825	Cassus Roadside Skipper	Amblyscirtes cassus	Rio Arriba
211840	Bronze Roadside Skipper	Amblyscirtes aenus	Rio Arriba
211855	Oslar's Roadside Skipper	Amblyscirtes oslari	Rio Arriba
211945	Roadside Skipper	Amblyscirtes vialis	Rio Arriba
211960	Orange-headed Roadside Skipper	Amblyscirtes phylace	Rio Arriba
212185	Colorado Giant Skipper	Megathymus coloradensis coloradensis	Rio Arriba
212275	Strecker's Giant Skipper	Megathymus streckeri streckeri	Rio Arriba
212335	Roger's False Parnassian Butterfly	Parnassius phoebus	Rio Arriba
212395	Black Swallowtail Butterfly	Papilio polyxenes asterius	Rio Arriba
212425	Baird's Swallowtail Butterfly	Papilio bairdii	Rio Arriba
212440	Anise Swallowtail Butterfly	Papilio zelicaon zelicaon	Rio Arriba
212455	Nitra Swallowtail Butterfly	Papilio zelicaon nitra	Rio Arriba
212530	Western Tiger Swallowtail Butterfly	Pterourus rutulus rutulus	Rio Arriba
212560	Two-Tailed Swallowtail Butterfly	Pterourus multicaudatus	Rio Arriba
212575	Pale Swallowtail Butterfly	Pterourus eurymedon	Rio Arriba
212635	Pine White Butterfly	Neophasia menapia	Rio Arriba
212680	Becker's White Butterfly	Pontia beckerii	Rio Arriba
212695	Spring White Butterfly	Pontia sisymbrii elivata	Rio Arriba
212725	Checkered White Butterfly	Pontia protodice	Rio Arriba
212740	Western White Butterfly	Pontia occidentalis	Rio Arriba
212755	McDunnough's White Butterfly	Pieris napi mcdunnoughi	Rio Arriba
212785	Cabbage White Butterfly	Pieris rapae	Rio Arriba
212845	Colorado Marble Butterfly	Euchloe ausonides	Rio Arriba
212860	Southern Marble Butterfly	Euchloe hyantis	Rio Arriba
212920	Ingham's Orangetip Butterfly	Anthocharis sara	Rio Arriba
212935	Western Common Sulphur Butterfly	Colias philodice	Rio Arriba
212950	Orange Sulphur Butterfly	Colias eurytheme	Rio Arriba
212965	Queen Alexandra's Sulphur Butterfly	Colias alexandra alexandra	Rio Arriba
212995	Mead's Sulphur Butterfly	Colias meadii	Rio Arriba
213010	Scudder's Willow Sulphur Butterfly	Colias scudderii	Rio Arriba
213025	Southern Dogface Butterfly	Zerene cesonia	Rio Arriba

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Species ID	Common Name	Scientific Name	County
213175	Mexican Yellow Butterfly	Eurema mexicanum	Rio Arriba
213250	Sleepy Orange Butterfly	Eurema nicippe	Rio Arriba
213265	Dainty Sulphur Butterfly	Nathalis iole	Rio Arriba
213280	Shellbach's Copper Butterfly	Tharsalea arota	Rio Arriba
213355	Sirius Copper Butterfly	Chalceria rubida	Rio Arriba
213370	Blue Copper Butterfly	Chalceria heteronea	Rio Arriba
213385	Purplish Copper Butterfly	Epidemia helloides	Rio Arriba
213400	Colorado Hairstreak Butterfly	Hypaurotis crysalus	Rio Arriba
213430	Great Purple Hairstreak Butterfly	Atlides halesus	Rio Arriba
213520	Immaculate Hairstreak Butterfly	Satyrium titus immaculosus	Rio Arriba
213535	Cross's Hairstreak Butterfly	Satyrium behrii	Rio Arriba
213550	Itys Hairstreak Butterfly	Satyrium sylvinum	Rio Arriba
213565	Godart's Hairstreak Butterfly	Satyrium calanus	Rio Arriba
213610	Leda Hairstreak Butterfly	Ministrymon leda	Rio Arriba
213655	Rocky Mountain Green Hairstreak Butterfly	Callophrys affinis homoperplexa	Rio Arriba
213670	Sheridan's Hairstreak Butterfly	Callophrys sheridanii sheridanii	Rio Arriba
213730	Thicket Hairstreak Butterfly	Mitoura spinetorum	Rio Arriba
213745	Juniper Hairstreak Butterfly	Mitoura siva	Rio Arriba
213805	Western Elfin Butterfly	Incisalia augustinus iroides	Rio Arriba
213850	Obscure Elfin Butterfly	Incisalia polia	Rio Arriba
213880	Western Pine Elfin Butterfly	Incisalia eryphon	Rio Arriba
213970	Frank's Common Hairstreak Butterfly	Strymon melinus	Rio Arriba
214015	Western Pygmy Blue Butterfly	Brephidum exile	Rio Arriba
214045	Marine Blue Butterfly	Leptotes marina	Rio Arriba
214090	Reakirt's Blue Butterfly	Hemiargus isola	Rio Arriba
214120	Western Tailed Blue Butterfly	Everes amyntula	Rio Arriba
214150	Arizona Blue Butterfly	Celastrina ladon cinerea	Rio Arriba
214165	Square-spotted Blue Butterfly	Euphilotes battoides centralis	Rio Arriba
214285	Spalding's Blue Butterfly	Euphilotes spaldingi	Rio Arriba
214330	Silvery Blue Butterfly	Glaucopsyche lygdamus oro	Rio Arriba
214360	Melissa Blue Butterfly	Lycaeides melissa	Rio Arriba
214375	Whitmer's Blue Butterfly	Plebejus saepiolus whitmeri	Rio Arriba
214405	Lycea Blue Butterfly	Plebejus icarioides lycea	Rio Arriba
214450	Texas Blue Butterfly	Plebejus acmon	Rio Arriba
214465	Rustic Blue Butterfly	Agriades rusticus	Rio Arriba
214570	Mormon Metalmark Butterfly	Apodemia mormo mormo	Rio Arriba

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Species ID	Common Name	Scientific Name	County
214675	Nais Metalmark Butterfly	Apodemia nais	Rio Arriba
214690	Southern Snout Butterfly	Libytheana bachmanii	Rio Arriba
214765	Variegated Fritillary Butterfly	Euptoieta claudia	Rio Arriba
214795	Great Spangled Fritillary Butterfly	Speyeria cybele	Rio Arriba
214870	Edwards' Fritillary Butterfly	Speyeria edwardsii	Rio Arriba
214900	Nikias Fritillary Butterfly	Speyeria hesperis nikias	Rio Arriba
214945	Electa Fritillary Butterfly	Speyeria hesperis electa	Rio Arriba
215005	Eurynome Silverspot Butterfly	Speyeria mormonia	Rio Arriba
215020	Tolland Fritillary Butterfly	Clossiana selene	Rio Arriba
215035	Brown's Fritillary Butterfly	Clossiana freija	Rio Arriba
215050	Helena Fritillary Butterfly	Clossiana titania	Rio Arriba
215080	Montane Penstemon Checkerspot Butterfly	Poladryas minuta arachne	Rio Arriba
215155	Fulvia Checkerspot Butterfly	Thessalia fulvia	Rio Arriba
215260	Carlota Checkerspot Butterfly	Chlosyne gorgone	Rio Arriba
215275	Drusius Checkerspot Butterfly	Charidryas nycteis	Rio Arriba
215290	Pearly Checkerspot Butterfly	Charidryas acastus acastus	Rio Arriba
215470	Pearl Crescent Butterfly	Phyciodes tharos Type B	Rio Arriba
215500	Camillus Crescent Butterfly	Phyciodes pulchella	Rio Arriba
215515	Painted Crescent Butterfly	Phyciodes pictus	Rio Arriba
215545	Mylitta Crescent Butterfly	Phyciodes mylitta	Rio Arriba
215575	Alena Checkerspot Butterfly	Occidryas anicia alena	Rio Arriba
215590	Chuska Mountains Checkerspot Butterfly	Euphydryas anicia chuskae	Rio Arriba
215620	Mead's Checkerspot Butterfly	Occidryas anicia eurytion	Rio Arriba
215680	Satyr Anglewing Butterfly	Polygonia satyrus	Rio Arriba
215695	Green Comma Butterfly	Polygonia faunus	Rio Arriba
215710	Hoary Comma Butterfly	Polygonia gracilis	Rio Arriba
215725	California Tortoise Shell Butterfly	Nymphalis californica	Rio Arriba
215740	Mourning Cloak Butterfly	Nymphalis antiopa	Rio Arriba
215755	Milbert's Tortoise Shell Butterfly	Aglais milberti	Rio Arriba
215770	American Lady Butterfly	Vanessa virginiensis	Rio Arriba
215785	Painted Lady Butterfly	Vanessa cardui	Rio Arriba
215800	West Coast Lady Butterfly	Vanessa annabella	Rio Arriba
215815	Red Admiral Butterfly	Vanessa atalanta	Rio Arriba
215830	Buckeye Butterfly	Junonia coenia	Rio Arriba
215965	Viceroy Butterfly	Limenitis archippus archippus	Rio Arriba
216010	Weidemeyer's Admiral Butterfly	Limenitis weidemeyerii weidemeyerii	Rio Arriba

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Species ID	Common Name	Scientific Name	County
216040	Arizona Sister Butterfly	Adelpha bredowii	Rio Arriba
216295	Canyonland Satyr Butterfly	Cyllopsis pertepida dorothea	Rio Arriba
216385	Ochre Ringlet Butterfly	Coenonympha ochracea ochracea	Rio Arriba
216415	Common Wood-Nymph Butterfly	Cercyonis pegala	Rio Arriba
216430	Mead's Wood Nymph Butterfly	Cercyonis meadii meadii	Rio Arriba
216475	Charon Satyr Butterfly	Cercyonis oetus	Rio Arriba
216505	Common Alpine Butterfly	Erebia epipsodea	Rio Arriba
216535	Ridings' Satyr Butterfly	Neominois ridingsii ridingsii	Rio Arriba
216565	Chryxus Arctic Butterfly	Oeneis chryxus chryxus	Rio Arriba
216595	Uhler's Arctic Butterfly	Oeneis uhleri	Rio Arriba
216640	CO Melissa Arctic Butterfly	Oeneis melissa	Rio Arriba
216655	Bruce's Arctic Butterfly	Oeneis polixenes	Rio Arriba
216670	Monarch Butterfly	Danaus plexippus	Rio Arriba
216685	Striated Queen Butterfly	Danaus gilippus	Rio Arriba
217150	Moth	Hemileuca nuttalli	Rio Arriba
217585	Twin-spot Sphinx Moth	Smerinthus jamaicensis	Rio Arriba
218095	White-lined Sphinx Moth	Hyles lineata	Rio Arriba
301480	Comb-Footed Spider	Theridion neomexicanum	Rio Arriba
301490	Comb-Footed Spider	Theridion ohlerti	Rio Arriba
302810	Orb Weaver Spider	Araneus bicentenarius	Rio Arriba
303560	Thin-legged Wolf Spider	Pardosa coloradensis	Rio Arriba
303580	Thin-legged Wolf Spider	Pardosa distincta	Rio Arriba
303620	Thin-legged Wolf Spider	Pardosa fuscula	Rio Arriba
303680	Thin-legged Wolf Spider	Pardosa ourayensis	Rio Arriba
303700	Thin-legged Wolf Spider	Pardosa sternalis	Rio Arriba
303960	Spider	Varacosa gosiuta	Rio Arriba
321040	Pseudoscorpion	Mundochthonius montanus	Rio Arriba
321080	Pseudoscorpion	Lechytia pacifica	Rio Arriba
321100	Pseudoscorpion	Syarinus obscurus	Rio Arriba
321130	Pseudoscorpion	Chitrella transversa	Rio Arriba
321240	Pseudoscorpion	Hesperochernes utahensis	Rio Arriba
321310	Pseudoscorpion	Dinocheirus athleticus	Rio Arriba
321400	Pseudoscorpion	Parachelifer persimilis	Rio Arriba

Sources:

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Species ID	Common Name	Scientific Name	County

Biota Information System of New Mexico. Report County Species List for Rio Arriba. New Mexico Department of Game and Fish, Santa Fe, NM. 2016. http://www.bison-m.org.

Appendix D2 – New Mexico Wildlife of Concern: Threatened and Endangered Species

APPENDIX D-2

NEW MEXICO WILDLIFE OF CONCERN: THREATENED AND ENDANGERED SPECIES
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Common Name	Scientific Name	NMGF	US FWS	Critical Habitat
Mammals				
Spotted Bat	*Euderma masculatum*	T		
Canada Lynx	*Lynx canadensis*		T	
Pacific Marten	*Martes caurina*	T		
Meadow Jumping Mouse	*Zapus hudsonius luteus*	E	E	Y
Birds				
White-Tailed Ptarmigan	*Lagopus leucura*	E		
Brown Pelican	*Pelecanus occidentalis*	E		
Common Black Hawk	*Buteogallus anthracinus*	T		
Bald Eagle	*Haliaeetus leucocephalus*	T		
Peregrin Falcon	*Falco peregrinus*	T		
Arctic Peregrin Falcon	*Falco peregrinus tundris*	T		
Least Tern	*Sternula antillarum*	E	E	
Yellow-Billed Cuckoo (Western Pop)	*Coccyzus americanus occidentalis*		T	
Boreal Owl	*Aegolius funereus*	T		
Mexican Spotted Owl	*Strix occidentalis lucida*		T	Y
Southwest Willow Flycatcher	*Empidonax traillii extimus*	E	E	Y
Gray Vireo	*Vireo vicinior*	T		
Baird's Sparrow	*Ammodramus bairdii*	T		
Amphibians				
Boreal Toad	*Anaxyrus boreas boreas*	E		
Jemez Mountains Salamander	*Plethodon neomexicanus*	E	E	Y
Fish				
Roundtail Chub (Upper Basin Populations)	*Gila robusta*	E		

Notes

E = Endangered

NMGF = New Mexico Game and Fish

T = Threatened

US FWS = US Fish and Wildlife Service

Y = Yes

Sources:

Biota Information System of New Mexico. Report County TES Table for Rio Arriba: New Mexico wildlife of concern. New Mexico Department of Game and Fish, Santa Fe, NM. 2016. http://www.bison-m.org.

Appendix D3 – Summary of Data Screened with ESV

Appendix D-3. Summay of data screened with ESV.

Sample Location:			**North Wall**		**South Wall**		**East Wall**		**West Wall**		**Base**		**Base (2)**				
Sample ID:			**SC-1**		**SC-2**		**SC-3**		**SC-4**		**SC-5**		**SC-5 (2)**		**S-1**		**S-2**
Sample Date:			**2/17/2015**		**2/17/2015**		**2/17/2015**		**2/17/2015**		**2/17/2015**		**4/30/2015**		**2/12/2016**		**2/12/2016**
Sample Depth:			**1-19 ft BGS**		**1-19 ft BGS**		**1-19 ft BGS**		**1-19 ft BGS**		**19 ft BGS**		**19 ft BGS**				
Parameters	**Units**	**ESV a**															
Volatile Organic Compounds																	
Benzene	mg/kg	0.05	0.032	U	0.038	U	0.044	U	0.031	U	**7.6[a]**		0.038	U	0.046	U	0.24
Ethylbenzene	mg/kg	0.05	0.032	U	0.038	U	0.044	U	0.031	U	**27[a]**		0.038	U	0.046	U	**1.2[a]**
Toluene	mg/kg	200	0.032	U	0.038	U	0.044	U	0.031	U	130		0.038	U	0.17		2.3
Xylenes (total)	mg/kg	0.05	0.064	U	0.076	U	0.088	U	0.062	U	**270[a]**		0.076	U	**1.5[a]**		**18[a]**
Semi-volatile Organic Compounds																	
Acenaphthene	mg/kg	20															
Acenaphthylene	mg/kg	682															
Anthracene	mg/kg	0.1															
Benzo(a)anthracene	mg/kg	5.21															
Benzo(a)pyrene	mg/kg	0.1															
Benzo(b)fluoranthene	mg/kg	59.8															
Benzo(g,h,i)perylene	mg/kg	119															
Benzo(k)fluoranthene	mg/kg	148															
Chrysene	mg/kg	4.73															
Dibenz(a,h)anthracene	mg/kg	18.4															
Fluoranthene	mg/kg	0.1															
Fluorene	mg/kg	30															
Indeno(1,2,3-cd)pyrene	mg/kg	109															
Naphthalene	mg/kg	0.1															
Phenanthrene	mg/kg	0.1															
Pyrene	mg/kg	0.1															
Petroleum Products																	
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	-	10	U	10	U	10	U	9.9	U	640		20		19		130
Total Petroleum Hydrocarbons (C10-C28) DRO	mg/kg	-															
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	-	50	U	50	U	50	U	50	U	50	U	49	U	47	U	47
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	-	3.2	U	3.2	U	4.4	U	3.1	U	3800		3.8	U	27		220
Total Petroleum Hydrocarbons (C6-C10) GRO	mg/kg	-															
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	-															
Total Petroleum Hydrocarbons (C6-C35)	mg/kg	-															
Total Petroleum Hydrocarbons (C6) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C6-C8) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C7-C8) Aromatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C8-C10) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C8-C10) Aromatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C10-C12) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C10-C12) Aromatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C12-C16) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C12-C16) Aromatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C12-C28)	mg/kg	-															
Total Petroleum Hydrocarbons (>C16-C21) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C16-C21) Aromatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C21-C35) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C28-C35)	mg/kg	-															
Total Petroleum Hydrocarbons (C21-C35) Aromatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C6-C35) Aliphatics & Aromatics	mg/kg	-															

Footnotes:

U Not detected at the associated reporting limit.
J Estimated concentration.

Appendix D-3. Summay of data screened with ESV.

Sample Location:			**North Wall**		**South Wall**		**East Wall**		**West Wall**								
Sample ID:			**SC-1**		**SC-2**		**SC-3**		**SC-4**		**S-3**		**S-4**		**S-5**		**S-6**
Sample Date:			**2/17/2015**		**2/17/2015**		**2/17/2015**		**2/17/2015**		**2/12/2016**		**2/12/2016**		**2/12/2016**		**2/12/2016**
Sample Depth:			**1-19 ft BGS**		**1-19 ft BGS**		**1-19 ft BGS**		**1-19 ft BGS**								
Parameters	**Units**	**ESV a**															
Volatile Organic Compounds																	
Benzene	mg/kg	0.05	0.032	U	0.038	U	0.044	U	0.031	U	0.046	U	0.12	U	0..048	U	0.095
Ethylbenzene	mg/kg	0.05	0.032	U	0.038	U	0.044	U	0.031		0.046	U	**0.39**[a]		0.048	U	**0.89**[a]
Toluene	mg/kg	200	0.032	U	0.038	U	0.044	U	0.031		0.046	U	0.5		0.16		1.6
Xylenes (total)	mg/kg	0.05	0.064	U	0.076	U	0.088	U	0.062		**0.31**[a]		**4.9**[a]		**5.1**[a]		**11**[a]
Semi-volatile Organic Compounds																	
Acenaphthene	mg/kg	20															
Acenaphthylene	mg/kg	682															
Anthracene	mg/kg	0.1															
Benzo(a)anthracene	mg/kg	5.21															
Benzo(a)pyrene	mg/kg	0.1															
Benzo(b)fluoranthene	mg/kg	59.8															
Benzo(g,h,i)perylene	mg/kg	119															
Benzo(k)fluoranthene	mg/kg	148															
Chrysene	mg/kg	4.73															
Dibenz(a,h)anthracene	mg/kg	18.4															
Fluoranthene	mg/kg	0.1															
Fluorene	mg/kg	30															
Indeno(1,2,3-cd)pyrene	mg/kg	109															
Naphthalene	mg/kg	0.1															
Phenanthrene	mg/kg	0.1															
Pyrene	mg/kg	0.1															
Petroleum Products																	
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	-	10	U	10	U	10	U	9.9		19		59		36		66
Total Petroleum Hydrocarbons (C10-C28) DRO	mg/kg	-															
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	-	50	U	50	U	50	U	50	U	46	U	48	U	50	U	48
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	-	3.2	U	3.2	U	4.4	U	3.1		40		91		150		240
Total Petroleum Hydrocarbons (C6-C10) GRO	mg/kg	-															
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	-															
Total Petroleum Hydrocarbons (C6-C35)	mg/kg	-															
Total Petroleum Hydrocarbons (C6) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C6-C8) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C7-C8) Aromatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C8-C10) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C8-C10) Aromatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C10-C12) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C10-C12) Aromatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C12-C16) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C12-C16) Aromatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C12-C28)	mg/kg	-															
Total Petroleum Hydrocarbons (>C16-C21) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C16-C21) Aromatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C21-C35) Aliphatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C28-C35)	mg/kg	-															
Total Petroleum Hydrocarbons (C21-C35) Aromatic	mg/kg	-															
Total Petroleum Hydrocarbons (>C6-C35) Aliphatics & Aromatics	mg/kg	-															

Footnotes:

U Not detected at the associated reporting limit.
J Estimated concentration.

Appendix D-3. Summay of data screened with ESV.

Sample Location:			**North Wall**		**South Wall**		**East Wall**		**West Wall**		**CH-2**		**CH-3**		**CH-3**
Sample ID:			**SC-1**		**SC-2**		**SC-3**		**SC-4**		**S-11119528-042116-CH-2-5**		**S-11119528-042216-CH-3-5**		**S-11119528-042216-CH-3-10**
Sample Date:			**2/17/2015**		**2/17/2015**		**2/17/2015**		**2/17/2015**		**4/21/2016**		**4/22/2016**		**4/22/2016**
Sample Depth:			**1-19 ft BGS**		**1-19 ft BGS**		**1-19 ft BGS**		**1-19 ft BGS**		**5 ft BGS**		**5 ft BGS**		**10 ft BGS**
Parameters	**Units**	**ESV a**													
Volatile Organic Compounds															
Benzene	mg/kg	0.05	0.032	U	0.038	U	0.044	U	0.031	U	**0.21**^{a}		0.024	U	0.024
Ethylbenzene	mg/kg	0.05	0.032	U	0.038	U	0.044	U	0.031		**8.1**^{a}		0.049	U	0.049
Toluene	mg/kg	200	0.032	U	0.038	U	0.044	U	0.031		34		0.049	U	0.049
Xylenes (total)	mg/kg	0.05	0.064	U	0.076	U	0.088	U	0.062		**120**^{a}		0.097	U	0.098
Semi-volatile Organic Compounds															
Acenaphthene	mg/kg	20									-		-		-
Acenaphthylene	mg/kg	682									-		-		-
Anthracene	mg/kg	0.1									-		-		-
Benzo(a)anthracene	mg/kg	5.21									-		-		-
Benzo(a)pyrene	mg/kg	0.1									-		-		-
Benzo(b)fluoranthene	mg/kg	59.8									-		-		-
Benzo(g,h,i)perylene	mg/kg	119									-		-		-
Benzo(k)fluoranthene	mg/kg	148									-		-		-
Chrysene	mg/kg	4.73									-		-		-
Dibenz(a,h)anthracene	mg/kg	18.4									-		-		-
Fluoranthene	mg/kg	0.1									-		-		-
Fluorene	mg/kg	30									-		-		-
Indeno(1,2,3-cd)pyrene	mg/kg	109									-		-		-
Naphthalene	mg/kg	0.1									-		-		-
Phenanthrene	mg/kg	0.1									-		-		-
Pyrene	mg/kg	0.1									-		-		-
Petroleum Products															
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	-	10	U	10	U	10	U	9.9		310		9.6	U	9.8
Total Petroleum Hydrocarbons (C10-C28) DRO	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	-	50	U	50	U	50	U	50	U	47	U	48	U	49
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	-	3.2	U	3.2	U	4.4	U	3.1		1500	J	4.9	U	4.9
Total Petroleum Hydrocarbons (C6-C10) GRO	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (C6-C35)	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (C6) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C6-C8) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C7-C8) Aromatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C8-C10) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C8-C10) Aromatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C10-C12) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C10-C12) Aromatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C12-C16) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C12-C16) Aromatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C12-C28)	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C16-C21) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C16-C21) Aromatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C21-C35) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C28-C35)	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (C21-C35) Aromatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C6-C35) Aliphatics & Aromatics	mg/kg	-									-		-		-

Footnotes:

U Not detected at the associated reporting limit.
J Estimated concentration.

Appendix D-3. Summay of data screened with ESV.

Sample Location:			**North Wall**		**South Wall**		**East Wall**		**West Wall**		**CH-4**		**CH-5**		**CH-5**
Sample ID:			**SC-1**		**SC-2**		**SC-3**		**SC-4**		**S-11119528-042216-CH-4-5**		**S-11119528-042216-CH-6-5**		**S-11119528-042216-CH-5-10**
Sample Date:			**2/17/2015**		**2/17/2015**		**2/17/2015**		**2/17/2015**		**4/22/2016**		**4/22/2016**		**4/22/2016**
Sample Depth:			**1-19 ft BGS**		**1-19 ft BGS**		**1-19 ft BGS**		**1-19 ft BGS**		**5 ft BGS**		**5 ft BGS**		**10 ft BGS**
Parameters	**Units**	**ESV a**													
Volatile Organic Compounds															
Benzene	mg/kg	0.05	0.032	U	0.038	U	0.044	U	0.031	U	**0.38**[a]	J	0.024	U	0.12
Ethylbenzene	mg/kg	0.05	0.032	U	0.038	U	0.044	U	0.031	U	**2.2**[a]	J	0.048	U	**0.84**[a]
Toluene	mg/kg	200	0.032	U	0.038	U	0.044	U	0.031	U	22		0.15		0.46
Xylenes (total)	mg/kg	0.05	0.064	U	0.076	U	0.088	U	0.062	U	**140**[a]		**0.38**[a]		**13**[a]
Semi-volatile Organic Compounds															
Acenaphthene	mg/kg	20									-		-		-
Acenaphthylene	mg/kg	682									-		-		-
Anthracene	mg/kg	0.1									-		-		-
Benzo(a)anthracene	mg/kg	5.21									-		-		-
Benzo(a)pyrene	mg/kg	0.1									-		-		-
Benzo(b)fluoranthene	mg/kg	59.8									-		-		-
Benzo(g,h,i)perylene	mg/kg	119									-		-		-
Benzo(k)fluoranthene	mg/kg	148									-		-		-
Chrysene	mg/kg	4.73									-		-		-
Dibenz(a,h)anthracene	mg/kg	18.4									-		-		-
Fluoranthene	mg/kg	0.1									-		-		-
Fluorene	mg/kg	30									-		-		-
Indeno(1,2,3-cd)pyrene	mg/kg	109									-		-		-
Naphthalene	mg/kg	0.1									-		-		-
Phenanthrene	mg/kg	0.1									-		-		-
Pyrene	mg/kg	0.1									-		-		-
Petroleum Products															
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	-	10	U	10	U	10	U	9.9	U	500		9.2	U	280
Total Petroleum Hydrocarbons (C10-C28) DRO	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	-	50	U	50	U	50	U	50	U	48	U	46	U	47
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	-	3.2	U	3.2	U	4.4	U	3.1	U	2800	J	4.8	U	240
Total Petroleum Hydrocarbons (C6-C10) GRO	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (C6-C35)	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (C6) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C6-C8) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C7-C8) Aromatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C8-C10) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C8-C10) Aromatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C10-C12) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C10-C12) Aromatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C12-C16) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C12-C16) Aromatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C12-C28)	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C16-C21) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C16-C21) Aromatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C21-C35) Aliphatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C28-C35)	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (C21-C35) Aromatic	mg/kg	-									-		-		-
Total Petroleum Hydrocarbons (>C6-C35) Aliphatics & Aromatics	mg/kg	-									-		-		-

Footnotes:

U Not detected at the associated reporting limit.
J Estimated concentration.

Appendix D-3. Summay of data screened with ESV.

Sample Location:			North Wall		South Wall		East Wall		West Wall		CH-5		CH-5	
Sample ID:			**SC-1**		**SC-2**		**SC-3**		**SC-4**		**S-11119528-042216-CH-5-15**		**S-11119528-042216-CH-6-10**	
Sample Date:			**2/17/2015**		**2/17/2015**		**2/17/2015**		**2/17/2015**		**4/22/2016**		**4/22/2016**	
Sample Depth:			**1-19 ft BGS**		**1-19 ft BGS**		**1-19 ft BGS**		**1-19 ft BGS**		**10 ft BGS**		**10 ft BGS**	
Parameters	**Units**	**ESV a**												
Volatile Organic Compounds														
Benzene	mg/kg	0.05	0.032	U	0.038	U	0.044	U	0.031	U	0.024	U	0.024	U
Ethylbenzene	mg/kg	0.05	0.032	U	0.038	U	0.044	U	0.031		0.049	U	0.047	U
Toluene	mg/kg	200	0.032	U	0.038	U	0.044	U	0.031		0.049	U	0.047	U
Xylenes (total)	mg/kg	0.05	0.064	U	0.076	U	0.088	U	0.062		0.098	U	0.094	U
Semi-volatile Organic Compounds														
Acenaphthene	mg/kg	20									-		-	
Acenaphthylene	mg/kg	682									-		-	
Anthracene	mg/kg	0.1									-		-	
Benzo(a)anthracene	mg/kg	5.21									-		-	
Benzo(a)pyrene	mg/kg	0.1									-		-	
Benzo(b)fluoranthene	mg/kg	59.8									-		-	
Benzo(g,h,i)perylene	mg/kg	119									-		-	
Benzo(k)fluoranthene	mg/kg	148									-		-	
Chrysene	mg/kg	4.73									-		-	
Dibenz(a,h)anthracene	mg/kg	18.4									-		-	
Fluoranthene	mg/kg	0.1									-		-	
Fluorene	mg/kg	30									-		-	
Indeno(1,2,3-cd)pyrene	mg/kg	109									-		-	
Naphthalene	mg/kg	0.1									-		-	
Phenanthrene	mg/kg	0.1									-		-	
Pyrene	mg/kg	0.1									-		-	
Petroleum Products														
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	-	10	U	10	U	10	U	9.9		15		9.4	U
Total Petroleum Hydrocarbons (C10-C28) DRO	mg/kg	-									-		-	
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	-	50	U	50	U	50	U	50	U	48	U	47	U
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	-	3.2	U	3.2	U	4.4	U	3.1	J	4.9	U	4.7	U
Total Petroleum Hydrocarbons (C6-C10) GRO	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (C6-C35)	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (C6) Aliphatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C6-C8) Aliphatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C7-C8) Aromatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C8-C10) Aliphatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C8-C10) Aromatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C10-C12) Aliphatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C10-C12) Aromatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C12-C16) Aliphatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C12-C16) Aromatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C12-C28)	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C16-C21) Aliphatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C16-C21) Aromatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C21-C35) Aliphatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C28-C35)	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (C21-C35) Aromatic	mg/kg	-									-		-	
Total Petroleum Hydrocarbons (>C6-C35) Aliphatics & Aromatics	mg/kg	-									-		-	

Footnotes:

U Not detected at the associated reporting limit.
J Estimated concentration.

Appendix D4 – ProUCL Calculation for Samples 0-5 ft bgs

Appendix D-4. UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	8/10/2016 11:45:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene

General Statistics

Total Number of Observations	20	Number of Distinct Observations	13
Number of Detects	3	Number of Non-Detects	17
Number of Distinct Detects	3	Number of Distinct Non-Detects	10
Minimum Detect	0.21	Minimum Non-Detect	0.024
Maximum Detect	7.6	Maximum Non-Detect	0.24
Variance Detects	17.79	Percent Non-Detects	85%
Mean Detects	2.73	SD Detects	4.218
Median Detects	0.38	CV Detects	1.545
Skewness Detects	1.729	Kurtosis Detects	N/A
Mean of Logged Detects	-0.167	SD of Logged Detects	1.924

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.767	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.378	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.512	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.43	Standard Error of Mean	0.451
SD	1.647	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.21	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.172	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.784	95% KM Chebyshev UCL	2.397
97.5% KM Chebyshev UCL	3.247	99% KM Chebyshev UCL	4.919

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.537	k star (bias corrected MLE)	N/A
Theta hat (MLE)	5.088	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.219	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0683	nu hat (KM)	2.732
		Adjusted Level of Significance (β)	0.038
Approximate Chi Square Value (2.73, α)	0.298	Adjusted Chi Square Value (2.73, β)	0.25
95% Gamma Approximate KM-UCL (use when n>=5	3.951	95% Gamma Adjusted KM-UCL (use when n<50)	4.696

Gamma (KM) may not be used when k hat (KM) is < 0.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.87	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.328	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.512	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.41	Mean in Log Scale	-7.597
SD in Original Scale	1.695	SD in Log Scale	3.744
95% t UCL (assumes normality of ROS data)	1.065	95% Percentile Bootstrap UCL	1.16
95% BCA Bootstrap UCL	1.581	95% Bootstrap t UCL	14.85
95% H-UCL (Log ROS)	329.9		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-3.189	95% H-UCL (KM -Log)	0.324

KM SD (logged)	1.413	95% Critical H Value (KM-Log)	3.279
KM Standard Error of Mean (logged)	0.388		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.435	Mean in Log Scale	-3.236
SD in Original Scale	1.689	SD in Log Scale	1.593
95% t UCL (Assumes normality)	1.088	95% H-Stat UCL	0.519

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.21	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Ethylbenzene

General Statistics

Total Number of Observations	20	Number of Distinct Observations	15
Number of Detects	7	Number of Non-Detects	13
Number of Distinct Detects	7	Number of Distinct Non-Detects	8
Minimum Detect	0.39	Minimum Non-Detect	0.031
Maximum Detect	27	Maximum Non-Detect	0.049
Variance Detects	94.47	Percent Non-Detects	65%
Mean Detects	5.803	SD Detects	9.72
Median Detects	1.2	CV Detects	1.675
Skewness Detects	2.285	Kurtosis Detects	5.297
Mean of Logged Detects	0.732	SD of Logged Detects	1.476

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.635	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.359	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.335	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	2.051	Standard Error of Mean	1.448
SD	5.993	95% KM (BCA) UCL	4.694
95% KM (t) UCL	4.554	95% KM (Percentile Bootstrap) UCL	4.435
95% KM (z) UCL	4.432	95% KM Bootstrap t UCL	19.28
90% KM Chebyshev UCL	6.394	95% KM Chebyshev UCL	8.361
97.5% KM Chebyshev UCL	11.09	99% KM Chebyshev UCL	16.45

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.653	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.291	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.325	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.602	k star (bias corrected MLE)	0.439
Theta hat (MLE)	9.641	Theta star (bias corrected MLE)	13.21
nu hat (MLE)	8.427	nu star (bias corrected)	6.149
MLE Mean (bias corrected)	5.803	MLE Sd (bias corrected)	8.756

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.117	nu hat (KM)	4.685
Approximate Chi Square Value (4.69, α)	1.01	Adjusted Chi Square Value (4.69, β)	0.884
95% Gamma Approximate KM-UCL (use when n>=50	9.519	95% Gamma Adjusted KM-UCL (use when n<50)	10.87

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detected data is small such as < 0.1
For such situations, GROS method tends to yield inflated values of UCLs and BTVs
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.038

Maximum	27	Median	0.01
SD	6.154	CV	3.02
k hat (MLE)	0.212	k star (bias corrected MLE)	0.213
Theta hat (MLE)	9.633	Theta star (bias corrected MLE)	9.56
nu hat (MLE)	8.461	nu star (bias corrected)	8.525
MLE Mean (bias corrected)	2.038	MLE Sd (bias corrected)	4.413
		Adjusted Level of Significance (β)	0.038
Approximate Chi Square Value (8.53, α)	3.043	Adjusted Chi Square Value (8.53, β)	2.789
95% Gamma Approximate UCL (use when n>=50)	5.709	95% Gamma Adjusted UCL (use when n<50)	6.228

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.217	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.335	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.044	Mean in Log Scale	-2.568
SD in Original Scale	6.152	SD in Log Scale	2.738
95% t UCL (assumes normality of ROS data)	4.422	95% Percentile Bootstrap UCL	4.583
95% BCA Bootstrap UCL	6.18	95% Bootstrap t UCL	22.72
95% H-UCL (Log ROS)	114.7		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-2.002	95% H-UCL (KM -Log)	13.75
KM SD (logged)	2.163	95% Critical H Value (KM-Log)	4.602
KM Standard Error of Mean (logged)	0.522		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.045	Mean in Log Scale	-2.24
SD in Original Scale	6.151	SD in Log Scale	2.39
95% t UCL (Assumes normality)	4.423	95% H-Stat UCL	29.02

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	4.554	95% GROS Adjusted Gamma UCL	6.228
95% Adjusted Gamma KM-UCL	10.87		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Toluene

General Statistics

Total Number of Observations	20	Number of Distinct Observations	17
Number of Detects	10	Number of Non-Detects	10
Number of Distinct Detects	10	Number of Distinct Non-Detects	7
Minimum Detect	0.15	Minimum Non-Detect	0.031
Maximum Detect	130	Maximum Non-Detect	0.049
Variance Detects	1654	Percent Non-Detects	50%
Mean Detects	19.13	SD Detects	40.67
Median Detects	1.05	CV Detects	2.126
Skewness Detects	2.73	Kurtosis Detects	7.78
Mean of Logged Detects	0.582	SD of Logged Detects	2.458

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.551	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.361	Lilliefors GOF Test
5% Lilliefors Critical Value	0.28	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	9.583	Standard Error of Mean	6.813
SD	28.91	95% KM (BCA) UCL	20.7
95% KM (t) UCL	21.36	95% KM (Percentile Bootstrap) UCL	22.08
95% KM (z) UCL	20.79	95% KM Bootstrap t UCL	59.09
90% KM Chebyshev UCL	30.02	95% KM Chebyshev UCL	39.28

97.5% KM Chebyshev UCL	52.13	99% KM Chebyshev UCL	77.37

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.848	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.817	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.285	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.288	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.292	k star (bias corrected MLE)	0.271
Theta hat (MLE)	65.48	Theta star (bias corrected MLE)	70.55
nu hat (MLE)	5.845	nu star (bias corrected)	5.425
MLE Mean (bias corrected)	19.13	MLE Sd (bias corrected)	36.74

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.11	nu hat (KM)	4.396
Approximate Chi Square Value (4.40, α)	0.884	Adjusted Chi Square Value (4.40, β)	0.77
95% Gamma Approximate KM-UCL (use when n>=50	47.65	95% Gamma Adjusted KM-UCL (use when n<50)	54.71

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	9.572
Maximum	130	Median	0.08
SD	29.66	CV	3.099
k hat (MLE)	0.176	k star (bias corrected MLE)	0.183
Theta hat (MLE)	54.45	Theta star (bias corrected MLE)	52.38
nu hat (MLE)	7.031	nu star (bias corrected)	7.31
MLE Mean (bias corrected)	9.572	MLE Sd (bias corrected)	22.39
		Adjusted Level of Significance (β)	0.038
Approximate Chi Square Value (7.31, α)	2.342	Adjusted Chi Square Value (7.31, β)	2.126
95% Gamma Approximate UCL (use when n>=50)	29.87	95% Gamma Adjusted UCL (use when n<50)	32.91

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.28	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9.568	Mean in Log Scale	-2.869
SD in Original Scale	29.66	SD in Log Scale	3.998
95% t UCL (assumes normality of ROS data)	21.04	95% Percentile Bootstrap UCL	21.55
95% BCA Bootstrap UCL	31.15	95% Bootstrap t UCL	59.6
95% H-UCL (Log ROS)	191686		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-1.446	95% H-UCL (KM -Log)	186.5
KM SD (logged)	2.614	95% Critical H Value (KM-Log)	5.435
KM Standard Error of Mean (logged)	0.616		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9.578	Mean in Log Scale	-1.644
SD in Original Scale	29.66	SD in Log Scale	2.845
95% t UCL (Assumes normality)	21.05	95% H-Stat UCL	508.6

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	21.36	95% GROS Adjusted Gamma UCL	32.91
95% Adjusted Gamma KM-UCL	54.71		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Xylene

General Statistics

Total Number of Observations	20	Number of Distinct Observations	18
Number of Detects	11	Number of Non-Detects	9
Number of Distinct Detects	11	Number of Distinct Non-Detects	7
Minimum Detect	0.31	Minimum Non-Detect	0.062
Maximum Detect	270	Maximum Non-Detect	0.098
Variance Detects	7654	Percent Non-Detects	45%
Mean Detects	53.11	SD Detects	87.49
Median Detects	11	CV Detects	1.647
Skewness Detects	1.884	Kurtosis Detects	3.126
Mean of Logged Detects	2.242	SD of Logged Detects	2.274

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.67	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.383	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.267	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	29.24	Standard Error of Mean	15.77
SD	67.26	95% KM (BCA) UCL	57.8
95% KM (t) UCL	56.51	95% KM (Percentile Bootstrap) UCL	55.8
95% KM (z) UCL	55.18	95% KM Bootstrap t UCL	82.74
90% KM Chebyshev UCL	76.56	95% KM Chebyshev UCL	97.99
97.5% KM Chebyshev UCL	127.7	99% KM Chebyshev UCL	186.2

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.495	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.804	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.23	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.273	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.383	k star (bias corrected MLE)	0.339
Theta hat (MLE)	138.6	Theta star (bias corrected MLE)	156.6
nu hat (MLE)	8.427	nu star (bias corrected)	7.462
MLE Mean (bias corrected)	53.11	MLE Sd (bias corrected)	91.19

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.189	nu hat (KM)	7.559
Approximate Chi Square Value (7.56, α)	2.482	Adjusted Chi Square Value (7.56, β)	2.258
95% Gamma Approximate KM-UCL (use when n>=50)	89.03	95% Gamma Adjusted KM-UCL (use when n<50)	97.86

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	29.21
Maximum	270	Median	0.345
SD	69.01	CV	2.362
k hat (MLE)	0.178	k star (bias corrected MLE)	0.184
Theta hat (MLE)	164.3	Theta star (bias corrected MLE)	158.3
nu hat (MLE)	7.114	nu star (bias corrected)	7.38
MLE Mean (bias corrected)	29.21	MLE Sd (bias corrected)	68.01
		Adjusted Level of Significance (β)	0.038
Approximate Chi Square Value (7.38, α)	2.381	Adjusted Chi Square Value (7.38, β)	2.163
95% Gamma Approximate UCL (use when n>=50)	90.53	95% Gamma Adjusted UCL (use when n<50)	99.67

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.945	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.141	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.267	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	29.22	Mean in Log Scale	-0.44
SD in Original Scale	69.01	SD in Log Scale	3.495
95% t UCL (assumes normality of ROS data)	55.91	95% Percentile Bootstrap UCL	56.97
95% BCA Bootstrap UCL	68.76	95% Bootstrap t UCL	83.57
95% H-UCL (Log ROS)	86374		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-0.018	95% H-UCL (KM -Log)	5228
KM SD (logged)	2.972	95% Critical H Value (KM-Log)	6.109
KM Standard Error of Mean (logged)	0.697		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	29.23	Mean in Log Scale	-0.201
SD in Original Scale	69.01	SD in Log Scale	3.228
95% t UCL (Assumes normality)	55.91	95% H-Stat UCL	19787

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (BCA) UCL	57.8	95% GROS Adjusted Gamma UCL	99.67
95% Adjusted Gamma KM-UCL	97.86		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix D5 – ProUCL Calculation for Samples 0-10 ft bgs

Appendix D-5. UCL Statistics for Data Sets with Non-Detects

User Selected Options

Date/Time of Computation	8/10/2016 3:49:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene 0-5

General Statistics

Total Number of Observations	16	Number of Distinct Observations	13
Number of Detects	3	Number of Non-Detects	13
Number of Distinct Detects	3	Number of Distinct Non-Detects	10
Minimum Detect	0.21	Minimum Non-Detect	0.024
Maximum Detect	7.6	Maximum Non-Detect	0.24
Variance Detects	17.79	Percent Non-Detects	81.25%
Mean Detects	2.73	SD Detects	4.218
Median Detects	0.38	CV Detects	1.545
Skewness Detects	1.729	Kurtosis Detects	N/A
Mean of Logged Detects	-0.167	SD of Logged Detects	1.924

Warning: Data set has only 3 Detected Values.

This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.767	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.378	Lilliefors GOF Test
5% Lilliefors Critical Value	0.512	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.532	Standard Error of Mean	0.56
SD	1.827	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.513	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.453	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	2.211	95% KM Chebyshev UCL	2.971
97.5% KM Chebyshev UCL	4.026	99% KM Chebyshev UCL	6.099

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.537	k star (bias corrected MLE)	N/A
Theta hat (MLE)	5.088	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.219	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.0848	nu hat (KM)	2.715
		Adjusted Level of Significance (β)	0.0335
Approximate Chi Square Value (2.72, α)	0.293	Adjusted Chi Square Value (2.72, β)	0.229
95% Gamma Approximate KM-UCL (use when n>=5	4.928	95% Gamma Adjusted KM-UCL (use when n<50)	6.321

Gamma (KM) may not be used when k hat (KM) is < 0.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.87	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.328	Lilliefors GOF Test
5% Lilliefors Critical Value	0.512	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.512	Mean in Log Scale	-6.534
SD in Original Scale	1.893	SD in Log Scale	3.417
95% t UCL (assumes normality of ROS data)	1.342	95% Percentile Bootstrap UCL	1.439
95% BCA Bootstrap UCL	1.964	95% Bootstrap t UCL	18.55
95% H-UCL (Log ROS)	300.9		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-3.051	95% H-UCL (KM -Log)	0.675

KM SD (logged)	1.551	95% Critical H Value (KM-Log)	3.635
KM Standard Error of Mean (logged)	0.477		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.538	Mean in Log Scale	-3.04
SD in Original Scale	1.886	SD in Log Scale	1.697
95% t UCL (Assumes normality)	1.364	95% H-Stat UCL	1.117

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.513	95% KM (Percentile Bootstrap) UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

EB_0-5

General Statistics

Total Number of Observations	16	Number of Distinct Observations	13
Number of Detects	6	Number of Non-Detects	10
Number of Distinct Detects	6	Number of Distinct Non-Detects	7
Minimum Detect	0.39	Minimum Non-Detect	0.031
Maximum Detect	27	Maximum Non-Detect	0.049
Variance Detects	107.6	Percent Non-Detects	62.5%
Mean Detects	6.63	SD Detects	10.37
Median Detects	1.7	CV Detects	1.565
Skewness Detects	2.09	Kurtosis Detects	4.389
Mean of Logged Detects	0.883	SD of Logged Detects	1.556

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.687	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.332	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.362	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	2.506	Standard Error of Mean	1.813
SD	6.621	95% KM (BCA) UCL	5.395
95% KM (t) UCL	5.684	95% KM (Percentile Bootstrap) UCL	5.719
95% KM (z) UCL	5.488	95% KM Bootstrap t UCL	23.79
90% KM Chebyshev UCL	7.945	95% KM Chebyshev UCL	10.41
97.5% KM Chebyshev UCL	13.83	99% KM Chebyshev UCL	20.55

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.44	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.276	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.346	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.611	k star (bias corrected MLE)	0.417
Theta hat (MLE)	10.85	Theta star (bias corrected MLE)	15.91
nu hat (MLE)	7.334	nu star (bias corrected)	5
MLE Mean (bias corrected)	6.63	MLE Sd (bias corrected)	10.27

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.143	nu hat (KM)	4.583
Approximate Chi Square Value (4.58, α)	0.965	Adjusted Chi Square Value (4.58, β)	0.794
95% Gamma Approximate KM-UCL (use when n>=5	11.9	95% Gamma Adjusted KM-UCL (use when n<50)	14.47

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detected data is small such as < 0.1
For such situations, GROS method tends to yield inflated values of UCLs and BTVs
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.493

Maximum	27	Median	0.01
SD	6.843	CV	2.746
k hat (MLE)	0.211	k star (bias corrected MLE)	0.213
Theta hat (MLE)	11.82	Theta star (bias corrected MLE)	11.7
nu hat (MLE)	6.749	nu star (bias corrected)	6.817
MLE Mean (bias corrected)	2.493	MLE Sd (bias corrected)	5.4
		Adjusted Level of Significance (β)	0.0335
Approximate Chi Square Value (6.82, α)	2.071	Adjusted Chi Square Value (6.82, β)	1.786
95% Gamma Approximate UCL (use when n>=50)	8.206	95% Gamma Adjusted UCL (use when n<50)	9.511

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.953	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.191	Lilliefors GOF Test
5% Lilliefors Critical Value	0.362	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.496	Mean in Log Scale	-2.444
SD in Original Scale	6.842	SD in Log Scale	2.894
95% t UCL (assumes normality of ROS data)	5.495	95% Percentile Bootstrap UCL	5.593
95% BCA Bootstrap UCL	7.5	95% Bootstrap t UCL	27.91
95% H-UCL (Log ROS)	594.1		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-1.84	95% H-UCL (KM -Log)	41.06
KM SD (logged)	2.282	95% Critical H Value (KM-Log)	5.01
KM Standard Error of Mean (logged)	0.625		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.499	Mean in Log Scale	-2.091
SD in Original Scale	6.841	SD in Log Scale	2.547
95% t UCL (Assumes normality)	5.497	95% H-Stat UCL	120

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	5.684	95% KM (Percentile Bootstrap) UCL	5.719

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Xylene_0-5

General Statistics

Total Number of Observations	16	Number of Distinct Observations	15
Number of Detects	6	Number of Non-Detects	10
Number of Distinct Detects	6	Number of Distinct Non-Detects	9
Minimum Detect	0.38	Minimum Non-Detect	0.062
Maximum Detect	270	Maximum Non-Detect	11
Variance Detects	11366	Percent Non-Detects	62.5%
Mean Detects	91.65	SD Detects	106.6
Median Detects	69	CV Detects	1.163
Skewness Detects	0.97	Kurtosis Detects	0.159
Mean of Logged Detects	2.943	SD of Logged Detects	2.69

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.861	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.255	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.362	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	34.44	Standard Error of Mean	20.34
SD	74.27	95% KM (BCA) UCL	68.16
95% KM (t) UCL	70.1	95% KM (Percentile Bootstrap) UCL	67.33
95% KM (z) UCL	67.9	95% KM Bootstrap t UCL	90.23
90% KM Chebyshev UCL	95.46	95% KM Chebyshev UCL	123.1
97.5% KM Chebyshev UCL	161.5	99% KM Chebyshev UCL	236.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.351	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.749	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.256	**Kolmogrov-Smirnoff GOF**	
5% K-S Critical Value	0.352	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.415	k star (bias corrected MLE)	0.319
Theta hat (MLE)	220.7	Theta star (bias corrected MLE)	287.5
nu hat (MLE)	4.983	nu star (bias corrected)	3.825
MLE Mean (bias corrected)	91.65	MLE Sd (bias corrected)	162.3

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.215	nu hat (KM)	6.883
Approximate Chi Square Value (6.88, α)	2.107	Adjusted Chi Square Value (6.88, β)	1.819
95% Gamma Approximate KM-UCL (use when n>=5	112.5	95% Gamma Adjusted KM-UCL (use when n<50)	130.3

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	34.37
Maximum	270	Median	0.01
SD	76.73	CV	2.232
k hat (MLE)	0.145	k star (bias corrected MLE)	0.16
Theta hat (MLE)	236.5	Theta star (bias corrected MLE)	215.2
nu hat (MLE)	4.651	nu star (bias corrected)	5.112
MLE Mean (bias corrected)	34.37	MLE Sd (bias corrected)	86
		Adjusted Level of Significance (β)	0.0335
Approximate Chi Square Value (5.11, α)	1.204	Adjusted Chi Square Value (5.11, β)	1.005
95% Gamma Approximate UCL (use when n>=50)	145.9	95% Gamma Adjusted UCL (use when n<50)	174.8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.886	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.254	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.362	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	34.38	Mean in Log Scale	-1.767
SD in Original Scale	76.73	SD in Log Scale	4.14
95% t UCL (assumes normality of ROS data)	68.01	95% Percentile Bootstrap UCL	67.93
95% BCA Bootstrap UCL	84.38	95% Bootstrap t UCL	102.4
95% H-UCL (Log ROS)	9968917		

UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed

KM Mean (logged)	-0.53	95% H-UCL (KM -Log)	16811
KM SD (logged)	3.124	95% Critical H Value (KM-Log)	6.669
KM Standard Error of Mean (logged)	0.868		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	35.05	Mean in Log Scale	-0.0173
SD in Original Scale	76.43	SD in Log Scale	3.27
95% t UCL (Assumes normality)	68.54	95% H-Stat UCL	73644

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	70.1	95% KM (Percentile Bootstrap) UCL	67.33

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix E - Tables

Table 2.1

Soil Screening Results
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Sample Location:												**North Wall**	**South Wall**	**East Wall**	**West Wall**	**Base**	**Base (2)**	**S-1**	**S-2**	**S-3**	**S-4**	**S-5**
Sample ID:												**SC-1**	**SC-2**	**SC-3**	**SC-4**	**SC-5**	**SC-5 (2)**	**S-1**	**S-2**	**S-3**	**S-4**	**S-5**
Sample Date:												**2/17/2015**	**2/17/2015**	**2/17/2015**	**2/17/2015**	**2/17/2015**	**4/30/2015**	**2/12/2016**	**2/12/2016**	**2/12/2016**	**2/12/2016**	**2/12/2016**
Sample Depth:			**USEPA May 2016 (1)**				**NMED July 2015 (2)**			**Site-Specific**		**1-19 ft BGS**	**1-19 ft BGS**	**1-19 ft BGS**	**1-19 ft BGS**	**1-19 ft BGS**	**1-19 ft BGS**	**-**	**-**	**-**	**-**	**-**
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**											
Parameters	**Units**	**Residential RSL**	**Industrial RSL**	**MCL-based RSL§ DAF20**	**Tap water-based RSL§ DAF20**	**Residential SSL**	**Commercial/Industrial SSL**	**Construction SSL**	**Tap water-based SSL DAF20**	**Residential SSCL**	**Commercial/Industrial SSCL**											
Volatile Organic Compounds																						
Benzene	mg/kg	12	51	0.052	0.046	17.8	87.2	142	0.038	-	-	0.032 U	0.038 U	0.044 U	0.031 U	**7.6**[cdh]	0.038 U	0.046 U	0.24 U	0.046 U	0.12 U	0.048 U
Ethylbenzene	mg/kg	58	250	15.6	0.34	75.1	368	1,770	0.262	-	-	0.032 U	0.038 U	0.044 U	0.031 U	**27**[cdh]	0.038 U	0.046 U	**1.2**[dh]	0.046 U	**0.39**[dh]	0.048 U
Toluene	mg/kg	4,900	47,000	13.8	15.2	5,230	61,300	14,000	12.1	-	-	0.032 U	0.038 U	0.044 U	0.031 U	**130**[cdh]	0.038 U	0.17	2.3	0.046 U	0.5	0.16
Xylenes (total)	mg/kg	580	2,500	198	3.8	871	4,280	798	2.98	-	-	0.064 U	0.076 U	0.088 U	0.062 U	**270**[cdh]	0.076 U	1.5	**18**[dh]	0.31	**4.9**[dh]	**5.1**[dh]
Semi-volatile Organic Compounds																						
Acenaphthene	mg/kg	3,600	45,000	-	110	3,480	50,500	15,100	82.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Acenaphthylene	mg/kg	3,800	37,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anthracene	mg/kg	18,000	230,000	-	1160	17,400	253,000	75,300	851	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)anthracene	mg/kg	1.6	29	-	0.84	1.53	32.3	240	1.82	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(a)pyrene	mg/kg	0.16	2.9	4.8	0.8	0.153	3.23	24	0.605	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(b)fluoranthene	mg/kg	1.6	29	-	8.2	1.53	32.3	240	6.17	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(g,h,i)perylene	mg/kg	1,800	19,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Benzo(k)fluoranthene	mg/kg	16	290	-	80	15.3	323	2310	60.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Chrysene	mg/kg	160	2,900	-	240	153	3,230	23,100	186	-	-	-	-	-	-	-	-	-	-	-	-	-
Dibenz(a,h)anthracene	mg/kg	0.16	2.9	-	2.6	0.153	3.23	24	6.11	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoranthene	mg/kg	2,400	30,000	-	1,780	2,320	33,700	10,000	1,340	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluorene	mg/kg	2,400	30,000	-	108	2,320	33,700	10,000	80	-	-	-	-	-	-	-	-	-	-	-	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	2	29	-	26	1.53	32.3	240	20.1	-	-	-	-	-	-	-	-	-	-	-	-	-
Naphthalene	mg/kg	38	170	-	0.108	49.7	241	159	0.0823	-	-	-	-	-	-	-	-	-	-	-	-	-
Phenanthrene	mg/kg	1,700	19,000	-	-	1,740	25,300	7,530	85.9	-	-	-	-	-	-	-	-	-	-	-	-	-
Pyrene	mg/kg	1,800	23,000	-	260	1,740	25,300	7,530	192	-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum Products																						
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	50	500	-	-	1,000	3,000	3,000	-	3,712	15,537	10 U	10 U	10 U	9.9 U	**640**[ab]	20	19	**130**[a]	19	**59**[a]	36
Total Petroleum Hydrocarbons (C10-C28) DRO	mg/kg	50	500	-	-	1,000	3,000	3,000	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	-	-	-	-	1,000	3,000	3,000	-	3,712	15,537	50 U	50 U	50 U	50 U	50 U	49 U	47 U	47 U	46 U	48 U	50 U
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	3.2 U	3.2 U	4.4 U	3.1 U	**3800**[abi]	3.8 U	27	**220**[a]	40	**91**[a]	**150**[a]
Total Petroleum Hydrocarbons (C6-C10) GRO	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
TX 1005																						
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C12-C28(3))	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C28-C35(3))	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (C6-C35(3))	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
TX 1006																						
Total Petroleum Hydrocarbons (C6) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C6-C8) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C7-C8) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C8-C10) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C8-C10) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C10-C12) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C10-C12) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C12-C16) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C12-C16) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C16-C21) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C16-C21) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C21-C35) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (C21-C35) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-
Total Petroleum Hydrocarbons (>C6-C35) Aliphatics & Aromatics	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-	-	-	-	-	-	-	-	-	-

Footnotes:
U-Not detected at the associated reporting limit.
J-Estimated concentration.
DAF-Dilution Attentuation Factor
§ USEPA May 2016 Soil RSLs for migration to groundwater pathway (USEPA, 2016) (adjusted to the default NMED cancer risk level of 1.0×10^{-5} and DAF=20)

References:
(1) USEPA, 2016. USEPA Regional Screening Levels, May 2016. http://www.epa.gov/region9/superfund/prg/.
(2) NMED, 2015, New Mexico Environmental Department Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015.
(3) DEQ, 2012. Oklahoma Department of Environmental Quality. Risk-Based Levels for Total Petroleum Hydrocarbons (TPH), October, 2012.

Table 2.1

Soil Screening Results
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Sample Location:												S-6	CH-1		CH-1		CH-1		CH-2		CH-2	
Sample ID:												**S-6**	**S-11119528-042116-CH-1-20**		**S-11119528-042116-CH-1-30**		**S-11119528-042216-CH-1-40**		**S-11119528-042116-CH-2-5**		**S-11119528-042116-CH-2-15**	
Sample Date:												**2/12/2016**	**4/21/2016**		**4/21/2016**		**4/22/2016**		**4/21/2016**		**4/21/2016**	
Sample Depth:		**USEPA May 2016 [1]**				**NMED July 2015 [2]**				**Site-Specific**		**-**	**20 ft BGS**		**30 ft BGS**		**40 ft BGS**		**5 ft BGS**		**15 ft BGS**	
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**											
Parameters	**Units**	**Residential RSL**	**Industrial RSL**	**MCL-based RSL§ DAF20**	**Tap water-based RSL§ DAF20**	**Residential SSL**	**Commercial/Industrial SSL**	**Construction SSL**	**Tap water-based SSL DAF20**	**Residential SSCL**	**Commercial/Industrial SSCL**											
Volatile Organic Compounds																						
Benzene	mg/kg	12	51	0.052	0.046	17.8	87.2	142	0.038	-	-	**0.095**[cdh]	0.23	U	**0.62**[cdh]		0.024	U	**0.21**[cdh]		0.023	U
Ethylbenzene	mg/kg	58	250	15.6	0.34	75.1	368	1,770	0.262	-	-	**0.89**[dh]	**4.5**[dh]		**5.0**[dh]		0.047	U	**8.1**[dh]		0.046	U
Toluene	mg/kg	4,900	47,000	13.8	15.2	5,230	61,300	14,000	12.1	-	-	1.6	11		**20**[cdh]		0.047	U	**34**[cdh]		0.046	U
Xylenes (total)	mg/kg	580	2,500	198	3.8	871	4,280	798	2.98	-	-	**11**[dh]	**49**[dh]		**68**[dh]		0.094	U	**120**[dh]		0.092	U
Semi-volatile Organic Compounds																						
Acenaphthene	mg/kg	3,600	45,000	-	110	3,480	50,500	15,100	82.5	-	-	-	-		-		-		-		-	
Acenaphthylene	mg/kg	3,800	37,000	-	-	-	-	-	-	-	-	-	-		-		-		-		-	
Anthracene	mg/kg	18,000	230,000	-	1160	17,400	253,000	75,300	851	-	-	-	-		-		-		-		-	
Benzo(a)anthracene	mg/kg	1.6	29	-	0.84	1.53	32.3	240	1.82	-	-	-	-		-		-		-		-	
Benzo(a)pyrene	mg/kg	0.16	2.9	4.8	0.8	0.153	3.23	24	0.605	-	-	-	-		-		-		-		-	
Benzo(b)fluoranthene	mg/kg	1.6	29	-	8.2	1.53	32.3	240	6.17	-	-	-	-		-		-		-		-	
Benzo(g,h,i)perylene	mg/kg	1,800	19,000	-	-	-	-	-	-	-	-	-	-		-		-		-		-	
Benzo(k)fluoranthene	mg/kg	16	290	-	80	15.3	323	2310	60.5	-	-	-	-		-		-		-		-	
Chrysene	mg/kg	160	2,900	-	240	153	3,230	23,100	186	-	-	-	-		-		-		-		-	
Dibenz(a,h)anthracene	mg/kg	0.16	2.9	-	2.6	0.153	3.23	24	6.11	-	-	-	-		-		-		-		-	
Fluoranthene	mg/kg	2,400	30,000	-	1,780	2,320	33,700	10,000	1,340	-	-	-	-		-		-		-		-	
Fluorene	mg/kg	2,400	30,000	-	108	2,320	33,700	10,000	80	-	-	-	-		-		-		-		-	
Indeno(1,2,3-cd)pyrene	mg/kg	2	29	-	26	1.53	32.3	240	20.1	-	-	-	-		-		-		-		-	
Naphthalene	mg/kg	38	170	-	0.108	49.7	241	159	0.0823	-	-	-	-		-		-		-		-	
Phenanthrene	mg/kg	1,700	19,000	-	-	1,740	25,300	7,530	85.9	-	-	-	-		-		-		-		-	
Pyrene	mg/kg	1,800	23,000	-	260	1,740	25,300	7,530	192	-	-	-	-		-		-		-		-	
Petroleum Products																						
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	50	500	-	-	1,000	3,000	3,000	-	3,712	15,537	**66**[a]	**240**[a]		**220**[a]		9.6	U	**310**[a]		15	
Total Petroleum Hydrocarbons (C10-C28) DRO	mg/kg	50	500	-	-	1,000	3,000	3,000	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	-	-	-	-	1,000	3,000	3,000	-	3,712	15,537	48	47	U	48	U	48	U	47	U	49	U
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	**240**[a]	**610**[ab]	J	**820**[ab]	J	4.7	U	**1500**[ab]	J	4.6	U
Total Petroleum Hydrocarbons (C6-C10) GRO	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
TX 1005																						
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C12-C28)(3)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C28-C35)(3)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (C6-C35)(3)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
TX 1006																						
Total Petroleum Hydrocarbons (C6) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C6-C8) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C7-C8) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C8-C10) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C8-C10) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C10-C12) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C10-C12) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C12-C16) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C12-C16) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C16-C21) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C16-C21) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C21-C35) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (C21-C35) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C6-C35) Aliphatics & Aromatics	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-	-		-		-		-		-	

Footnotes:
U-Not detected at the associated reporting limit.
J-Estimated concentration.
DAF-Dilution Attentuation Factor
§ USEPA May 2016 Soil RSLs for migration to groundwater pathway (USEPA, 2016) (adjusted to the default NMED cancer risk level of 1.0×10^{-5} and DAF=20)

References:
(1) USEPA, 2016. USEPA Regional Screening Levels, May 2016. http://www.epa.gov/region9/superfund/prg/.
(2) NMED, 2015, New Mexico Environmental Department Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015.
(3) DEQ, 2012. Oklahoma Department of Environmental Quality. Risk-Based Levels for Total Petroleum Hydrocarbons (TPH), October, 2012.

Table 2.1

Soil Screening Results
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Sample Location:												CH-3		CH-3		CH-4		CH-4		CH-5	
Sample ID:												S-11119528-042216-CH-3-5		S-11119528-042216-CH-3-10		S-11119528-042216-CH-4-5		S-11119528-042216-CH-4-15		S-11119528-042216-CH-6-5	
Sample Date:												4/22/2016		4/22/2016		4/22/2016		4/22/2016		4/22/2016	
Sample Depth:			USEPA May 2016 (1)				NMED July 2015 (2)			Site-Specific		5 ft BGS		10 ft BGS		5 ft BGS		15 ft BGS		5 ft BGS	
		a	b	c	d	e	f	g	h	i	j										
Parameters	Units	Residential RSL	Industrial RSL	MCL-based RSL§ DAF20	Tap water-based RSL§ DAF20	Residential SSL	Commercial/Industrial SSL	Construction SSL	Tap water-based SSL DAF20	Residential SSCL	Commercial/Industrial SSCL										
Volatile Organic Compounds																					
Benzene	mg/kg	12	51	0.052	0.046	17.8	87.2	142	0.038	-	-	0.024	U	0.024	U	**0.38**[cdh]	J	0.025	U	0.024	U
Ethylbenzene	mg/kg	58	250	15.6	0.34	75.1	368	1,770	0.262	-	-	0.049	U	0.049	U	**2.2**[dh]	J	0.05	U	0.048	U
Toluene	mg/kg	4,900	47,000	13.8	15.2	5,230	61,300	14,000	12.1	-	-	0.049	U	0.049	U	**22**[cdh]		0.05	U	0.15	
Xylenes (total)	mg/kg	580	2,500	198	3.8	871	4,280	798	2.98	-	-	0.097	U	0.098	U	**140**[dh]		0.1	U	0.38	
Semi-volatile Organic Compounds																					
Acenaphthene	mg/kg	3,600	45,000	-	110	3,480	50,500	15,100	82.5	-	-	-		-		-		-		-	
Acenaphthylene	mg/kg	3,800	37,000	-	-	-	-	-	-	-	-	-		-		-		-		-	
Anthracene	mg/kg	18,000	230,000	-	1160	17,400	253,000	75,300	851	-	-	-		-		-		-		-	
Benzo(a)anthracene	mg/kg	1.6	29	-	0.84	1.53	32.3	240	1.82	-	-	-		-		-		-		-	
Benzo(a)pyrene	mg/kg	0.16	2.9	4.8	0.8	0.153	3.23	24	0.605	-	-	-		-		-		-		-	
Benzo(b)fluoranthene	mg/kg	1.6	29	-	8.2	1.53	32.3	240	6.17	-	-	-		-		-		-		-	
Benzo(g,h,i)perylene	mg/kg	1,800	19,000	-	-	-	-	-	-	-	-	-		-		-		-		-	
Benzo(k)fluoranthene	mg/kg	16	290	-	80	15.3	323	2310	60.5	-	-	-		-		-		-		-	
Chrysene	mg/kg	160	2,900	-	240	153	3,230	23,100	186	-	-	-		-		-		-		-	
Dibenz(a,h)anthracene	mg/kg	0.16	2.9	-	2.6	0.153	3.23	24	6.11	-	-	-		-		-		-		-	
Fluoranthene	mg/kg	2,400	30,000	-	1,780	2,320	33,700	10,000	1,340	-	-	-		-		-		-		-	
Fluorene	mg/kg	2,400	30,000	-	108	2,320	33,700	10,000	80	-	-	-		-		-		-		-	
Indeno(1,2,3-cd)pyrene	mg/kg	2	29	-	26	1.53	32.3	240	20.1	-	-	-		-		-		-		-	
Naphthalene	mg/kg	38	170	-	0.108	49.7	241	159	0.0823	-	-	-		-		-		-		-	
Phenanthrene	mg/kg	1,700	19,000	-	-	1,740	25,300	7,530	85.9	-	-	-		-		-		-		-	
Pyrene	mg/kg	1,800	23,000	-	260	1,740	25,300	7,530	192	-	-	-		-		-		-		-	
Petroleum Products																					
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	50	500	-	-	1,000	3,000	3,000	-	3,712	15,537	9.6	U	9.8	U	**500**[a]		9.4	U	9.2	U
Total Petroleum Hydrocarbons (C10-C28) DRO	mg/kg	50	500	-	-	1,000	3,000	3,000	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	-	-	-	-	1,000	3,000	3,000	-	3,712	15,537	48	U	49	U	48	U	47	U	46	U
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	4.9	U	4.9	U	**2800**[ab]	J	5	U	4.8	U
Total Petroleum Hydrocarbons (C6-C10) GRO	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
TX 1005																					
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C12-C28(3)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C28-C35(3)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (C6-C35(3)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
TX 1006																					
Total Petroleum Hydrocarbons (C6) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C6-C8) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C7-C8) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C8-C10) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C8-C10) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C10-C12) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C10-C12) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C12-C16) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C12-C16) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C16-C21) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C16-C21) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C21-C35) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (C21-C35) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C6-C35) Aliphatics & Aromatics	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	

Footnotes:
U-Not detected at the associated reporting limit.
J-Estimated concentration.
DAF-Dilution Attentuation Factor
§ USEPA May 2016 Soil RSLs for migration to groundwater pathway (USEPA, 2016) (adjusted to the default NMED cancer risk level of 1.0×10^{-5} and DAF=20)

References:
(1) USEPA, 2016. USEPA Regional Screening Levels, May 2016. http://www.epa.gov/region9/superfund/prg/.
(2) NMED, 2015, New Mexico Environmental Department Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015.
(3) DEQ, 2012. Oklahoma Department of Environmental Quality. Risk-Based Levels for Total Petroleum Hydrocarbons (TPH), October, 2012.

Table 2.1

Soil Screening Results
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Sample Location:												**CH-5**		**CH-5**		**CH-5**		**CH-7**		**CH-8**	
Sample ID:												**S-11119528-042216-CH-5-10**		**S-11119528-042216-CH-5-15**		**S-11119528-042216-CH-6-10**		**SL-11119528-070616-JW-B7-32**		**SL-11119528-070616-JW-B8-37**	
Sample Date:												**4/22/2016**		**4/22/2016**		**4/22/2016**		**7/6/2016**		**7/6/2016**	
Sample Depth:		**USEPA May 2016 (1)**				**NMED July 2015 (2)**				**Site-Specific**		**10 ft BGS**		**10 ft BGS**		**10 ft BGS**		**32 ft BGS**		**37 ft BGS**	
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**										
Parameters	**Units**	**Residential RSL**	**Industrial RSL**	**MCL-based RSL§ DAF20**	**Tap water-based RSL§ DAF20**	**Residential SSL**	**Commercial/Industrial SSL**	**Construction SSL**	**Tap water-based SSL DAF20**	**Residential SSCL**	**Commercial/Industrial SSCL**										
Volatile Organic Compounds																					
Benzene	mg/kg	12	51	0.052	0.046	17.8	87.2	142	0.038	-	-	0.12	U	0.024	U	0.024	U	0.0052	U	0.0052	U
Ethylbenzene	mg/kg	58	250	15.6	0.34	75.1	368	1,770	0.262	-	-	**0.84**[dh]		0.049	U	0.047	U	0.0052	U	0.0052	U
Toluene	mg/kg	4,900	47,000	13.8	15.2	5,230	61,300	14,000	12.1	-	-	0.46		0.049	U	0.047	U	0.0052	U	0.0052	U
Xylenes (total)	mg/kg	580	2,500	198	3.8	871	4,280	798	2.98	-	-	**13**[dh]		0.098	U	0.094	U	0.01	U	0.01	U
Semi-volatile Organic Compounds																					
Acenaphthene	mg/kg	3,600	45,000	-	110	3,480	50,500	15,100	82.5	-	-	-		-		-		0.0034	U	0.0033	U
Acenaphthylene	mg/kg	3,800	37,000	-	-	-	-	-	-	-	-	-		-		-		0.0034	U	0.0033	U
Anthracene	mg/kg	18,000	230,000	-	1160	17,400	253,000	75,300	851	-	-	-		-		-		0.0034	U	0.0033	U
Benzo(a)anthracene	mg/kg	1.6	29	-	0.84	1.53	32.3	240	1.82	-	-	-		-		-		0.0034	U	0.0033	U
Benzo(a)pyrene	mg/kg	0.16	2.9	4.8	0.8	0.153	3.23	24	0.605	-	-	-		-		-		0.0034	U	0.0033	U
Benzo(b)fluoranthene	mg/kg	1.6	29	-	8.2	1.53	32.3	240	6.17	-	-	-		-		-		0.0034	U	0.0033	U
Benzo(g,h,i)perylene	mg/kg	1,800	19,000	-	-	-	-	-	-	-	-	-		-		-		0.0034	U	0.0033	U
Benzo(k)fluoranthene	mg/kg	16	290	-	80	15.3	323	2310	60.5	-	-	-		-		-		0.0034	U	0.0033	U
Chrysene	mg/kg	160	2,900	-	240	153	3,230	23,100	186	-	-	-		-		-		0.0034	U	0.0033	U
Dibenz(a,h)anthracene	mg/kg	0.16	2.9	-	2.6	0.153	3.23	24	6.11	-	-	-		-		-		0.0034	U	0.0033	U
Fluoranthene	mg/kg	2,400	30,000	-	1,780	2,320	33,700	10,000	1,340	-	-	-		-		-		0.0034	U	0.0033	U
Fluorene	mg/kg	2,400	30,000	-	108	2,320	33,700	10,000	80	-	-	-		-		-		0.0034	U	0.0033	U
Indeno(1,2,3-cd)pyrene	mg/kg	2	29	-	26	1.53	32.3	240	20.1	-	-	-		-		-		0.0034	U	0.0033	U
Naphthalene	mg/kg	38	170	-	0.108	49.7	241	159	0.0823	-	-	-		-		-		0.0034	U	0.0033	U
Phenanthrene	mg/kg	1,700	19,000	-	-	1,740	25,300	7,530	85.9	-	-	-		-		-		0.0034	U	0.0033	U
Pyrene	mg/kg	1,800	23,000	-	260	1,740	25,300	7,530	192	-	-	-		-		-		0.0034	U	0.0033	U
Petroleum Products																					
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	50	500	-	-	1,000	3,000	3,000	-	3,712	15,537	**280**[a]		15		9.4	U	11.8		11	
Total Petroleum Hydrocarbons (C10-C28) DRO	mg/kg	50	500	-	-	1,000	3,000	3,000	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	-	-	-	-	1,000	3,000	3,000	-	3,712	15,537	47	U	48	U	47	U	-		-	
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	**240**[a]	J	4.9	U	4.7	U	-		-	
Total Petroleum Hydrocarbons (C6-C10) GRO	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-		-		-		0.52	U	0.52	U
TX 1005																					
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		20.6	U	20	U
Total Petroleum Hydrocarbons (>C12-C28(3)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-		-		-		20.6	U	20	U
Total Petroleum Hydrocarbons (>C28-C35(3)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-		-		-		20.6	U	20	U
Total Petroleum Hydrocarbons (C6-C35(3)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-		-		-		20.6	U	20	U
TX 1006																					
Total Petroleum Hydrocarbons (C6) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C6-C8) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C7-C8) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C8-C10) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C8-C10) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C10-C12) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C10-C12) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C12-C16) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C12-C16) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C16-C21) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C16-C21) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C21-C35) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (C21-C35) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	
Total Petroleum Hydrocarbons (>C6-C35) Aliphatics & Aromatics	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		-		-		-	

Footnotes:
U-Not detected at the associated reporting limit.
J-Estimated concentration.
DAF-Dilution Attentuation Factor
§ USEPA May 2016 Soil RSLs for migration to groundwater pathway (USEPA, 2016) (adjusted to the default NMED cancer risk level of 1.0×10^{-5} and DAF=20)

References:
(1) USEPA, 2016. USEPA Regional Screening Levels, May 2016. http://www.epa.gov/region9/superfund/prg/.
(2) NMED, 2015, New Mexico Environmental Department Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015.
(3) DEQ, 2012. Oklahoma Department of Environmental Quality. Risk-Based Levels for Total Petroleum Hydrocarbons (TPH), October, 2012.

Table 2.1

Soil Screening Results
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Sample Location:												**CH-9**		**CH-10**		**CH-11**		**CH-11**	
Sample ID:												**SL-11119528-070616-JW-B9-42.5**		**SL-11119528-070716-JW-B10-42.5**		**11119528-B-11@22.5**		**11119528-B-11@22.5 DUP**	
Sample Date:												**7/6/2016**		**7/6/2016**		**7/6/2016**		**7/6/2016**	
Sample Depth:		**USEPA May 2016 (1)**				**NMED July 2015 (2)**				**Site-Specific**		**42.5 ft BGS**		**42.5 ft BGS**		**22.5 ft BGS**		**22.5 ft BGS**	
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**							**Duplicate**	
Parameters	**Units**	**Residential RSL**	**Industrial RSL**	**MCL-based RSL§ DAF20**	**Tap water-based RSL§ DAF20**	**Residential SSL**	**Commercial/Industrial SSL**	**Construction SSL**	**Tap water-based SSL DAF20**	**Residential SSCL**	**Commercial/Industrial SSCL**								
Volatile Organic Compounds																			
Benzene	mg/kg	12	51	0.052	0.046	17.8	87.2	142	0.038	-	-	0.006	U	0.0052	U	0.0055	U	-	
Ethylbenzene	mg/kg	58	250	15.6	0.34	75.1	368	1,770	0.262	-	-	0.006	U	0.0052	U	0.0055	U	-	
Toluene	mg/kg	4,900	47,000	13.8	15.2	5,230	61,300	14,000	12.1	-	-	0.017		0.0052	U	0.0055	U	-	
Xylenes (total)	mg/kg	580	2,500	198	3.8	871	4,280	798	2.98	-	-	0.012	U	0.01	U	0.011	U	-	
Semi-volatile Organic Compounds																			
Acenaphthene	mg/kg	3,600	45,000	-	110	3,480	50,500	15,100	82.5	-	-	0.004	U	0.0034	U	0.0036	U	-	
Acenaphthylene	mg/kg	3,800	37,000	-	-	-	-	-	-	-	-	0.004	U	0.0034	U	0.0036	U	-	
Anthracene	mg/kg	18,000	230,000	-	1160	17,400	253,000	75,300	851	-	-	0.004	U	0.0034	U	0.0036	U	-	
Benzo(a)anthracene	mg/kg	1.6	29	-	0.84	1.53	32.3	240	1.82	-	-	0.004	U	0.0034	U	0.0036	U	-	
Benzo(a)pyrene	mg/kg	0.16	2.9	4.8	0.8	0.153	3.23	24	0.605	-	-	0.004	U	0.0034	U	0.0036	U	-	
Benzo(b)fluoranthene	mg/kg	1.6	29	-	8.2	1.53	32.3	240	6.17	-	-	0.004	U	0.0034	U	0.0036	U	-	
Benzo(g,h,i)perylene	mg/kg	1,800	19,000	-	-	-	-	-	-	-	-	0.004	U	0.0034	U	0.0036	U	-	
Benzo(k)fluoranthene	mg/kg	16	290	-	80	15.3	323	2310	60.5	-	-	0.004	U	0.0034	U	0.0036	U	-	
Chrysene	mg/kg	160	2,900	-	240	153	3,230	23,100	186	-	-	0.004	U	0.0034	U	0.0036	U	-	
Dibenz(a,h)anthracene	mg/kg	0.16	2.9	-	2.6	0.153	3.23	24	6.11	-	-	0.004	U	0.0034	U	0.0036	U	-	
Fluoranthene	mg/kg	2,400	30,000	-	1,780	2,320	33,700	10,000	1,340	-	-	0.004	U	0.0034	U	0.0036	U	-	
Fluorene	mg/kg	2,400	30,000	-	108	2,320	33,700	10,000	80	-	-	0.004	U	0.0034	U	0.0036	U	-	
Indeno(1,2,3-cd)pyrene	mg/kg	2	29	-	26	1.53	32.3	240	20.1	-	-	0.004	U	0.0034	U	0.0036	U	-	
Naphthalene	mg/kg	38	170	-	0.108	49.7	241	159	0.0823	-	-	0.004	U	0.0082		0.0036	U	-	
Phenanthrene	mg/kg	1,700	19,000	-	-	1,740	25,300	7,530	85.9	-	-	0.004	U	0.0034	U	0.0036	U	-	
Pyrene	mg/kg	1,800	23,000	-	260	1,740	25,300	7,530	192	-	-	0.004	U	0.0034	U	0.0036	U	-	
Petroleum Products																			
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	50	500	-	-	1,000	3,000	3,000	-	3,712	15,537	11.6	U	10	U	10.9	U	-	
Total Petroleum Hydrocarbons (C10-C28) DRO	mg/kg	50	500	-	-	1,000	3,000	3,000	-	3,712	15,537	-		-		10.9	U	-	
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	-	-	-	-	1,000	3,000	3,000	-	3,712	15,537	-		-		-		-	
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	-		-		-		-	
Total Petroleum Hydrocarbons (C6-C10) GRO	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	0.6	U	0.52	U	0.55	U	-	
TX 1005																			
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	23.9	U	20.5	U	47.7	U	-	
Total Petroleum Hydrocarbons (>C12-C28(3)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	23.9	U	20.5	U	47.7	U	-	
Total Petroleum Hydrocarbons (>C28-C35(3)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	23.9	U	20.5	U	47.7	U	-	
Total Petroleum Hydrocarbons (C6-C35(3)	mg/kg	50	500	-	-	-	-	-	-	3,712	15,537	23.9	U	20.5	U	47.7	U	-	
TX 1006																			
Total Petroleum Hydrocarbons (C6) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		20	U	27.7	U
Total Petroleum Hydrocarbons (>C6-C8) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		40	U	55.4	U
Total Petroleum Hydrocarbons (>C7-C8) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		4.6	U	6.4	U
Total Petroleum Hydrocarbons (>C8-C10) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		20	U	27.7	U
Total Petroleum Hydrocarbons (>C8-C10) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		30.7	U	42.6	U
Total Petroleum Hydrocarbons (>C10-C12) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		20	U	27.7	U
Total Petroleum Hydrocarbons (>C10-C12) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		20	U	27.7	U
Total Petroleum Hydrocarbons (>C12-C16) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		20	U	27.7	U
Total Petroleum Hydrocarbons (>C12-C16) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		20	U	27.7	U
Total Petroleum Hydrocarbons (>C16-C21) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		20	U	27.7	U
Total Petroleum Hydrocarbons (>C16-C21) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		20	U	27.7	U
Total Petroleum Hydrocarbons (>C21-C35) Aliphatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		40	U	55.4	U
Total Petroleum Hydrocarbons (C21-C35) Aromatic	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		40	U	55.4	U
Total Petroleum Hydrocarbons (>C6-C35) Aliphatics & Aromatics	mg/kg	-	-	-	-	-	-	-	-	3,712	15,537	-		-		4.6	U	6.4	U

Footnotes:
U-Not detected at the associated reporting limit.
J-Estimated concentration.
DAF-Dilution Attentuation Factor
§ USEPA May 2016 Soil RSLs for migration to groundwater pathway (USEPA, 2016) (adjusted to the default NMED cancer risk level of 1.0×10^{-5} and DAF=20)

References:
(1) USEPA, 2016. USEPA Regional Screening Levels, May 2016. http://www.epa.gov/region9/superfund/prg/.
(2) NMED, 2015, New Mexico Environmental Department Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015.
(3) DEQ, 2012. Oklahoma Department of Environmental Quality. Risk-Based Levels for Total Petroleum Hydrocarbons (TPH), October, 2012.

TABLE 5.1

POTENTIALLY - COMPLETE EXPOSURE PATHWAY SCENARIOS BASED ON IDENTIFIED COPCs

HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Scenario/ Timeframe	Receptor Population	Receptor Age	Source Medium	Exposure Medium	Exposure Route	Rationale for Selection of Exposure Pathway
Current/Future	Construction/Utility Worker	Adult	Surface and Subsurface Soil (0 to > 2 ft BGS)	Soil	Ingestion of Soil	Potential exposure to impacted soil during ground-intrusive activities.
					Dermal Contact with Soil	
				Ambient Air	Inhalation of Particulate Matter and Vapors	Potential exposure to vapor and soil dust during general activities.
			Sediment	Sediment	Ingestion of Sediment	Potential exposure to impacted sediment and surface water during construction/remediation activities.
					Dermal Contact with Sediment	
				Ambient Air	Inhalation of Vapors	
			Surface Water	Water	Ingestion of Surface Water	
					Dermal Contact with Surface Water	
				Ambient Air	Inhalation of Vapors	
			Groundwater	Water	Ingestion of Groundwater	Potential exposure to impacted groundwater during excavation activities.
					Dermal Contact with Groundwater	
				Ambient Air	Inhalation of Vapors	
	Outdoor Worker	Adult	Surface Soil (0 to 2 ft BGS)	Soil	Ingestion of Soil	Potential exposure to impacted soil during maintenance activities.
					Dermal Contact with Soil	
				Ambient Air	Inhalation of Particulate Matter and Vapors	Potential exposure to vapors and soil dust during maintenance activities.
			Sediment	Sediment	Ingestion of Sediment	Potential exposure to impacted sediment and surface water during maintenance activities.
					Dermal Contact with Sediment	
				Ambient Air	Inhalation of Vapors	
			Surface Water	Water	Ingestion of Surface Water	
					Dermal Contact with Surface Water	
				Ambient Air	Inhalation of Vapors	
			Groundwater	Water	Ingestion of Groundwater	Potential exposure to impacted groundwater during maintenance activities.
					Dermal Contact with Groundwater	
				Ambient Air	Inhalation of Vapors	
	Trespasser	Young Adult	Surface and Subsurface Soil (0 to > 2 ft BGS)	Soil	Ingestion of Soil	Potential exposure to various media during trespassing activities, which includes events during active remediation.
					Dermal Contact with Soil	
				Ambient Air	Inhalation of Particulate Matter and Vapors	
			Sediment	Sediment	Ingestion of Sediment	
					Dermal Contact with Sediment	
				Ambient Air	Inhalation of Vapors	
			Surface Water	Water	Ingestion of Surface Water	
					Dermal Contact with Surface Water	
				Ambient Air	Inhalation of Vapors	
			Groundwater	Water	Ingestion of Groundwater	
					Dermal Contact with Groundwater	
				Ambient Air	Inhalation of Vapors	

TABLE 5.1

POTENTIALLY - COMPLETE EXPOSURE PATHWAY SCENARIOS BASED ON IDENTIFIED COPCs

HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Scenario/ Timeframe	Receptor Population	Receptor Age	Source Medium	Exposure Medium	Exposure Route	Rationale for Selection of Exposure Pathway
Future	Resident	Child	Surface Soil (0 to 2 ft BGS)	Soil	Ingestion of Soil	Potential exposure to various media during general activities.
					Dermal Contact with Soil	
				Indoor Air	Inhalation of Particulate Matter	
				Produce/Beef	Ingestion of Vegetables and/or Beef	
			Sediment	Sediment	Ingestion of Sediment	
					Dermal Contact with Sediment	
				Ambient Air	Inhalation of Vapors	
			Surface Water	Water	Ingestion of Surface Water	
					Dermal Contact with Surface Water	
				Ambient Air	Inhalation of Vapors	
			Groundwater	Water	Ingestion of Groundwater	
					Dermal Contact with Groundwater	
				Indoor Air	Inhalation of Vapors	
		Adult	Surface Soil (0 to 2 ft BGS)	Soil	Ingestion of Soil	Potential exposure to various media during general activities.
					Dermal Contact with Soil	
				Indoor Air	Inhalation of Particulate Matter	
				Produce/Beef	Ingestion of Vegetables and/or Beef	
			Sediment	Sediment	Ingestion of Sediment	
					Dermal Contact with Sediment	
				Ambient Air	Inhalation of Vapors	
			Surface Water	Water	Ingestion of Surface Water	
					Dermal Contact with Surface Water	
				Ambient Air	Inhalation of Vapors	
			Groundwater	Water	Ingestion of Groundwater	
					Dermal Contact with Groundwater	
				Indoor Air	Inhalation of Vapors	
	Indoor Worker	Adult	Surface Soil (0 to 2 ft BGS)	Soil	Ingestion of Soil Dust	Potential exposure to groundwater (via tap water), soil dust, and intruding vapors while working indoors.
					Dermal Contact with Soil Dust	
					Inhalation of Particulate Matter and Vapors	
			Groundwater	Water	Ingestion of Groundwater	
					Dermal Contact with Groundwater	
				Ambient Air	Inhalation of Vapors	
			Sediment	Ambient Air	Inhalation of Vapors	
			Surface Water	Ambient Air	Inhalation of Vapors	

Notes:

COPC = Constituent of Potential Concern

ft BGS = feet below ground surface

TABLE 5.3

Assumptions for Outdoor Worker Exposure to Surface Soil (0 to 2 ft BGS)
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Scenario Timeframe: Current/Future
Medium: Surface Soil
Exposure Medium: Soil/Ambient Air
Receptor Population: Outdoor Worker
Receptor Age: Adult (Age 16-30)

Exposure Route	Parameter Code	Parameter Definition	Units	Exposure Assumption	Exposure Assumption Rationale/ Reference
Ingestion	IR	Ingestion Rate of Soil	mg/day	100	NMED, 2015
	CF	Conversion Factor	kg/mg	1.00E-06	--
	EF	Exposure Frequency	days/year	225	NMED, 2015
	ED	Exposure Duration	years	25	NMED, 2015
	BW	Body Weight	kg	80	USEPA, 2014
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989
	AT-NC	Averaging Time (non-cancer)	days	9,125	USEPA, 1989
	ABSo	Absorption Factor	unitless	1	Professional Judgment (1)
Dermal	SA	Skin Surface Area Available for Contact	cm^2/event	3,470	USEPA, 2014
	CF	Conversion Factor	kg/mg	1.00E-06	--
	EF	Exposure Frequency	days/year	225	NMED, 2015
	ED	Exposure Duration	years	25	NMED, 2015
	BW	Body Weight	kg	80	USEPA, 2014
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989
	AT-NC	Averaging Time (non-cancer)	days	9,125	USEPA, 1989
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.12	NMED, 2015
	ABSd	Absorption Factor	unitless	Chemical-specific	(2)
Inhalation	FT	Fraction Time Exposed	unitless	8/24	Professional Judgment (3)
	EF	Exposure Frequency	days/year	225	NMED, 2015
	ED	Exposure Duration	years	25	NMED, 2015
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989
	AT-NC	Averaging Time (non-cancer)	days	9,125	USEPA, 1989
	PEF	Particulate Emission Factor	m^3/kg	6.61E+09	NEMD, 2015

Notes:

-- = Not Available or Applicable
ft BGS = feet below ground surface
(1) Conservatively assumes that all ingested soil is contaminated soil.
(2) Dermal absorption factor for TPH is 0.1 (USEPA, 2004 and Health Canada, 2004).
(3) Assumed an 8-hour work day.

References:

NMED, 2015: Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015.
Health Canada, 2004: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), September 2004.
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A OERR, EPA/540-1-89-002, December 1989.
USEPA, 1997: Exposure Factors Handbook, August 1997.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Office of Emergency and Remedial Response, OSWER 9355.4-24, December 2002.
USEPA, 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.

TABLE 5.4

Assumptions for Indoor Worker Exposure to Surface Soil (0 to 2 ft BGS)
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Soil/Ambient Air
Receptor Population: Indoor Worker
Receptor Age: Adult (16 to 30 years)

Exposure Route	Parameter Code	Parameter Definition	Units	Exposure Assumption	Exposure Assumption Rationale/ Reference
Ingestion	IR	Ingestion Rate of Soil Dust	mg/day	50	USEPA, 2002
	CF	Conversion Factor	kg/mg	1.00E-06	--
	EF	Exposure Frequency	days/year	225	NMED, 2015
	ED	Exposure Duration	years	25	NMED, 2015
	BW	Body Weight	kg	80	USEPA, 2014
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989
	AT-NC	Averaging Time (non-cancer)	days	9,125	USEPA, 1989
	ABSo	Absorption Factor	unitless	1	Professional Judgment (1)
Dermal	SA	Skin Surface Area Available for Contact	cm^2/event	3,470	USEPA, 2014
	CF	Conversion Factor	kg/mg	1.00E-06	--
	EF	Exposure Frequency	events/year	225	NMED, 2015
	ED	Exposure Duration	years	25	NMED, 2015
	BW	Body Weight	kg	80	USEPA, 2014
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989
	AT-NC	Averaging Time (non-cancer)	days	9,125	USEPA, 1989
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.12	USEPA, 2014
	ABSd	Absorption Factor	unitless	Chemical-specific	(2)
Inhalation	FT	Fraction Time Exposed	unitless	8/24	Professional Judgment (3)
	EF	Exposure Frequency	days/year	225	NMED, 2015
	ED	Exposure Duration	years	25	NMED, 2015
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989
	AT-NC	Averaging Time (non-cancer)	days	9,125	USEPA, 2002
	PEF	Particulate Emission Factor	m^3/kg	6.61E+09	NEMD, 2015

Notes:
-- = Not Available or Applicable
ft BGS = feet below ground surface
(1) Conservatively assumes that all ingested soil is contaminated soil.
(2) Dermal absorption factor for TPH is 0.1 (USEPA, 2004 and Health Canada, 2004).
(3) Assumed a 8-hour work day.

References:

Health Canada, 2004: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), September 2004.
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A OERR, EPA/540-1-89-002, December 1989.
USEPA, 1997: Exposure Factors Handbook, August 1997.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Office of Emergency and Remedial Response, OSWER 9355.4-24, December 2002.
USEPA, 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.

TABLE 5.5

Assumptions for Trespasser Exposure to Surface and Subsurface Soil (0 to >2 ft BGS)
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Scenario Timeframe: Current/Future
Medium: Surface and Subsurface Soil
Exposure Medium: Soil/Ambient Air
Receptor Population: Trespasser
Receptor Age: Young Adult (Age 6-16)

Exposure Route	Parameter Code	Parameter Definition	Units	Exposure Assumption	Exposure Assumption Rationale/ Reference
Ingestion	IR	Ingestion Rate of Soil	mg/day	100	USEPA, 2002 (1)
	CF	Conversion Factor	kg/mg	1.00E-06	--
	EF	Exposure Frequency	days/year	52	DEQ, 2013
	ED	Exposure Duration	years	6	DEQ, 2013
	BW	Body Weight	kg	52	DEQ, 2013
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989
	AT-NC	Averaging Time (non-cancer)	days	2,190	USEPA, 1989
	ABSo	Absorption Factor	unitless	1	Professional Judgment (2)
Dermal	SA	Skin Surface Area Available for Contact	cm^2/event	4,219	USEPA, 2006 (3)
	CF	Conversion Factor	kg/mg	1.00E-06	--
	EF	Exposure Frequency	days/year	52	DEQ, 2013
	ED	Exposure Duration	years	6	DEQ, 2013
	BW	Body Weight	kg	52	DEQ, 2013
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989
	AT-NC	Averaging Time (non-cancer)	days	2,190	USEPA, 1989
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.12	USEPA, 2014
	ABSd	Absorption Factor	unitless	Chemical-specific	(4)
Inhalation	FT	Fraction Time Exposed	unitless	2.5/24	Professional Judgment (5)
	EF	Exposure Frequency	days/year	52	DEQ, 2013
	ED	Exposure Duration	years	6	DEQ, 2013
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989
	AT-NC	Averaging Time (non-cancer)	days	2,190	USEPA, 1989
	PEF	Particulate Emission Factor	m^3/kg	6.61E+09	NEMD, 2015

Notes:

-- = Not Available or Applicable

ft BGS = feet below ground surface

(1) Incidental ingestion of soil is assumed to be similar to that for an outdoor worker.

(2) Conservatively assumes that all ingested soil is contaminated soil.

(3) Based on male and female mean surface areas and percent body parts. Refer to Table 8-6 and Table 8-3 of USEPA (2006).

(4) Dermal absorption factor for TPH is 0.1 (USEPA, 2004 and Health Canada, 2004).

(5) Each trespassing event is assumed to last 2.5 hours.

References:

DEQ, 2013: Risk-Based Decision Making for Site Cleanup. DEQ's Facts Sheets, July 2013.
Health Canada, 2004: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), September 2004.
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A OERR. EPA/540-1-89-002, December 1989.
USEPA, 1997: Exposure Factors Handbook, August 1997.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Office of Emergency and Remedial Response, OSWER 9355.4-24, December 2002.
USEPA, 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.
USEPA, 2006: Child-Specific Exposure Factors Handbook (External Review Draft), EPA-600-R06-096A, September 2006.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.

TABLE 5.6

ASSUMPTIONS FOR RESIDENT EXPOSURE TO SURFACE SOIL (0 to 2 ft BGS)
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Soil/Ambient Air
Receptor Population: Resident
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	Exposure Assumption	Exposure Assumption Rationale/ Reference
Ingestion	IRyc	Ingestion Rate of Soil - Young Child (Age 0-2)	mg/day	200	USEPA, 2002
	IRc	Ingestion Rate of Soil - Child (Age 2-6)	mg/day	200	USEPA, 2002
	IRya	Ingestion Rate of Soil - Young Adult (Age 6-16)	mg/day	100	USEPA, 2002
	IRa	Ingestion Rate of Soil - Adult (Age 16-26)	mg/day	100	USEPA, 2002
	CF	Conversion Factor	kg/mg	1.00E-06	--
	EF	Exposure Frequency	days/year	350	USEPA, 2004
	EDyc	Exposure Duration - Young Child (Age 0-2)	years	2	USEPA, 2005
	EDc	Exposure Duration - Child (Age 2-6)	years	4	USEPA, 2005
	EDya	Exposure Duration - Young Adult (Age 6-16)	years	10	USEPA, 2005
	EDa	Exposure Duration - Adult (Age 16-26)	years	10	USEPA, 2014
	BWyc	Body Weight - Young Child (Age 0-2)	kg	10	USEPA, 2006 (1)
	BWc	Body Weight - Child (Age 2-6)	kg	18	USEPA, 2006 (1)
	BWya	Body Weight - Young Adult (Age 6-16)	kg	44	USEPA, 2006 (1)
	BWa	Body Weight - Adult (Age 16-26)	kg	80	USEPA, 2014
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989
	AT-NCyc	Averaging Time (non-cancer) - Young Child (Age 0-2)	days	730	USEPA, 1989
	AT-NCc	Averaging Time (non-cancer) - Child (Age 2-6)	days	1,460	USEPA, 1989
	AT-NCya	Averaging Time (non-cancer) - Young Adult (Age 6-16)	days	3,650	USEPA, 1989
	AT-NCa	Averaging Time (non-cancer) - Adult (Age 16-26)	days	3,650	USEPA, 1989
	ABSo	Absorption Factor	unitless	1	Professional Judgment (2)
Dermal	SAyc	Skin Surface Area Available for Contact - Young Child (Age 0-2)	cm^2/event	1,297	USEPA, 2006 (3)
	SAc	Skin Surface Area Available for Contact - Child (Age 2-6)	cm^2/event	2,204	USEPA, 2006 (3)
	SAya	Skin Surface Area Available for Contact - Young Adult (Age 6-16)	cm^2/event	4,219	USEPA, 2006 (3)
	SAa	Skin Surface Area Available for Contact - Adult (Age 16-26)	cm^2/event	6,032	USEPA, 2014
	CF	Conversion Factor	kg/mg	1.00E-06	--
	EF	Exposure Frequency	days/year	350	USEPA, 2004
	EDyc	Exposure Duration - Young Child (Age 0-2)	years	2	USEPA, 2005
	EDc	Exposure Duration - Child (Age 2-6)	years	4	USEPA, 2005
	EDya	Exposure Duration - Young Adult (Age 6-16)	years	10	USEPA, 2005
	EDa	Exposure Duration - Adult (Age 16-26)	years	10	USEPA, 2014
	BWyc	Body Weight - Young Child (Age 0-2)	kg	10	USEPA, 2006 (1)
	BWc	Body Weight - Child (Age 2-6)	kg	18	USEPA, 2006 (1)
	BWya	Body Weight - Young Adult (Age 6-16)	kg	44	USEPA, 2006 (1)
	BWa	Body Weight - Adult (Age 16-26)	kg	80	USEPA, 2014
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989
	AT-NCyc	Averaging Time (non-cancer) - Young Child (Age 0-2)	days	730	USEPA, 1989
	AT-Ncc	Averaging Time (non-cancer) - Child (Age 2-6)	days	1,460	USEPA, 1989
	AT-NCya	Averaging Time (non-cancer) - Young Adult (Age 6-16)	days	3,650	USEPA, 1989
	AT-NCa	Averaging Time (non-cancer) - Adult (Age 16-26)	days	3,650	USEPA, 1989
	AFyc	Soil to Skin Adherence Factor - Young Child (Age 0-2)	mg/cm^2	0.2	USEPA, 2014
	AFc	Soil to Skin Adherence Factor - Child (Age 2-6)	mg/cm^2	0.2	USEPA, 2014
	AFya	Soil to Skin Adherence Factor - Young Adult (Age 6-16)	mg/cm^2	0.07	USEPA, 2014
	AFa	Soil to Skin Adherence Factor - Adult (Age 16-26)	mg/cm^2	0.07	USEPA, 2014
	ABSd	Absorption Factor	unitless	Chemical-specific (4)	USEPA, 2004

TABLE 5.6

ASSUMPTIONS FOR RESIDENT EXPOSURE TO SURFACE SOIL (0 to 2 ft BGS)
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Scenario Timeframe: Future
Medium: Surface Soil
Exposure Medium: Soil/Ambient Air
Receptor Population: Resident
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	Exposure Assumption	Exposure Assumption Rationale/ Reference
Inhalation	FT	Fraction Time Exposed	unitless	3/24	USEPA, 2006 (5)
	EF	Exposure Frequency	days/year	350	USEPA, 2002
	EDyc	Exposure Duration - Young Child (Age 0-2)	years	2	USEPA, 2005
	EDc	Exposure Duration - Child (Age 2-6)	years	4	USEPA, 2005
	EDya	Exposure Duration - Young Adult (Age 6-16)	years	10	USEPA, 2005
	EDa	Exposure Duration - Adult (Age 16-26)	years	10	USEPA, 2014
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989
	AT-NCyc	Averaging Time (non-cancer) - Young Child (Age 0-2)	days	730	USEPA, 1989
	AT-NCc	Averaging Time (non-cancer) - Child (Age 2-6)	days	1,460	USEPA, 1989
	AT-NCya	Averaging Time (non-cancer) - Young Adult (Age 6-16)	days	3,650	USEPA, 1989
	AT-NCa	Averaging Time (non-cancer) - Adult (Age 16-26)	days	3,650	USEPA, 1989
	PEF	Particulate Emission Factor	m^3/kg	6.61E+09	NEMD, 2015

Notes:

-- = Not Available or Applicable
ft BGS = feet below ground surface
(1) Body weights are average calculated weights based on male and female mean body weight, as indicated in USEPA (2006; Table 11-5).
(2) Professional Judgment; conservatively assumes all ingested soil is contaminated soil.
(3) Surface areas are average calculated areas based on male and female mean surface areas and percent body parts. Refer to Table 8-6 and Table 8-3 of USEPA (2006), respectively.
(4) Dermal absorption factor for TPH is 0.1 (USEPA, 2004 and Health Canada, 2004).
(5) Exposure time based on mean time spent outdoors for ages 3-5 yrs, and assumes that adult will spend the same amount of time outdoors with their child. Refer to Table 9-75 of USEPA (2006).

References:

Health Canada, 2004: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), September 2004.
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A OERR, EPA/540-1-89-002, December 1989.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Office of Emergency and Remedial Response, OSWER 9355.4-24, December 2002.
USEPA, 2004: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.
USEPA, 2005: Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens, EPA/630/R-03/003F, March 2005.
USEPA, 2006: Child-Specific Exposure Factors Handbook (External Review Draft), EPA-600-R06-096A, September 2006.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.

TABLE 5.7

ASSUMPTIONS FOR RESIDENT EXPOSURE TO GARDEN PRODUCE
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Garden Produce
Receptor Population: Resident
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	Exposure Assumption	Exposure Assumption Rationale/ Reference
Ingestion	Pr_{ag}	Above-Ground Plant Concentration due to Root Uptake	mg/kg DW	Chemical-specific	USEPA, 2005b (1)
	Pr_{bg}	Below-Ground Plant Concentration due to Root Uptake	mg/kg DW	Chemical-specific	USEPA, 2005b (1)
	CRagyc	Consumption Rate of Above-Ground Produce - Young Child (Age 0-2)	kg/day	0.129	USEPA, 1997a (2)
	CRagc	Consumption Rate of Above-Ground Produce - Child (Age 2-6)	kg/day	0.233	USEPA, 1997a (2)
	CRagya	Consumption Rate of Above-Ground Produce - Young Adult (Age 6-16)	kg/day	0.188	USEPA, 1997a (2)
	CRaga	Consumption Rate of Above-Ground Produce - Adult (Age 16-26)	kg/day	0.341	USEPA, 1997a (2)
	CRbgyc	Consumption Rate of Below-Ground Produce - Young Child (Age 0-2)	kg/day	0.0715	USEPA, 1997a (2)
	CRbgc	Consumption Rate of Below-Ground Produce - Child (Age 2-6)	kg/day	0.129	USEPA, 1997a (2)
	CRbgya	Consumption Rate of Below-Ground Produce - Young Adult (Age 6-16)	kg/day	0.585	USEPA, 1997a (2)
	CRbga	Consumption Rate of Below-Ground Produce - Adult (Age 16-26)	kg/day	1.063	USEPA, 1997a (2)
	F_{ag}	Fraction of Above-Ground produce consumed that is homegrown	unitless	0.063	USEPA, 1997b (3)
	F_{bg}	Fraction of Below-Ground produce consumed that is homegrown	unitless	0.042	USEPA, 1997b (3)
	EDyc	Exposure Duration - Young Child (Age 0-2)	years	2	USEPA, 2005a
	EDc	Exposure Duration - Child (Age 2-6)	years	4	USEPA, 2005a
	EDya	Exposure Duration - Young Adult (Age 6-16)	years	10	USEPA, 2005a
	EDa	Exposure Duration - Adult (Age 16-26)	years	10	USEPA, 2014
	BWyc	Body Weight - Young Child (Age 0-2)	kg	10	USEPA, 2006 (4)
	BWc	Body Weight - Child (Age 2-6)	kg	18	USEPA, 2006 (4)
	BWya	Body Weight - Young Adult (Age 6-16)	kg	44	USEPA, 2006 (4)
	BWa	Body Weight - Adult (Age 16-26)	kg	80	USEPA, 2014
	AT-C	Averaging Time (cancer)	years	70	USEPA, 1989
	AT-NCyc	Averaging Time (non-cancer) - Young Child (Age 0-2)	years	2	USEPA, 1989
	AT-NCc	Averaging Time (non-cancer) - Child (Age 2-6)	years	4	USEPA, 1989
	AT-NCya	Averaging Time (non-cancer) - Young Adult (Age 6-16)	years	10	USEPA, 1989
	AT-NCa	Averaging Time (non-cancer) - Adult (Age 16-26)	years	10	USEPA, 2014

Notes:

DW = dry weight

(1) Plant concentrations were calculated according to equations presented in USEPA (2005b). Refer to Tables 3.25 and 3.26 for COPCs after screening for consideration of garden produce exposure.

(2) Consumption rates of above- and below-ground produce were calculated from data in Tables 9-7, 9-8, 9-9, and 9-10 (for above-ground produce), and Table 9.11 (for below-ground produce) of USEPA (1997a). Results for children and adults are presented as the average of the 95th percentile data for <0, 0-2, and 3-5 year olds, and 6-11, 12-19, and 20-39 year olds, respectively. Values converted to kg/day by multiplying by body weight.

(3) Calculated from data presented for the Southern Region in Table 13.71 of USEPA (1997b). The fraction of home-produced above-ground produce is taken as the average of exposed and protected fruits and vegetables; the fraction of home-produced below-ground produce is the value for root vegetables.

(4) Body weights are average calculated weights based on male and female mean body weight as indicated in USEPA (2006; Table 11-5).

References:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A OERR, EPA/540-1-89-002, December 1989.
USEPA, 1997a: Exposure Factors Handbook, Volume I, August 1997.
USEPA, 1997b: Exposure Factors Handbook, Volume II, August 1997.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Office of Emergency and Remedial Response, OSWER 9355.4-24, December 2002.
USEPA, 2005a: Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens, EPA/630/R-03/003F, March 2005.
USEPA, 2005b: Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Office of Solid Waste and Emergency Response, United States Environmental Protection Agency, EPA530-R-05-006, September 2005.
USEPA, 2006: Child-Specific Exposure Factors Handbook (External Review Draft), EPA-600-R06-096A, September 2006.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.

Table 5.8

Non-Cancer Toxicity Data - Oral and Dermal Routes of Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituents of Potential Concern (COPC)	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (ABS_{GI}) (1)	Absorbed Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ (MMM-YY)
TPH (by TX Method 1005)										
TPH (C6-C12; GRO)	Chronic	4.00E-02	mg/kg-d	100%	4.00E-02	mg/kg-d	--	--	TCEQ	Jun-12
TPH (>C12-C28; DRO)	Chronic	4.00E-02	mg/kg-d	100%	4.00E-02	mg/kg-d	--	--	TCEQ	Jun-12
TPH (>C28-C35; LOR)	Chronic	4.00E-02	mg/kg-d	100%	4.00E-02	mg/kg-d	--	--	TCEQ	Jun-12
TPH (by TX Method 1006)										
Aliphatic (C6)	Chronic	6.00E-02	mg/kg-d	100%	6.00E-02	mg/kg-d	--	--	TCEQ	Mar-16
Aliphatic (>C6-C8)	Chronic	6.00E-02	mg/kg-d	100%	6.00E-02	mg/kg-d	--	--	TCEQ	Mar-16
Aliphatic (>C8-C10)	Chronic	1.00E-01	mg/kg-d	100%	1.00E-01	mg/kg-d	--	--	TCEQ	Mar-16
Aliphatic (>C10-C12)	Chronic	1.00E-01	mg/kg-d	100%	1.00E-01	mg/kg-d	--	--	TCEQ	Mar-16
Aliphatic (>C12-C16)	Chronic	1.00E-01	mg/kg-d	100%	1.00E-01	mg/kg-d	--	--	TCEQ	Mar-16
Aliphatic (>C16-C21)	Chronic	2.00E+00	mg/kg-d	100%	2.00E+00	mg/kg-d	--	--	TCEQ	Mar-16
Aliphatic (>C21-C35)	Chronic	2.00E+00	mg/kg-d	100%	2.00E+00	mg/kg-d	--	--	TCEQ	Mar-16
Aromatic (>C7-C8)	Chronic	1.00E-01	mg/kg-d	100%	1.00E-01	mg/kg-d	--	--	TCEQ	Mar-16
Aromatic (>C8-C10)	Chronic	4.00E-02	mg/kg-d	100%	4.00E-02	mg/kg-d	--	--	TCEQ	Mar-16
Aromatic (>C10-C12)	Chronic	4.00E-02	mg/kg-d	100%	4.00E-02	mg/kg-d	--	--	TCEQ	Mar-16
Aromatic (>C12-C16)	Chronic	4.00E-02	mg/kg-d	100%	4.00E-02	mg/kg-d	--	--	TCEQ	Mar-16
Aromatic (>C16-C21)	Chronic	3.00E-02	mg/kg-d	100%	3.00E-02	mg/kg-d	--	--	TCEQ	Mar-16
Aromatic (>C21-C35)	Chronic	3.00E-02	mg/kg-d	100%	3.00E-02	mg/kg-d	--	--	TCEQ	Mar-16

Notes:

--	Not Available or Applicable
DRO	Diesel Range Organics
GRO	Gasoline Range Organics
LOR	Lube Oil Range
RfD	Reference Dose
RSL	Regional Screening Level
TCEQ	Texas Commission on Environmental Quality
TPH	Total Petroleum Hydrocarbons

(1) Percent gastrointestinal (GI) absorption (ABS_{GI}) as presented in Exhibit 4-1 of USEPA, Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual, Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004. Note: If GI absorption is equal to or greater than 50%, a default value of 100% was used, as recommended in USEPA (2004). For parameters not presented in Exhibit 4-1, a default value of 100% was assumed.

(2) Absorbed Dermal RfD = Oral RfD x (ABS_{GI}/100), consistent with Equation 4.3 of USEPA (2004).

(3) USEPA has ruled that a reference dose is inappropriate for constituents without a threshold. A default USEPA screening level of 800 mg/kg for soil is adopted as the screening level for industrial exposure scenarios.

References:

TCEQ, 2012: Texas Commission of Environmental Quality (TCEQ), Summary of Updates to the Tables Accompanying the Texas Risk Reduction Program (TRRP) Rule, http://www.tceq.texas.gov/assets/public/remediation/trrp/trrptoxpcls.pdf, June 2012.

TCEQ, 2016: Texas Commission on Environmental Quality (TCEQ), Texas Risk Reduction Program (TRRP) Protective Concentration Levels (PCLs), March 2016 PCL and Supporting Tables http://www.tceq.state.tx.us/remediation/trrp/trrppcls.html.

USEPA, 2004: RAGS Volume 1, Human Health Evaluation Manual, Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.

USEPA, 2015: Regional Screening Levels (RSLs), USEPA November 2015.

Table 5.9

Non-Cancer Toxicity Data - Inhalation Route of Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

	Chronic/ Subchronic	Inhalation Value RfC	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Source of RfC	Dates (MMM-YY)
TPH (by TX Method 1005)							
TPH (C6-C12; GRO)	Chronic	2.00E-01	mg/m^3	--	--	TCEQ	Jun-12
TPH (>C12-C28; DRO)	Chronic	2.00E-01	mg/m^3	--	--	TCEQ	Jun-12
TPH (>C28-C35; LOR)	Chronic	2.00E-01	mg/m^3	--	--	TCEQ	Jun-12
TPH (by TX Method 1006)							
Aliphatic (C6)	Chronic	6.70E-01	mg/m^3	--	--	TCEQ	Mar-16
Aliphatic (>C6-C8)	Chronic	6.70E-01	mg/m^3	--	--	TCEQ	Mar-16
Aliphatic (>C8-C10)	Chronic	5.00E-01	mg/m^3	--	--	TCEQ	Mar-16
Aliphatic (>C10-C12)	Chronic	5.00E-01	mg/m^3	--	--	TCEQ	Mar-16
Aliphatic (>C12-C16)	Chronic	5.00E-01	mg/m^3	--	--	TCEQ	Mar-16
Aliphatic (>C16-C21)	--	--	--	--	--	--	--
Aliphatic (>C21-C35)	--	--	--	--	--	--	--
Aromatic (>C7-C8)	Chronic	1.90E+00	mg/m^3	--	--	TCEQ	Mar-16
Aromatic (>C8-C10)	Chronic	2.00E-01	mg/m^3	--	--	TCEQ	Mar-16
Aromatic (>C10-C12)	Chronic	2.00E-01	mg/m^3	--	--	TCEQ	Mar-16
Aromatic (>C12-C16)	Chronic	2.00E-01	mg/m^3	--	--	TCEQ	Mar-16
Aromatic (>C16-C21)	--	--	--	--	--	--	--
Aromatic (>C21-C35)	--	--	--	--	--	--	--

Notes:

--	Not Available or Applicable
DRO	Diesel Range Organics
GRO	Gasoline Range Organics
LOR	Lube Oil Range
RfC	Inhalation Reference Concentration
RSL	Regional Screening Level
TCEQ	Texas Commission on Environmental Quality
TPH	Total Petroleum Hydrocarbons
(1)	USEPA has ruled that a reference dose is inappropriate for constituents without a threshold. A default USEPA screening level of 800 mg/kg for soil is adopted as the screening level for industrial exposure scenarios.

References:

TCEQ, 2012: Texas Commission of Environmental Quality (TCEQ), Summary of Updates to the Tables Accompanying the Texas Risk Reduction Program (TRRP) Rule, http://www.tceq.texas.gov/assets/public/remediation/trrp/trrptoxpcls.pdf, June 2012.

TCEQ, 2016: Texas Commission on Environmental Quality (TCEQ), Texas Risk Reduction Program (TRRP) Protective Concentration Levels (PCLs), March 2016 PCL and Supporting Tables http://www.tceq.state.tx.us/remediation/trrp/trrppcls.html.

USEPA, 2015: Regional Screening Levels (RSLs), USEPA November 2015.

Table 5.10

Derivation of Site-Specific Cleanup Levels for Surface and Subsurface Soil (0 to >2 ft BGS) - Construction/Utility Worker Oral, Dermal, and Dust Inhalation Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituents of Potential Concern (COPC)	Cancer Toxicity Data			Non-Cancer Toxicity Data			Absorption Factor		Particulate Emission Factor	Construction/Utility Worker		Cleanup Level per TPH Mass Fraction	Site-Specific Cleanup Level for Soil
	CSF		URF	RfD		RfC	ABSo	ABSd		TR	THQ		
	Oral 1/(mg/kg-d)	Dermal 1/(mg/kg-d)	Inhalation 1/(mg/m^3)	Oral (mg/kg-d)	Dermal (mg/kg-d)	Inhalation (mg/m^3)	Oral (%/100)	Dermal (%/100)	PEF (m^3/kg)	Adult (mg/kg)	Adult (mg/kg)	(mg/kg)	($SSCL_{soil}$)(1) (mg/kg)
Total TPH (by TX1005)													**3.21E+04**
TPH (C6-C12; GRO)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	2.10E+06	NV	1.07E+04	--	1.07E+04
TPH (>C12-C28; DRO)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	2.10E+06	NV	1.07E+04	--	1.07E+04
TPH (>C28-C35; LOR)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	2.10E+06	NV	1.07E+04	--	1.07E+04

Constituents of Potential Concern (COPC)	Cancer Toxicity Data			Non-Cancer Toxicity Data			Absorption Factor		Particulate Emission Factor	Construction/Utility Worker		Cleanup Level per TPH Mass Fraction	Site-Specific Cleanup Level for Soil
	CSF		URF	RfD		RfC	ABSo	ABSd		TR	THQ		
	Oral 1/(mg/kg-d)	Dermal 1/(mg/kg-d)	Inhalation 1/(mg/m^3)	Oral (mg/kg-d)	Dermal (mg/kg-d)	Inhalation (mg/m^3)	Oral (%/100)	Dermal (%/100)	PEF (m^3/kg)	Adult (mg/kg)	Adult (mg/kg)	(mg/kg)	($SSCL_{soil}$)(1) (mg/kg)
Total TPH (2) (by TX1006) - TPHCWG Site-Specific Mass Fraction Approach as Implemented by TCEQ (2000)												SSCL for Total TPH (minimum of $SSCL_1$ and $SSCL_2$) =	**1.55E+04**
												$SSCL_1$ (MFi/SSCLi) (2) =	1.55E+04
												$SSCL_2$ (SSCLi/MFi) (3) =	6.36E+04
													TPH MFi
Aliphatic (C6)	--	--	--	6.00E-02	6.00E-02	6.70E-01	1.00E+00	1.00E-01	2.10E+06	NV	1.61E+04	1.61E+04	6.34E-02
Aliphatic (>C6-C8)	--	--	--	6.00E-02	6.00E-02	6.70E-01	1.00E+00	1.00E-01	2.10E+06	NV	1.61E+04	1.61E+04	1.27E-01
Aliphatic (>C8-C10)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	2.10E+06	NV	2.67E+04	2.67E+04	6.34E-02
Aliphatic (>C10-C12)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	2.10E+06	NV	2.67E+04	2.67E+04	6.34E-02
Aliphatic (>C12-C16)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	2.10E+06	NV	2.67E+04	2.67E+04	6.34E-02
Aliphatic (>C16-C21)	--	--	--	2.00E+00	2.00E+00	--	1.00E+00	1.00E-01	2.10E+06	NV	5.38E+05	5.38E+05	6.34E-02
Aliphatic (>C21-C35)	--	--	--	2.00E+00	2.00E+00	--	1.00E+00	1.00E-01	2.10E+06	NV	5.38E+05	5.38E+05	1.27E-01
Aromatic (>C7-C8)	--	--	--	1.00E-01	1.00E-01	1.90E+00	1.00E+00	1.00E-01	2.10E+06	NV	2.69E+04	2.69E+04	1.46E-02
Aromatic (>C8-C10)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	2.10E+06	NV	1.07E+04	1.07E+04	9.75E-02
Aromatic (>C10-C12)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	2.10E+06	NV	1.07E+04	1.07E+04	6.34E-02
Aromatic (>C12-C16)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	2.10E+06	NV	1.07E+04	1.07E+04	6.34E-02
Aromatic (>C16-C21)	--	--	--	3.00E-02	3.00E-02	--	1.00E+00	1.00E-01	2.10E+06	NV	8.07E+03	8.07E+03	6.34E-02
Aromatic (>C21-C35)	--	--	--	3.00E-02	3.00E-02	--	1.00E+00	1.00E-01	2.10E+06	NV	8.07E+03	8.07E+03	1.27E-01

Table 5.10

Derivation of Site-Specific Cleanup Levels for Surface and Subsurface Soil (0 to >2 ft BGS) - Construction/Utility Worker Oral, Dermal, and Dust Inhalation Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Notes:

BOLD	Value indicates SSCL
--	Not Available or Applicable
ft BGS	feet below ground surface
DRO	Diesel Range Organics
GRO	Gasoline Range Organics
LOR	Lube Oil Range
NV	No Value
TPH	Total Petroleum Hydrocarbons
(1)	Final SSCL is the lower of the carcinogenic and noncarcinogenic concentrations; for TPH it is the lower of the TX1005 or TX1006 methods.
(2)	$SSCL_1$ is calculated as $SSCL_1$ = HI/Sum (MFi/SSCLi), following TCEQ (2000; Table 3, Equation 3-1). The mass fraction (MFi) results for soil samples taken from a TPH source is reported in Table 5.18.
(3)	$SSCL_2$ is calculated as $SSCL_2$ = MIN(SSCLi/MFi), following TCEQ (2000; Table 3, Equation 3-2). The mass fraction (MFi) results for soil samples taken from a TPH source is reported in Table 5.18.

References:

NMED, 2015: Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015.

DEQ, 2013: Risk-Based Decision Making for Site Cleanup, DEQ's Facts Sheets, July 2013.

TCEQ, 2000: Development of Human Health Protective Concentration Levels (PCLs) for Total Petroleum Hydrocarbon (TPH) Mixtures, Texas Commission on Environmental Quality (TCEQ) Regulatory Guidance, Remediation, RG-366/TRRP-27, June 2000.

Construction/Utility Worker Exposure Assumptions	Abbreviation	Value	Source
Site-Specific Cleanup Level for Soil (mg/kg)	$SSCL_{soil}$	calculated	--
Target Risk Level (unitless)	TR	1.0E-05	NMED, 2015
Target Hazard Level (unitless)	THQ	1	NMED, 2015
Reference Dose (mg/kg-day)	RfD	chemical-specific	Table 5.8
Reference Concentration (mg/m^3)	RfC	chemical-specific	Table 5.9
Ingestion Rate (mg/day)	IR	330	Table 5.2
Absorption Factor - Oral (%/100)	ABSo	chemical-specific	Table 5.2
Surface Area Exposed (cm^2/day)	SA	3470	Table 5.2
Adherence Factor (mg/cm^2)	AF	0.3	Table 5.2
Absorption Factor - Dermal (%/100)	ABSd	chemical-specific	Table 5.2
Fraction Time Exposed (unitless)	FT	8/24	Table 5.2
Exposure Frequency (days/year)	EF	250	Table 5.2
Exposure Duration (years)	ED	1	Table 5.2
Body Weight (kg)	BW	80	Table 5.2
Conversion Factor (kg/mg)	CF	0.000001	Table 5.2
Averaging Time - carc. (days)	AT-C	25550	Table 5.2

Table 5.10

Derivation of Site-Specific Cleanup Levels for Surface and Subsurface Soil (0 to >2 ft BGS) - Construction/Utility Worker Oral, Dermal, and Dust Inhalation Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Averaging Time - noncarc. (days)	AT-NC	365	Table 5.2
Particulate Emission Factor (m^3/kg)	PEF	Site-specific	Table 5.2

Exposure Equations

Carcinogenic Endpoints:

$$SSCL_{soil} = \frac{TR \times AT\text{-}C}{EF \times ED \times [(CSF \times IR \times CF \times ABSo)/BW + (CSF \times SA \times AF \times CF \times ABSd)/BW + (URF \times FT \times (1/PEF))]}$$

Non-Carcinogenic Endpoints:

$$SSCL_{soil} = \frac{THQ \times AT\text{-}NC}{EF \times ED \times [((1/RfD) \times IR \times CF \times ABSo)/BW + ((1/RfD) \times SA \times AF \times CF \times ABSd)/BW + ((1/RfC) \times FT \times (1/PEF))]}$$

Table 5.11

Derivation of Site-Specific Cleanup Levels for Surface Soil (0 to 2 ft BGS) - Outdoor Worker Oral, Dermal, and Dust Inhalation Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituents of Potential Concern (COPC)	**Cancer Toxicity Data**			**Non-Cancer Toxicity Data**			**Absorption Factor**		**Particulate Emission Factor**	**Outdoor Worker**		**Cleanup Level per TPH Mass Fraction**	**Site-Specific Cleanup Level for Soil ($SSCL_{soil}$)[(1)]**
	CSF		**URF**	**RfD**		**RfC**	**ABSo**	**ABSd**		**TR**	**THQ**		
	Oral	**Dermal**	**Inhalation**	**Oral**	**Dermal**	**Inhalation**	**Oral**	**Dermal**	**PEF**	**Adult**	**Adult**		
	1/(mg/kg-d)	**1/(mg/kg-d)**	**1/(mg/m^3)**	**(mg/kg-d)**	**(mg/kg-d)**	**(mg/m^3)**	**(%/100)**	**(%/100)**	**(m^3/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
Total TPH [(2)] (by TX1005)													**1.10E+05**
TPH (C6-C12; GRO)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	3.66E+04	--	3.66E+04
TPH (>C12-C28; DRO)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	3.66E+04	--	3.66E+04
TPH (>C28-C35; LOR)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	3.66E+04	--	3.66E+04

Constituents of Potential Concern (COPC)	**Cancer Toxicity Data**			**Non-Cancer Toxicity Data**			**Absorption Factor**		**Particulate Emission Factor**	**Outdoor Worker**		**Cleanup Level per TPH Mass Fraction**	**Site-Specific Cleanup Level for Soil ($SSCL_{soil}$)[(1)]**
	CSF		**URF**	**RfD**		**RfC**	**ABSo**	**ABSd**		**TR**	**THQ**		
	Oral	**Dermal**	**Inhalation**	**Oral**	**Dermal**	**Inhalation**	**Oral**	**Dermal**	**PEF**	**Adult**	**Adult**		
	1/(mg/kg-d)	**1/(mg/kg-d)**	**1/(mg/m^3)**	**(mg/kg-d)**	**(mg/kg-d)**	**(mg/m^3)**	**(%/100)**	**(%/100)**	**(m^3/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**	**(mg/kg)**
Total TPH (by TX1006) - TPHCWG Site-Specific Mass Fraction Approach as Implemented by TCEQ (2000)												SSCL for Total TPH (minimum of $SSCL_1$ and $SSCL_2$) =	**5.31E+04**
												$SSCL_1$ (MFi/SSCLi) [(2)] =	5.31E+04
												$SSCL_2$ (SSCLi/MFi) [(3)] =	2.17E+05
													TPH MFi
Aliphatic (C6)	--	--	--	6.00E-02	6.00E-02	6.70E-01	1.00E+00	1.00E-01	6.61E+09	NV	5.50E+04	5.50E+04	6.34E-02
Aliphatic (>C6-C8)	--	--	--	6.00E-02	6.00E-02	6.70E-01	1.00E+00	1.00E-01	6.61E+09	NV	5.50E+04	5.50E+04	1.27E-01
Aliphatic (>C8-C10)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	9.16E+04	9.16E+04	6.34E-02
Aliphatic (>C10-C12)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	9.16E+04	9.16E+04	6.34E-02
Aliphatic (>C12-C16)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	9.16E+04	9.16E+04	6.34E-02
Aliphatic (>C16-C21)	--	--	--	2.00E+00	2.00E+00	--	1.00E+00	1.00E-01	6.61E+09	NV	1.83E+06	1.83E+06	6.34E-02
Aliphatic (>C21-C35)	--	--	--	2.00E+00	2.00E+00	--	1.00E+00	1.00E-01	6.61E+09	NV	1.83E+06	1.83E+06	1.27E-01
Aromatic (>C7-C8)	--	--	--	1.00E-01	1.00E-01	1.90E+00	1.00E+00	1.00E-01	6.61E+09	NV	9.16E+04	9.16E+04	1.46E-02
Aromatic (>C8-C10)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	3.66E+04	3.66E+04	9.75E-02
Aromatic (>C10-C12)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	3.66E+04	3.66E+04	6.34E-02
Aromatic (>C12-C16)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	3.66E+04	3.66E+04	6.34E-02
Aromatic (>C16-C21)	--	--	--	3.00E-02	3.00E-02	--	1.00E+00	1.00E-01	6.61E+09	NV	2.75E+04	2.75E+04	6.34E-02
Aromatic (>C21-C35)	--	--	--	3.00E-02	3.00E-02	--	1.00E+00	1.00E-01	6.61E+09	NV	2.75E+04	2.75E+04	1.27E-01

Table 5.11

Derivation of Site-Specific Cleanup Levels for Surface Soil (0 to 2 ft BGS) - Outdoor Worker Oral, Dermal, and Dust Inhalation Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Notes:

BOLD	Value indicates SSCL
--	Not Available or Applicable
ft BGS	feet below ground surface
DRO	Diesel Range Organics
GRO	Gasoline Range Organics
LOR	Lube Oil Range
NV	No Value
TPH	Total Petroleum Hydrocarbons

(1) Final SSCL is the lower of the carcinogenic and noncarcinogenic concentrations; for TPH, it is the lower of the TX1005 or TX1006 methods; for lead, a default USEPA screening level of 800 mg/kg is adopted.
(2) $SSCL_1$ is calculated as $SSCL_1$ = HI/Sum (MFi/SSCLi), following TCEQ (2000; Table 3, Equation 3-1). The mass fraction (MFi) results for soil samples taken from a TPH source is reported in Table 5.18.
(3) $SSCL_2$ is calculated as $SSCL_2$ = MIN(SSCLi/MFi), following TCEQ (2000; Table 3, Equation 3-2). The mass fraction (MFi) results for soil samples taken from a TPH source is reported in Table 5.18.

References:

NMED, 2015: Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015.
DEQ, 2013: Risk-Based Decision Making for Site Cleanup, DEQ's Facts Sheets, July 2013.
TCEQ, 2000: Development of Human Health Protective Concentration Levels (PCLs) for Total Petroleum Hydrocarbon (TPH) Mixtures, Texas Commission on Environmental Quality (TCEQ) Regulatory Guidance, Remediation, RG-366/TRRP-27, June 2000.

Outdoor Worker Exposure Assumptions	Abbreviation	Value	Source
Site-Specific Cleanup Level for Soil (mg/kg)	$SSCL_{soil}$	calculated	--
Target Risk Level (unitless)	TR	1.0E-05	NMED, 2015
Target Hazard Level (unitless)	THQ	1	NMED, 2015
Reference Dose (mg/kg-day)	RfD	chemical-specific	Table 5.8
Reference Concentration (mg/m^3)	RfC	chemical-specific	Table 5.9
Ingestion Rate (mg/day)	IR	100	Table 5.3
Absorption Factor - Oral (%/100)	ABSo	chemical-specific	Table 5.3
Surface Area Exposed (cm^2/day)	SA	3,470	Table 5.3
Adherence Factor (mg/cm^2)	AF	0.12	Table 5.3
Absorption Factor - Dermal (%/100)	ABSd	chemical-specific	Table 5.3
Fraction Time Exposed (unitless)	FT	8/24	Table 5.3
Exposure Frequency (days/year)	EF	225	Table 5.3
Exposure Duration (years)	ED	25	Table 5.3
Body Weight (kg)	BW	80	Table 5.3
Conversion Factor (kg/mg)	CF	1.0E-06	Table 5.3
Averaging Time - carc. (days)	AT-C	25,550	Table 5.3
Averaging Time - noncarc. (days)	AT-NC	9,125	Table 5.3
Particulate Emission Factor (m^3/kg)	PEF	6.61E+09	Table 5.3

Exposure Equations

Carcinogenic Endpoints:

$$SSCL_{soil} = \frac{\text{TR x AT-C}}{\text{EF x ED x [(CSF x IR x CF x ABSo)/BW + (CSF x SA x AF x CF x ABSd)/BW + (URF x FT x (1/PEF))]}}$$

Non-Carcinogenic Endpoints:

$$SSCL_{soil} = \frac{\text{THQ x AT-NC}}{\text{EF x ED x [((1/RfD) x IR x CF x ABSo)/BW + ((1/RfD) x SA x AF x CF x ABSd)/BW + ((1/RfC) x FT x (1/PEF))]}}$$

Table 5.12

Derivation of Site-Specific Cleanup Levels for Surface Soil (0 to 2 ft BGS) - Indoor Worker Oral, Dermal, and Dust Inhalation Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituents of Potential Concern (COPC)	Cancer Toxicity Data			Non-Cancer Toxicity Data			Absorption Factor		Particulate Emission Factor	Indoor Worker		Cleanup Level per TPH Mass Fraction	Site-Specific Cleanup Level for Soil
	CSF		URF	RfD		RfC	ABSo	ABSd	PEF	TR	THQ		
	Oral 1/(mg/kg-d)	Dermal 1/(mg/kg-d)	Inhalation 1/(mg/m^3)	Oral (mg/kg-d)	Dermal (mg/kg-d)	Inhalation (mg/m^3)	Oral (%/100)	Dermal (%/100)	(m^3/kg)	Adult (mg/kg)	Adult (mg/kg)	(mg/kg)	(SSCL$_{soil}$)(1) (mg/kg)
Total TPH (by TX1005)													**1.70E+05**
TPH (C6-C12; GRO)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	5.66E+04	--	5.66E+04
TPH (>C12-C28; DRO)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	5.66E+04	--	5.66E+04
TPH (>C28-C35; LOR)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	5.66E+04	--	5.66E+04

Constituents of Potential Concern (COPC)	Cancer Toxicity Data			Non-Cancer Toxicity Data			Absorption Factor		Particulate Emission Factor	Indoor Worker		Cleanup Level per TPH Mass Fraction	Site-Specific Cleanup Level for Soil
	CSF		URF	RfD		RfC	ABSo	ABSd	PEF	TR	THQ		
	Oral 1/(mg/kg-d)	Dermal 1/(mg/kg-d)	Inhalation 1/(mg/m^3)	Oral (mg/kg-d)	Dermal (mg/kg-d)	Inhalation (mg/m^3)	Oral (%/100)	Dermal (%/100)	(m^3/kg)	Adult (mg/kg)	Adult (mg/kg)	(mg/kg)	(SSCL$_{soil}$)(1) (mg/kg)
Total TPH (2) (by TX1006) - TPHCWG Site-Specific Mass Fraction Approach as Implemented by TCEQ (2000)												SSCL for Total TPH (minimum of SSCL$_1$ and SSCL$_2$) =	**8.20E+04**
												SSCL$_1$ (MFi/SSCLi) (2) =	8.20E+04
												SSCL$_2$ (SSCLi/MFi) (3) =	3.35E+05
													TPH MFi
Aliphatic (C6)	--	--	--	6.00E-02	6.00E-02	6.70E-01	1.00E+00	1.00E-01	6.61E+09	NV	8.50E+04	8.50E+04	6.34E-02
Aliphatic (>C6-C8)	--	--	--	6.00E-02	6.00E-02	6.70E-01	1.00E+00	1.00E-01	6.61E+09	NV	8.50E+04	8.50E+04	1.27E-01
Aliphatic (>C8-C10)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	1.42E+05	1.42E+05	6.34E-02
Aliphatic (>C10-C12)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	1.42E+05	1.42E+05	6.34E-02
Aliphatic (>C12-C16)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	1.42E+05	1.42E+05	6.34E-02
Aliphatic (>C16-C21)	--	--	--	2.00E+00	2.00E+00	--	1.00E+00	1.00E-01	6.61E+09	NV	2.83E+06	2.83E+06	6.34E-02
Aliphatic (>C21-C35)	--	--	--	2.00E+00	2.00E+00	--	1.00E+00	1.00E-01	6.61E+09	NV	2.83E+06	2.83E+06	1.27E-01
Aromatic (>C7-C8)	--	--	--	1.00E-01	1.00E-01	1.90E+00	1.00E+00	1.00E-01	6.61E+09	NV	1.42E+05	1.42E+05	1.46E-02
Aromatic (>C8-C10)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	5.66E+04	5.66E+04	9.75E-02
Aromatic (>C10-C12)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	5.66E+04	5.66E+04	6.34E-02
Aromatic (>C12-C16)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	5.66E+04	5.66E+04	6.34E-02
Aromatic (>C16-C21)	--	--	--	3.00E-02	3.00E-02	--	1.00E+00	1.00E-01	6.61E+09	NV	4.25E+04	4.25E+04	6.34E-02
Aromatic (>C21-C35)	--	--	--	3.00E-02	3.00E-02	--	1.00E+00	1.00E-01	6.61E+09	NV	4.25E+04	4.25E+04	1.27E-01

Table 5.12

Derivation of Site-Specific Cleanup Levels for Surface Soil (0 to 2 ft BGS) - Indoor Worker Oral, Dermal, and Dust Inhalation Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Notes:

BOLD Value indicates SSCL
-- Not Available or Applicable
ft BGS feet below ground surface
DRO Diesel Range Organics
GRO Gasoline Range Organics
LOR Lube Oil Range
NV No Value
TPH Total Petroleum Hydrocarbons
(1) Final SSCL is the lower of the carcinogenic and noncarcinogenic concentrations; for TPH, it is the lower of the TX1005 or TX1006 methods; for lead, a default USEPA screening level of 800 mg/kg is adopted.
(2) $SSCL_1$ is calculated as $SSCL_1$ = HI/Sum (MFi/SSCLi), following TCEQ (2000; Table 3, Equation 3-1). The mass fraction (MFi) results for soil samples taken from a TPH source is reported in Table 5.18
(3) $SSCL_2$ is calculated as $SSCL_2$ = MIN(SSCLi/MFi), following TCEQ (2000; Table 3, Equation 3-2). The mass fraction (MFi) results for soil samples taken from a TPH source is reported in Table 5.18.

References:

NMED, 2015: Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015.
DEQ, 2013: Risk-Based Decision Making for Site Cleanup, DEQ's Facts Sheets, July 2013.
TCEQ, 2000: Development of Human Health Protective Concentration Levels (PCLs) for Total Petroleum Hydrocarbon (TPH) Mixtures, Texas Commission on Environmental Quality (TCEQ) Regulatory Guidance, Remediation, RG-366/TRRP-27, June 2000.

Indoor Worker Exposure Assumptions	**Abbreviation**	**Value**	**Source**
Site-Specific Cleanup Level for Soil (mg/kg)	$SSCL_{soil}$	calculated	--
Target Risk Level (unitless)	TR	1.0E-05	NMED, 2015
Target Hazard Level (unitless)	THQ	1	NMED, 2015
Reference Dose (mg/kg-day)	RfD	chemical-specific	Table 5.8
Reference Concentration (mg/m^3)	RfC	chemical-specific	Table 5.9
Ingestion Rate (mg/day)	IR	50	Table 5.4
Absorption Factor - Oral (%/100)	ABSo	chemical-specific	Table 5.4
Surface Area Exposed (cm^2/day)	SA	3,470	Table 5.4
Adherence Factor (mg/cm^2)	AF	0.12	Table 5.4
Absorption Factor - Dermal (%/100)	ABSd	chemical-specific	Table 5.4
Fraction Time Exposed (unitless)	FT	8/24	Table 5.4
Exposure Frequency (days/year)	EF	225	Table 5.4
Exposure Duration (years)	ED	25	Table 5.4
Body Weight (kg)	BW	80	Table 5.4
Conversion Factor (kg/mg)	CF	1.0E-06	Table 5.4
Averaging Time - carc. (days)	AT-C	25,550	Table 5.4
Averaging Time - noncarc. (days)	AT-NC	9,125	Table 5.4
Particulate Emission Factor (m^3/kg)	PEF	6.61E+09	Table 5.4

Exposure Equations

Carcinogenic Endpoints:

$$SSCL_{soil} = \frac{TR \times AT\text{-}C}{EF \times ED \times [(CSF \times IR \times CF \times ABSo)/BW + (CSF \times SA \times AF \times CF \times ABSd)/BW + (URF \times FT \times (1/PEF))]}$$

Non-Carcinogenic Endpoints:

$$SSCL_{soil} = \frac{THQ \times AT\text{-}NC}{EF \times ED \times [((1/RfD) \times IR \times CF \times ABSo)/BW + ((1/RfD) \times SA \times AF \times CF \times ABSd)/BW + ((1/RfC) \times FT \times (1/PEF))]}$$

Table 5.13

Derivation of Site-Specific Cleanup Levels for Surface and Subsurface Soil (0 to >2 ft BGS) - Trespasser Oral, Dermal, and Dust Inhalation Exposure

HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituents of Potential Concern (COPC)	Cancer Toxicity Data			Non-Cancer Toxicity Data			Absorption Factor		Particulate Emission Factor	Trespasser		Cleanup Level per TPH Mass Fraction	Site-Specific Cleanup Level for Soil
	CSF		URF	RfD		RfC	ABSo	ABSd	PEF	TR	THQ		$(SSCL_{soil})^{(1)}$
	Oral 1/(mg/kg-d)	Dermal 1/(mg/kg-d)	Inhalation 1/(mg/m^3)	Oral (mg/kg-d)	Dermal (mg/kg-d)	Inhalation (mg/m^3)	Oral (%/100)	Dermal (%/100)	(m^3/kg)	Youth (mg/kg)	Youth (mg/kg)	(mg/kg)	(mg/kg)
Total TPH (by TX1005)													**2.91E+05**
TPH (C6-C12; GRO)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	9.69E+04	--	9.69E+04
TPH (>C12-C28; DRO)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	9.69E+04	--	9.69E+04
TPH (>C28-C35; LOR)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	9.69E+04	--	9.69E+04

Constituents of Potential Concern (COPC)	Cancer Toxicity Data			Non-Cancer Toxicity Data			Absorption Factor		Particulate Emission Factor	Trespasser		Cleanup Level per TPH Mass Fraction	Site-Specific Cleanup Level for Soil
	CSF		URF	RfD		RfC	ABSo	ABSd	PEF	TR	THQ		$(SSCL_{soil})^{(1)}$
	Oral 1/(mg/kg-d)	Dermal 1/(mg/kg-d)	Inhalation 1/(mg/m^3)	Oral (mg/kg-d)	Dermal (mg/kg-d)	Inhalation (mg/m^3)	Oral (%/100)	Dermal (%/100)	(m^3/kg)	Youth (mg/kg)	Youth (mg/kg)	(mg/kg)	(mg/kg)
Total TPH (2) (by TX1006) - TPHCWG Site-Specific Mass Fraction Approach as Implemented by TCEQ (2000)												SSCL for Total TPH (minimum of $SSCL_1$ and $SSCL_2$) =	**1.40E+05**
												$SSCL_1$ (MFi/SSCLi) (2) =	1.40E+05
												$SSCL_2$ (SSCLi/MFi) (3) =	5.73E+05
													TPH MFi
Aliphatic (C6)	--	--	--	6.00E-02	6.00E-02	6.70E-01	1.00E+00	1.00E-01	6.61E+09	NV	1.45E+05	1.45E+05	6.34E-02
Aliphatic (>C6-C8)	--	--	--	6.00E-02	6.00E-02	6.70E-01	1.00E+00	1.00E-01	6.61E+09	NV	1.45E+05	1.45E+05	1.27E-01
Aliphatic (>C8-C10)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	2.42E+05	2.42E+05	6.34E-02
Aliphatic (>C10-C12)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	2.42E+05	2.42E+05	6.34E-02
Aliphatic (>C12-C16)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	2.42E+05	2.42E+05	6.34E-02
Aliphatic (>C16-C21)	--	--	--	2.00E+00	2.00E+00	--	1.00E+00	1.00E-01	6.61E+09	NV	4.85E+06	4.85E+06	6.34E-02
Aliphatic (>C21-C35)	--	--	--	2.00E+00	2.00E+00	--	1.00E+00	1.00E-01	6.61E+09	NV	4.85E+06	4.85E+06	1.27E-01
Aromatic (>C7-C8)	--	--	--	1.00E-01	1.00E-01	1.90E+00	1.00E+00	1.00E-01	6.61E+09	NV	2.42E+05	2.42E+05	1.46E-02
Aromatic (>C8-C10)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	9.69E+04	9.69E+04	9.75E-02
Aromatic (>C10-C12)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	9.69E+04	9.69E+04	6.34E-02
Aromatic (>C12-C16)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	9.69E+04	9.69E+04	6.34E-02
Aromatic (>C16-C21)	--	--	--	3.00E-02	3.00E-02	--	1.00E+00	1.00E-01	6.61E+09	NV	7.27E+04	7.27E+04	6.34E-02
Aromatic (>C21-C35)	--	--	--	3.00E-02	3.00E-02	--	1.00E+00	1.00E-01	6.61E+09	NV	7.27E+04	7.27E+04	1.27E-01

Table 5.13

Derivation of Site-Specific Cleanup Levels for Surface and Subsurface Soil (0 to >2 ft BGS) - Trespasser Oral, Dermal, and Dust Inhalation Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Notes:

BOLD	Value indicates SSCL
--	Not Available or Applicable
ft BGS	feet below ground surface
DRO	Diesel Range Organics
GRO	Gasoline Range Organics
LOR	Lube Oil Range
NV	No Value
TPH	Total Petroleum Hydrocarbons

(1) Final SSCL is the lower of the carcinogenic and noncarcinogenic concentrations; for TPH, it is the lower of the TX1005 or TX1006 methods.
(2) $SSCL_1$ is calculated as $SSCL_1$ = HI/Sum (MFi/SSCLi), following TCEQ (2000; Table 3, Equation 3-1). The mass fraction (MFi) results for soil samples taken from a TPH source is reported in Table 5.18.
(3) $SSCL_2$ is calculated as $SSCL_2$ = MIN(SSCLi/MFi), following TCEQ (2000; Table 3, Equation 3-2). The mass fraction (MFi) results for soil samples taken from a TPH source is reported in Table 5.18.

References:

NMED, 2015: Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015.
DEQ, 2013: Risk-Based Decision Making for Site Cleanup, DEQ's Facts Sheets, July 2013.
TCEQ, 2000: Development of Human Health Protective Concentration Levels (PCLs) for Total Petroleum Hydrocarbon (TPH) Mixtures, Texas Commission on Environmental Quality (TCEQ) Regulatory Guidance, Remediation, RG-366/TRRP-27, June 2000.

Trespasser Exposure Assumptions	**Abbreviation**	**Value**	**Source**
Site-Specific Cleanup Level for Soil (mg/kg)	$SSCL_{soil}$	calculated	--
Target Risk Level (unitless)	TR	1.0E-05	NMED, 2015
Target Hazard Level (unitless)	THQ	1	NMED, 2015
Reference Dose (mg/kg-day)	RfD	chemical-specific	Table 5.8
Reference Concentration (mg/m^3)	RfC	chemical-specific	Table 5.9
Ingestion Rate (mg/day)	IR	100	Table 5.5
Absorption Factor - Oral (%/100)	ABSo	chemical-specific	Table 5.5
Surface Area Exposed (cm^2/day)	SA	4,219	Table 5.5
Adherence Factor (mg/cm^2)	AF	0.12	Table 5.5
Absorption Factor - Dermal (%/100)	ABSd	chemical-specific	Table 5.5
Fraction Time Exposed (unitless)	FT	2.5/24	Table 5.5
Exposure Frequency (days/year)	EF	52	Table 5.5
Exposure Duration (years)	ED	6	Table 5.5
Body Weight (kg)	BW	52	Table 5.5
Conversion Factor (kg/mg)	CF	1.0E-06	Table 5.5
Averaging Time - carc. (days)	AT-C	25,550	Table 5.5
Averaging Time - noncarc. (days)	AT-NC	2,190	Table 5.5
Particulate Emission Factor (m^3/kg)	PEF	6.61E+09	Table 5.5

Exposure Equations

Carcinogenic Endpoints:

$$SSCL_{soil} = \frac{TR \times AT\text{-}C}{EF \times ED \times [(CSF \times IR \times CF \times ABSo)/BW + (CSF \times SA \times AF \times CF \times ABSd)/BW + (URF \times FT \times (1/PEF))]}$$

Non-Carcinogenic Endpoints:

$$SSCL_{soil} = \frac{THQ \times AT\text{-}NC}{EF \times ED \times MF \times [((1/RfD) \times IR \times CF \times ABSo)/BW + ((1/RfD) \times SA \times AF \times CF \times ABSd)/BW + ((1/RfC) \times FT \times (1/PEF))]}$$

Table 5.14

Derivation of Site-Specific Cleanup Levels for Surface Soil (0 to 2 ft BGS) - Resident Oral, Dermal, and Dust Inhalation Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituents of Potential Concern (COPC)	Mutagenic Compound Yes or No	Cancer Toxicity Data			Non-Cancer Toxicity Data			Absorption Factor		Particulate Emission Factor	Resident					TPH Mass Fraction (mg/kg)	Cleanup Level per TPH Mass Fraction (mg/kg)	Site-Specific Cleanup Level for Soil ($SSCL_{soil}$) (2) (mg/kg)
		CSF		URF	RfD		RfC	ABSo	ABSd		TR Lifetime (1) (mg/kg)	THQ Young Child (0-2 yrs) (mg/kg)	THQ Child (2-6 yrs) (mg/kg)	THQ Adolescent (6-16 yrs) (mg/kg)	THQ Adult (16-26 yrs) (mg/kg)			
		Oral 1/(mg/kg-d)	Dermal 1/(mg/kg-d)	Inhalation 1/(mg/m^3)	Oral (mg/kg-d)	Dermal (mg/kg-d)	Inhalation (mg/m^3)	Oral (%/100)	Dermal (%/100)	PEF (m^3/kg)								
Total TPH (3) (by TX1005)																--	--	**7.69E+03**
TPH (C6-C12; GRO)	No	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	2.77E+03	2.56E+03	2.58E+04	2.35E+04	--	--	2.56E+03
TPH (>C12-C28; DRO)	No	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	2.77E+03	2.56E+03	2.58E+04	2.35E+04	--	--	2.56E+03
TPH (>C28-C35; LOR)	No	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	2.77E+03	2.56E+03	2.58E+04	2.35E+04	--	--	2.56E+03

Constituents of Potential Concern (COPC)	Cancer Toxicity Data			Non-Cancer Toxicity Data			Absorption Factor		Particulate Emission Factor	Resident					TPH Mass Fraction (mg/kg)	Cleanup Level per TPH Mass Fraction (mg/kg)	Site-Specific Cleanup Level for Soil ($SSCL_{soil}$) (2) (mg/kg)
	CSF		URF	RfD		RfC	ABSo	ABSd		TR Lifetime (1) (mg/kg)	THQ Young Child (0-2 yrs) (mg/kg)	THQ Child (2-6 yrs) (mg/kg)	THQ Adolescent (6-16 yrs) (mg/kg)	THQ Adult (16-30 yrs) (mg/kg)			
	Oral 1/(mg/kg-d)	Dermal 1/(mg/kg-d)	Inhalation 1/(mg/m^3)	Oral (mg/kg-d)	Dermal (mg/kg-d)	Inhalation (mg/m^3)	Oral (%/100)	Dermal (%/100)	PEF (m^3/kg)								
Total TPH (3) (by TX1006) - TPHCWG Site-Specific Mass Fraction Approach as Implemented by TCEQ (2000)																SSCL for Total TPH (minimum of $SSCL_1$ and $SSCL_2$) =	**3.71E+03**
																$SSCL_1$ (MFi/SSCLi) (4) =	3.71E+03
																$SSCL_2$ (SSCLi/MFi) (5) =	1.52E+04
																	TPH MFi
Aliphatic (C6)	--	--	--	6.00E-02	6.00E-02	6.70E-01	1.00E+00	1.00E-01	6.61E+09	NV	4.15E+03	3.85E+03	3.86E+04	3.52E+04	3.85E+03	3.85E+03	6.34E-02
Aliphatic (>C6-C8)	--	--	--	6.00E-02	6.00E-02	6.70E-01	1.00E+00	1.00E-01	6.61E+09	NV	4.15E+03	3.85E+03	3.86E+04	3.52E+04	3.85E+03	3.85E+03	1.27E-01
Aliphatic (>C8-C10)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	6.92E+03	6.41E+03	6.44E+04	5.87E+04	6.41E+03	6.41E+03	6.34E-02
Aliphatic (>C10-C12)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	6.92E+03	6.41E+03	6.44E+04	5.87E+04	6.41E+03	6.41E+03	6.34E-02
Aliphatic (>C12-C16)	--	--	--	1.00E-01	1.00E-01	5.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	6.92E+03	6.41E+03	6.44E+04	5.87E+04	6.41E+03	6.41E+03	6.34E-02
Aliphatic (>C16-C21)	--	--	--	2.00E+00	2.00E+00	--	1.00E+00	1.00E-01	6.61E+09	NV	1.38E+05	1.28E+05	1.29E+06	1.17E+06	1.28E+05	1.28E+05	6.34E-02
Aliphatic (>C21-C35)	--	--	--	2.00E+00	2.00E+00	--	1.00E+00	1.00E-01	6.61E+09	NV	1.38E+05	1.28E+05	1.29E+06	1.17E+06	1.28E+05	1.28E+05	1.27E-01
Aromatic (>C7-C8)	--	--	--	1.00E-01	1.00E-01	1.90E+00	1.00E+00	1.00E-01	6.61E+09	NV	6.92E+03	6.41E+03	6.44E+04	5.87E+04	6.41E+03	6.41E+03	1.46E-02
Aromatic (>C8-C10)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	2.77E+03	2.56E+03	2.58E+04	2.35E+04	2.56E+03	2.56E+03	9.75E-02
Aromatic (>C10-C12)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	2.77E+03	2.56E+03	2.58E+04	2.35E+04	2.56E+03	2.56E+03	6.34E-02
Aromatic (>C12-C16)	--	--	--	4.00E-02	4.00E-02	2.00E-01	1.00E+00	1.00E-01	6.61E+09	NV	2.77E+03	2.56E+03	2.58E+04	2.35E+04	2.56E+03	2.56E+03	6.34E-02
Aromatic (>C16-C21)	--	--	--	3.00E-02	3.00E-02	--	1.00E+00	1.00E-01	6.61E+09	NV	2.08E+03	1.92E+03	1.93E+04	1.76E+04	1.92E+03	1.92E+03	6.34E-02
Aromatic (>C21-C35)	--	--	--	3.00E-02	3.00E-02	--	1.00E+00	1.00E-01	6.61E+09	NV	2.08E+03	1.92E+03	1.93E+04	1.76E+04	1.92E+03	1.92E+03	1.27E-01

Table 5.14

Derivation of Site-Specific Cleanup Levels for Surface Soil (0 to 2 ft BGS) - Resident Oral, Dermal, and Dust Inhalation Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Notes:

BOLD	Value indicates SSCL
--	Not Available or Applicable
ft BGS	feet below ground surface
DRO	Diesel Range Organics
GRO	Gasoline Range Organics
LOR	Lube Oil Range
NV	No Value
TPH	Total Petroleum Hydrocarbons
(1)	Carcinogenic risk includes young child, child, adolescent, and adult over a 26-year residency.
(2)	The selected SSCL is the lower of the carcinogenic-based concentration and the non-carcinogenic-based concentration.
(3)	TPH is not identified as a COPC but is included here because soil SSCLs are developed for TPH as part of the Uncertainty Analysis in Section 4.
(4)	$SSCL_1$ is calculated as $SSCL_1$ = HI/Sum (MFi/SSCLi), following TCEQ (2000; Table 3, Equation 3-1). The mass fraction results for soil samples from a TPH source is reported in Table 5.18.
(5)	$SSCL_2$ is calculated as $SSCL_2$ = MIN(SSCLi/MFi), following TCEQ (2000; Table 3, Equation 3-2). The average of the mass fraction results for soil samples from a TPH is reported in Table 5.18.

References:

NMED, 2015: Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015.
DEQ, 2013: Risk-Based Decision Making for Site Cleanup, DEQ's Facts Sheets, July 2013.
TCEQ, 2000: Development of Human Health Protective Concentration Levels (PCLs) for Total Petroleum Hydrocarbon (TPH) Mixtures, Texas Commission on Environmental Quality (TCEQ) Regulatory Guidance, Remediation, RG-366/TRRP-27, June 2000.

Resident Exposure Assumptions	**Abbreviation**	**Value**	**Source**
Cleanup Level for Soil (mg/kg)	$SSCL_{soil}$	calculated	--
Target Risk Level (unitless)	TR	1.0E-05	NMED, 2015
Target Hazard Level (unitless)	THQ	1	NMED, 2015
Reference Dose (mg/kg-day)	RfD	chemical-specific	Table 5.8
Reference Concentration (mg/m^3)	RfC	chemical-specific	Table 5.9
Ingestion Rate (mg/day) - Young Child (Age 0-2)	IRyc	200	Table 5.6
Ingestion Rate (mg/day) - Child (Age 2-6)	IRc	200	Table 5.6
Ingestion Rate (mg/day) - Young Adult (Age 6-16)	IRya	100	Table 5.6
Ingestion Rate (mg/day) - Adult (Age 16-26)	IRa	100	Table 5.6
Absorption Factor - Oral (%/100)	ABSo	1	Table 5.6
Surface Area (cm^2/day) - Young Child (Age 0-2)	SAyc	1,297	Table 5.6
Surface Area (cm^2/day) - Child (Age 2-6)	SAc	2,204	Table 5.6
Surface Area (cm^2/day) - Young Adult (Age 6-16)	SAya	4,219	Table 5.6
Surface Area (cm^2/day) - Adult (Age 16-26)	SAa	6,032	Table 5.6
Adherence Factor (mg/cm^2) - Young Child (Age 0-2)	AFyc	0.2	Table 5.6
Adherence Factor (mg/cm^2) - Child (Age 2-6)	AFc	0.2	Table 5.6
Adherence Factor (mg/cm^2) - Young Adult (Age 6-16)	AFya	0.07	Table 5.6
Adherence Factor (mg/cm^2) - Adult (Age 16-26)	AFa	0.07	Table 5.6
Absorption Factor - Dermal (%/100)	ABSd	chemical-specific	Table 5.6
Fraction Time Exposed (unitless)	FT	3/24	Table 5.6
Exposure Frequency (days/year)	EF	350	Table 5.6
Exposure Duration (years) - Young Child (Age 0-2)	EDyc	2	Table 5.6
Exposure Duration (years) - Child (Age 2-6)	EDc	4	Table 5.6
Exposure Duration (years) - Young Adult (Age 6-16)	EDya	10	Table 5.6
Exposure Duration (years) - Adult (Age 16-26)	EDa	10	Table 5.6
Mutagenic Factor (unitless) - Young Child (Age 0-2)	MF1	10	Table 5.6
Mutagenic Factor (unitless) - Child (Age 2-6)	MF2	3	Table 5.6
Mutagenic Factor (unitless) - Young Adult (Age 6-16)	MF3	3	Table 5.6
Mutagenic Factor (unitless) - Adult (Age 16-26)	MF4	1	Table 5.6
Body Weight (kg) - Young Child (Age 0-2)	BWyc	15	Table 5.6
Body Weight (kg) - Child (Age 2-6)	BWc	15	Table 5.6
Body Weight (kg) - Young Adult (Age 6-16)	BWya	80	Table 5.6
Body Weight (kg) - Adult (Age 16-26)	BWa	80	Table 5.6
Conversion Factor (kg/mg)	CF	1.0E-06	Table 5.6
Averaging Time - carc. (days)	AT-C	25,550	Table 5.6
Averaging Time - noncarc. (days) - Young Child (Age 0-2)	AT-NCyc	730	Table 5.6
Averaging Time - noncarc. (days) - Child (Age 2-6)	AT-NCc	1,460	Table 5.6
Averaging Time - noncarc. (days) - Young Adult (Age 6-16)	AT-NCya	3,650	Table 5.6
Averaging Time - noncarc. (days) - Adult (Age 16-26)	AT-NCa	3,650	Table 5.6
Particulate Emission Factor (m^3/kg)	PEF	6.61E+09	Table 5.6

Table 5.14

Derivation of Site-Specific Cleanup Levels for Surface Soil (0 to 2 ft BGS) - Resident Oral, Dermal, and Dust Inhalation Exposure
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Exposure Equations

Carcinogenic Constituents:

$$SSCL_{soil} = \frac{\text{TR x AT-C}}{\begin{gathered}\text{EF x [(((CSF x IRyc x EDyc x CF x ABSo) / BWyc + (CSF x SAyc x AFyc x EDyc x CF x ABSd) / BWyc + (URF x FT x EDyc x (1/PEF))) +}\\ \text{((CSF x IRc x EDc x CF x ABSo) / BWc + (CSF x SAc x AFc x EDc x CF x ABSd) / BWc + (URF x FT x EDc x (1/PEF))) +}\\ \text{((CSF x IRya x EDya x CF x ABSo) / BWya + (CSF x SAya x AFya x EDya x CF x ABSd) / BWya + (URF x FT x EDya x (1/PEF))) +}\\ \text{((CSF x IRa x EDa x CF x ABSo) / BWa + (CSF x SAa x AFa x EDa x CF x ABSd) / BWa + (URF x FT x EDa x (1/PEF)))]}\end{gathered}}$$

Carcinogenic Constituents: Mutagenic Compounds

$$SSCL_{soil} = \frac{\text{TR x AT-C}}{\begin{gathered}\text{EF x [(((CSF x IRyc x EDyc x MF1 x CF x ABSo) / BWyc + (CSF x SAyc x AFyc x EDyc x CF x MF1 x ABSd) / BWyc + (URF x FT x EDyc x MF1 x (1/PEF))) +}\\ \text{((CSF x IRc x EDc x MF2 x CF x ABSo) / BWc + (CSF x SAc x AFc x EDc x MF2 x CF x ABSd) / BWc + (URF x FT x EDc x MF2 x (1/PEF))) +}\\ \text{((CSF x IRya x EDya x MF3 x CF x ABSo) / BWya + (CSF x SAya x AFya x EDya x MF3 x CF x ABSd) / BWya + (URF x FT x EDya x MF3 x (1/PEF))) +}\\ \text{((CSF x IRa x EDa x MF4 x CF x ABSo) / BWa + (CSF x SAa x AFa x EDa x MF4 x CF x ABSd) / BWa + (URF x FT x EDa x MF4 x (1/PEF)))]}\end{gathered}}$$

Non-Carcinogenic Constituents:

$$SSCL_{soil} = \frac{\text{THQ x AT-NC}}{\text{EF x ED x [((1/RfD) x IR x CF x ABSo)/BW + ((1/RfD) x SA x AF x CF x ABSd)/BW + ((1/RfC) x FT x (1/PEF))]}}$$

Table 5.15

Derivation of Site-Specific Cleanup Levels for Soil - Resident Exposure to Homegrown Below-Ground Garden Produce
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

		Toxicity Data		Allowable Residential Below-Ground Produce Exposure										
Constituents of Potential Concern (COPC)	Mutagenic Compound Yes or No	CSF Oral 1/(mg/kg-d)	RfD Oral (mg/kg-d)	TR Lifetime[(1)] (mg/kg DW)	THQ Young Child (0-2 yrs) (mg/kg DW)	THQ Child (2-6 yrs) (mg/kg DW)	THQ Young Adult (6-16 yrs) (mg/kg DW)	THQ Adult (16-26 yrs) (mg/kg DW)	Allowable Below-Ground Produce Concentration Pr_{bg} [(2)] (mg/kg DW)	Correction Factor for Below Ground Vegetation VG_{root} [(3)]	Plant-Soil Bioconcentration Factor Below-Ground Produce $Br_{rootveg}$ [(4)] (mg/kg DW)/(mg/kg soil)	TPH Mass Fraction	Site-Specific Cleanup Level per TPH Mass Fraction (mg/kg)	Site-Specific Cleanup Level for Soil ($SSCL_{soil}$) (mg/kg) [(5)]
Total TPH [(6)] (by TX1005)														**9.05E+03**
TPH (C6-C12; GRO)	No	--	4.00E-02	NV	7.99E+00	4.43E+00	5.21E+00	2.87E+00	2.87E+00	1.00E-02	9.50E-02	--	--	3.02E+03
TPH (>C12-C28; DRO)	No	--	4.00E-02	NV	7.99E+00	4.43E+00	5.21E+00	2.87E+00	2.87E+00	1.00E-02	9.50E-02	--	--	3.02E+03
TPH (>C28-C35; LOR)	No	--	4.00E-02	NV	7.99E+00	4.43E+00	5.21E+00	2.87E+00	2.87E+00	1.00E-02	9.50E-02	--	--	3.02E+03

	Toxicity Data		Allowable Residential Below-Ground Produce Exposure										
Constituents of Potential Concern (1) (COPC)	CSF oral 1/(mg/kg-d)	RfD oral (mg/kg-d)	TR Lifetime[(1)] (mg/kg DW)	THQ Young Child (0-2 yrs) (mg/kg DW)	THQ Child (2-6 yrs) (mg/kg DW)	THQ Young Adult (6-16 yrs) (mg/kg DW)	THQ Adult (16-30 yrs) (mg/kg DW)	Allowable Below-Ground Produce Concentration Pr_{bg} [(2)] (mg/kg DW)	Correction Factor for Below Ground Vegetation VG_{root} [(3)]	Plant-Soil Bioconcentration Factor Below-Ground Produce $Br_{rootveg}$ [(4)] (mg/kg DW)/(mg/kg soil)	TPH Mass Fraction	Site-Specific Cleanup Level per TPH Mass Fraction (mg/kg)	Site-Specific Cleanup Level for Soil ($SSCL_{soil}$) (mg/kg) [(5)]
Total TPH [(6)] (by TX1006) - TPHCWG Site-Specific Mass Fraction Approach as Implemented by TCEQ (2000)												SSCL for Total TPH (minimum of $SSCL_1$ and $SSCL_2$) =	**4.44E+03**
												$SSCL_1$ (MFi/SSCLi) [(7)] =	4.44E+03
												$SSCL_2$ (SSCLi/MFi) [(8)] =	1.34E+04
													TPH MFi
Aliphatic (C6)	--	6.00E-02	NV	1.80E+01	9.97E+00	1.17E+01	6.45E+00	6.45E+00	1.00E-02	9.50E-02	6.79E+03	6.45E+00	6.34E-02
Aliphatic (>C6-C8)	--	6.00E-02	NV	1.80E+01	9.97E+00	1.17E+01	6.45E+00	6.45E+00	1.00E-02	9.50E-02	6.79E+03	6.45E+00	1.27E-01
Aliphatic (>C8-C10)	--	1.00E-01	NV	5.00E+01	2.77E+01	3.26E+01	1.79E+01	1.79E+01	1.00E-02	9.50E-02	1.89E+04	1.79E+01	6.34E-02
Aliphatic (>C10-C12)	--	1.00E-01	NV	5.00E+01	2.77E+01	3.26E+01	1.79E+01	1.79E+01	1.00E-02	9.50E-02	1.89E+04	1.79E+01	6.34E-02
Aliphatic (>C12-C16)	--	1.00E-01	NV	5.00E+01	2.77E+01	3.26E+01	1.79E+01	1.79E+01	1.00E-02	9.50E-02	1.89E+04	1.79E+01	6.34E-02
Aliphatic (>C16-C21)	--	2.00E+00	NV	2.00E+04	1.11E+04	1.30E+04	7.17E+03	7.17E+03	1.00E-02	9.50E-02	7.54E+06	7.17E+03	6.34E-02
Aliphatic (>C21-C35)	--	2.00E+00	NV	2.00E+04	1.11E+04	1.30E+04	7.17E+03	7.17E+03	1.00E-02	9.50E-02	7.54E+06	7.17E+03	1.27E-01
Aromatic (>C7-C8)	--	1.00E-01	NV	5.00E+01	2.77E+01	3.26E+01	1.79E+01	1.79E+01	1.00E-02	9.50E-02	1.89E+04	1.79E+01	1.46E-02
Aromatic (>C8-C10)	--	4.00E-02	NV	7.99E+00	4.43E+00	5.21E+00	2.87E+00	2.87E+00	1.00E-02	9.50E-02	3.02E+03	2.87E+00	9.75E-02
Aromatic (>C10-C12)	--	4.00E-02	NV	7.99E+00	4.43E+00	5.21E+00	2.87E+00	2.87E+00	1.00E-02	9.50E-02	3.02E+03	2.87E+00	6.34E-02
Aromatic (>C12-C16)	--	4.00E-02	NV	7.99E+00	4.43E+00	5.21E+00	2.87E+00	2.87E+00	1.00E-02	9.50E-02	3.02E+03	2.87E+00	6.34E-02
Aromatic (>C16-C21)	--	3.00E-02	NV	4.50E+00	2.49E+00	2.93E+00	1.61E+00	1.61E+00	1.00E-02	9.50E-02	1.70E+03	1.61E+00	6.34E-02
Aromatic (>C21-C35)	--	3.00E-02	NV	4.50E+00	2.49E+00	2.93E+00	1.61E+00	1.61E+00	1.00E-02	9.50E-02	1.70E+03	1.61E+00	1.27E-01

Table 5.15

Derivation of Site-Specific Cleanup Levels for Soil - Resident Exposure to Homegrown Below-Ground Garden Produce
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Notes:

BOLD	**Value indicates SSCL**
--	Not Available or Applicable
DRO	Diesel Range Organics
GRO	Gasoline Range Organics
LOR	Lube Oil Range
NV	No Value
TPH	Total Petroleum Hydrocarbons

(1) Carcinogenic risk includes young child, child, young adult, and adult over a 26-year residency.
(2) The selected Allowable Below-Ground Produce Concentration value is the lowest of the carcinogenic-based and non-carcinogenic-based concentrations.
(3) Correction factors applied as follows: VG = 0.01 for chemicals with a log K_{ow} greater than 4; VG = 1.0 for chemicals with a log K_{ow} less than 4.
(4) Where $Br_{rootveg}$ was not provided from Chemical-Specific Input Values; for compounds with log K_{ow} values greater than or equal to 2.0, $Br_{rootveg}$ = Root Concentration Factor (RCF) / K_{ds}, where log (RCF) = 0.77 x log K_{ow} - 1.52; Equations A-2-14 & A-2-16, Appendix A-2, Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, USEPA530-R-05-006, September 2005 (USEPA, 2005). Calculated from the formula K_{ds} = K_{oc} x f_s, where fs is a conservatively applied sorbent content (fraction of clays plus organic carbon) of 0.03, as presented in Section 3.2 of the USEPA Superfund Chemical Data Matrix Methodology (USEPA, 2004).
(5) The selected SSCL is based on the lower of the allowable below ground produce concentration value, Pr_{bg}, corresponding to the lowest of the carcinogenic-based and non-carcinogenic-based concentrations divided by the product of the plant-soil bioconcentration factor, $Br_{rootveg}$, and the correction factor, VG_{root}.
(6) TPH is not identified as a COPC but is included here because soil SSCLs are developed for TPH as part of the Uncertainty Analysis in Section 4.
(7) $SSCL_1$ is calculated as $SSCL_1$ = HI/Sum (MFi/SSCLi), following TCEQ (2000; Table 3, Equation 3-1). The mass fraction (MFi) results for a soil sample taken from a TPH source is reported in Table 3.18.
(8) $SSCL_2$ is calculated as $SSCL_2$ = MIN(SSCLi/MFi), following TCEQ (2000; Table 3, Equation 3-2). The mass fraction (MFi) results for a soil sample taken from a TPH source is reported in Table 3.18.

References:

NMED, 2015: Risk Assessment Guidance for Site Investigations and Remediation, Volume I, July 2015.
DEQ, 2013: Risk-Based Decision Making for Site Cleanup, DEQ's Facts Sheets, July 2013.
TCEQ, 2000: Development of Human Health Protective Concentration Levels (PCLs) for Total Petroleum Hydrocarbon (TPH) Mixtures, Texas Commission on Environmental Quality (TCEQ) Regulatory Guidance, Remediation, RG-366/TRRP-27, June 2000.
USEPA, 2004: Superfund Chemical Data Matrix (SCDM). Office of Emergency and Remedial Response, United States Environmental Protection Agency, EPA/540-R-94-009 January, 2004.
USEPA, 2005: Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, Office of Solid Waste and Emergency Response, United States Environmental Protection Agency, EPA530-R-05-006, September 2005.

Table 5.15

Derivation of Site-Specific Cleanup Levels for Soil - Resident Exposure to Homegrown Below-Ground Garden Produce
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Resident Exposure Assumptions	**Abbreviation**	**Value**	**Source**
Site-Specific Cleanup Level for Soil (mg/kg)	$SSCL_{soil}$	calculated	--
Target Risk Level (unitless)	TR	1.0E-05	NMED, 2015
Target Hazard Level (unitless)	THQ	1	NMED, 2015
Reference Dose (mg/kg-day)	RfD	chemical-specific	Table 5.8
Consumption Rate of Below-Ground Produce (kg/day) - Young Child (Age 0-2)	CR_{bgyc}	0.0715	Table 5.7
Consumption Rate of Below-Ground Produce (kg/day) - Child (Age 2-6)	CR_{bgc}	0.129	Table 5.7
Consumption Rate of Below-Ground Produce (kg/day) - Young Adult (Age 6-16)	CR_{bgya}	0.585	Table 5.7
Consumption Rate of Below-Ground Produce (kg/day) - Adult (Age 16-26)	CR_{bga}	1.063	Table 5.7
Correction Factor for Below-Ground Vegetation	VG_{root}	chemical-specific	(3)
Plant-Soil Bioconcentration Factor for Below-Ground Produce	$Br_{rootveg}$	chemical-specific	(4)
Fraction of Homegrown Below-Ground Produce Consumed	F_{bg}	0.042	Table 5.7
Exposure Duration (years) - Young Child (Age 0-2)	EDyc	2	Table 5.7
Exposure Duration (years) - Child (Age 2-6)	EDc	4	Table 5.7
Exposure Duration (years) - Young Adult (Age 6-16)	EDya	10	Table 5.7
Exposure Duration (years) - Adult (Age 16-26)	EDa	10	Table 5.7
Mutagenic Factor (unitless) - Young Child (Age 0-2)	MF1	10	Table 5.7
Mutagenic Factor (unitless) - Child (Age 2-6)	MF2	3	Table 5.7
Mutagenic Factor (unitless) - Young Adult (Age 6-16)	MF3	3	Table 5.7
Mutagenic Factor (unitless) - Adult (Age 16-26)	MF4	1	Table 5.7
Body Weight (kg) - Young Child (Age 0-2)	BWyc	15	Table 5.7
Body Weight (kg) - Child (Age 2-6)	BWc	15	Table 5.7
Body Weight (kg) - Young Adult (Age 6-16)	BWya	80	Table 5.7
Body Weight (kg) - Adult (Age 16-26)	BWa	80	Table 5.7
Averaging Time - carc. (years)	AT-C	70	Table 5.7
Averaging Time (non-cancer) - Young Child (Age 0-2) (years)	AT-NCyc	2	Table 5.7
Averaging Time (non-cancer) - Child (Age 2-6) (years)	AT-NCc	4	Table 5.7
Averaging Time (non-cancer) - Young Adult (Age 6-16) (years)	AT-NCya	10	Table 5.7
Averaging Time (non-cancer) - Adult (Age 16-26) (years)	AT-NCa	10	Table 5.7

Below-Ground Produce (Prbg) Exposure Equations

Carcinogenic Constituents:

$$Pr_{bg} = \frac{TR \times AT\text{-}C}{[F_{bg} \times ((CR_{bgyc} \times EDyc \times CSF/ BWyc) + (CR_{bgc} \times EDc \times CSF / BWc) + (CR_{bgya} \times EDya \times CSF/ BWya) + (CR_{bga} \times EDa \times CSF/ BWa))]}$$

Carcinogenic Constituents: Mutagenic Compounds

$$Pr_{bg} = \frac{TR \times AT\text{-}C}{[F_{bg} \times ((CR_{bgyc} \times EDyc \times CSF \times MF1 / BWyc) + (CR_{bgc} \times EDc \times CSF \times MF2 / BWc) + (CR_{bgya} \times EDya \times CSF \times MF3 / BWya) + (CR_{bga} \times EDa \times CSF \times MF4 / BWa))]}$$

Non-Carcinogenic Constituents:

$$Pr_{bg} = \frac{THQ \times AT\text{-}NC}{[ED \times CR_{bg} \times F_{bg} \times (1/RfD) / BW]}$$

$$SSCL_{soil} = \frac{Pr_{bg}}{Br_{rootveg} \times VG_{root}}$$

Table 5.16

Summary of Site-Specific Cleanup Levels for Industrial Soil
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituents of Potential Concern (COPC)	Calculated SSCLs Per Exposure Pathway [1] (Table Reference)				Site-Specific Cleanup Level (SSCL) [2]
	Human Health-Based SSCLs				
	(A) Construction/Utility Worker (see Table 3.10)	(B) Outdoor Worker (see Table 3.11)	(C) Indoor Worker (see Table 3.12)	(D) Trespasser (see Table 3.13)	
Surface Soil (mg/kg)					
Total TPH [3, 4]	1.55E+04	5.31E+04	8.20E+04	1.40E+05	**1.55E+04**

Notes:

BOLD	Value indicates final SSCL
TPH	Total Petroleum Hydrocarbons
(1)	Exposure Pathway:

Receptor	**Pathway**
(A) Construction/Utility Worker	Direct Contact (incidental ingestion of soil, dermal contact, and inhalation of soil dust)
(B) Outdoor Worker	Direct Contact (incidental ingestion of soil, dermal contact, and inhalation of soil dust)
(C) Indoor Worker	Direct Contact (incidental ingestion of soil, dermal contact, and inhalation of soil dust)
(D) Trespasser	Direct Contact (incidental ingestion of soil, dermal contact, and inhalation of soil dust)

(2) Final SSCL corresponds to the lowest applicable or practicable calculated risk-based or default USEPA Regional Screening Level value.

(3) TPH is not identified as a COPC but is included here because soil SSCLs are developed for TPH as part of the Uncertainty Analysis in Section 4.

(4) Based on Total TPH (by TX1006) which is lower than Total TPH (by TX1005).

Table 5.17

Summary of Site-Specific Cleanup Levels for Residential Soil Produce
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituents of Potential Concern (COPC)	Calculated SSCLs Per Exposure Pathway [1] (Table Reference)			Site-Specific Cleanup Level (SSCL) [2]
	Human Health-Based SSCLs			
	(A) Soil (see Table 3.14)	(B) Produce (Above)	(C) Produce (Below) (see Table 3.15)	Soil
	mg/kg	mg/kg	mg/kg	mg/kg
Total TPH [3]	3.71E+03	--	4.44E+03	**3.71E+03**

Notes:

BOLD	Value indicates final SSCL
--	Not available or applicable
TPH	Total Petroleum Hydrocarbons
(1)	Exposure Pathway:

Receptor	**Pathway**
(A) Soil	Direct Contact (incidental ingestion, dermal contact, and inhalation of soil dust)
(B) Produce (below ground)	Direct Contact (ingestion of produce)
(C) Produce (above ground)	Direct Contact (ingestion of produce)

(2) Final SSCL corresponds to the lowest applicable or practicable calculated risk-based screening level,

(3) Based on Total TPH (by TX1006) which is lower than Total TPH (by TX1005).

Table 5.18

Derivation of TPH Mass Fractions for Soil
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Boiling Point Range	Concentration(1) C_i (mg/kg)	TPH Mass Fraction(2) MF_i
C6 Aliphatic	1.19E+01	6.34E-02
>C6-C8 Aliphatic	2.39E+01	1.27E-01
>C8-C10 Aliphatic	1.19E+01	6.34E-02
>C10-C12 Aliphatic	1.19E+01	6.34E-02
>C12-C16 Aliphatic	1.19E+01	6.34E-02
>C16-C21 Aliphatic	1.19E+01	6.34E-02
>C21-C35 Aliphatic	2.39E+01	1.27E-01
>C7-C8 Aromatic	2.75E+00	1.46E-02
>C8-C10 Aromatic	1.83E+01	9.75E-02
>C10-C12 Aromatic	1.19E+01	6.34E-02
>C12-C16 Aromatic	1.19E+01	6.34E-02
>C16-C21 Aromatic	1.19E+01	6.34E-02
>C21-C35 Aromatic	2.39E+01	1.27E-01
Total TPH	**1.88E+02**	**1.00E+00**

Notes:

ND	Not Detected
TPH	Total Petroleum Hydrocarbons
(1)	Concentration is average across representative soil samples collected from the Site on July 6, 2016.
(2)	TPH Mass Fraction is calculated as $MF_i = C_i$/Total TPH, following TCEQ (2000).

Non-detect concentrations are assigned a value equal to one-half of the reporting limit.

Reference:

TCEQ, 2000: Development of Human Health Protective Concentration Levels (PCLs) for Total Petroleum Hydrocarbon (TPH) Mixtures, Texas Commission on Environmental Quality (TCEQ) Regulatory Guidance, Remediation, RG-366/TRRP-27, June 2000.

TABLE 5.19

SOIL EXPOSURE POINT CONCENTRATIONS
HHRA: SAN JUAN 28-6 No. 155N
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituents of Potential Concern (COPC)	Unit	$\text{SSCL}_{\text{soil}}$		Maximum Detected Value	Arithmetic Mean	CTE					RME		
						Arithmetic Mean > $\text{SSCL}_{\text{soil}}$		Geometric Mean	Geometric Mean > $\text{SSCL}_{\text{soil}}$		95% UCL	95% UCL > $\text{SSCL}_{\text{soil}}$	
		Residential	Commercial/ Industrial			Residential	Commercial/ Industrial		Residential	Commercial/ Industrial		Residential	Commercial/ Industrial
TPH - Extractable (DRO)	mg/kg	3.71E+03	1.55E+04	6.40E+02	1.53E+02	N	N	6.44E+01	N	N	1.74E+02	N	N
TPH - Purgeable (GRO)	mg/kg	3.71E+03	1.55E+04	3.80E+03	8.78E+02	N	N	3.27E+02	N	N	1.11E+03	N	N

Notes:

COPC = Constituent of Potential Concern

CTE = Central Tendency Exposure

NA = Not Applicable

N = No

RME = Reasonable Maximum Exposure

$\text{SSCL}_{\text{soil}}$ = Site Specific Cleanup Level for Soil

TPH = Total Petroleum Hydrocarbons

UCL = Upper Confidence Level

Y = Yes

TABLE 6.1

ASSESSMENT AND MEASUREMENT ENDPOINTS
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Medium	Exposure Route	Assessment Endpoint	Measurement Endpoint
Soil	Direct Contact Ingestion/Uptake Adsorption	Species richness and productivity of terrestrial plant and soil invertebrate communities. Populations of avian and mammalian insectivores, herbivores, omnivores, and carnivores.	Maximum detected concentration of chemical constituents in soil.
	Food Web Transfer (Ingestion and Absorption)	Relative and absolute densities of avian and mammalian insectivores, herbivores, omnivores, and carnivores.	Maximum detected concentration of chemical constituents in soil. Estimated ingestion of BCOCs in soil (based on maximum concentration).
Sediment	Direct Contact Ingestion Adsorption	Species richness and productivity of benthic macroinvertebrate community Relative and absolute densities of avian and mammalian insectivores, herbivores, omnivores, and carnivores.	Maximum detected concentration of chemical constituents in sediment.
	Food Web Transfer (Ingestion and Absorption)	Relative and absolute densities of avian and mammalian insectivores, herbivores, omnivores, carnivores, and piscivores.	Maximum detected concentration of chemical constituents in sediment. Estimated ingestion of BCOCs in sediment (based on maximum concentration).

Notes:

BCOC - Bioaccumulative chemical of concern

TABLE 6.2

ECOLOGICAL SCREENING VALUES FOR SOIL
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Compound	Units	Ecological Screening Value	Source
BTEX			
Benzene	mg/kg	0.05	USEPA Region 4
Ethylbenzene	mg/kg	0.05	USEPA Region 4
Toluene	mg/kg	200	TCEQ Plants
Xylene	mg/kg	0.05	USEPA Region 4
Polycyclic Aromatic Hydrocarbons (PAHs)			
Acenaphthene	mg/kg	20	TCEQ Plants
Acenaphthylene	mg/kg	682	USEPA Region 5
Anthracene	mg/kg	0.1	USEPA Region 4
Benz(a)anthracene	mg/kg	5	USEPA Region 5
Benzo(a)pyrene	mg/kg	0.1	USEPA Region 4
Benzo(b)fluoranthene	mg/kg	60	USEPA Region 5
Benzo(g,h,i)perylene	mg/kg	119	USEPA Region 5
Benzo(k)fluoranthene	mg/kg	148	USEPA Region 5
Chrysene	mg/kg	5	USEPA Region 5
Dibenz(a,h)anthracene	mg/kg	18	USEPA Region 5
Indeno(1,2,3-cd)pyrene	mg/kg	109	USEPA Region 5
Fluoranthene	mg/kg	0.1	USEPA Region 4
Fluorene	mg/kg	30	TCEQ Earthworms
Naphthalene	mg/kg	0.1	USEPA Region 4
Phenanthrene	mg/kg	0.1	USEPA Region 4
Pyrene	mg/kg	0.1	USEPA Region 4
Total Petroleum Hydrocarbons (mg/kg)			
C5-C12	mg/kg	n/a	---
C6-C12	mg/kg	n/a	---

TABLE 6.2

ECOLOGICAL SCREENING VALUES FOR SOIL
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Compound	Units	Ecological Screening Value	Source
C6-C35	mg/kg	n/a	---
C10-C28	mg/kg	n/a	---
C12-C28	mg/kg	n/a	---
C28-C35	mg/kg	n/a	---

Notes:

n/a - Ecological Screening Value is not available

TCEQ Earthworms - Ecological Screening Benchmark for Earthworms (TCEQ 2006)

TCEQ Plants - Ecological Screening Benchmark for Plants (TCEQ 2006)

USEPA Region 4 - Ecological Screening Benchmark (USEPA 2001)

USEPA Region 5 - Ecological Screening Level (ESL)(USEPA 2003)

TABLE 6.3

ECOLOGICAL SCREENING VALUES FOR SEDIMENT
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Compound	Units	Ecological Screening Value	Source
BTEX			
Benzene	mg/kg	0.14157	USEPA Region 5
Ethylbenzene	mg/kg	0.175	USEPA Region 5
Toluene	mg/kg	1	USEPA Region 5
Xylene	mg/kg	0.433	USEPA Region 5
Polycyclic Aromatic Hydrocarbons (PAHs)			
2-Methylnaphthalene	mg/kg	0.0202	USEPA Region 5
Acenaphthene	mg/kg	0.00671	USEPA Region 5
Acenaphthylene	mg/kg	0.00587	USEPA Region 5
Anthracene	mg/kg	0.0572	Consensus TEC
Benz(a)anthracene	mg/kg	0.108	Consensus TEC
Benzo(a)pyrene	mg/kg	0.15	Consensus TEC
Benzo(b)fluoranthene	mg/kg	10	USEPA Region 5
Benzo(g,h,i)perylene	mg/kg	0.17	USEPA Region 5
Benzo(k)fluoranthene	mg/kg	0.24	USEPA Region 5
Chrysene	mg/kg	0.166	Consensus TEC
Dibenz(a,h)anthracene	mg/kg	0.033	Consensus TEC
Fluoranthene	mg/kg	0.423	Consensus TEC
Fluorene	mg/kg	0.0774	Consensus TEC
Indeno(1,2,3-cd)pyrene	mg/kg	0.2	USEPA Region 5
Naphthalene	mg/kg	0.176	Consensus TEC
Phenanthrene	mg/kg	0.204	Consensus TEC
Pyrene	mg/kg	0.195	Consensus TEC
Total Petroleum Hydrocarbons (mg/kg)			
C5-C12	mg/kg	n/a	---
C6-C12	mg/kg	n/a	---
C6-C35	mg/kg	n/a	---
C10-C28	mg/kg	n/a	---
C12-C28	mg/kg	n/a	---
C28-C35	mg/kg	n/a	---

Notes:

n/a - Ecological Screening Value is not available
ARCS TEC - USEPA Assessment and Remediation of Contaminated Sediments Threshold Effects Concentration (USEPA 1996a)
Consensus TEC - Threshold Effects Concentration (MacDonald et al. 2000)
USEPA OSWER - Office of Solid Waste and Emergency Response Ecotox Threshold Sediment Screening Benchmark (USEPA 1996b)
USEPA Region 5 - Ecological Screening Level (ESL) (USEPA 2003)

TABLE 6.4

SCREENING SUMMARY FOR SOIL - DETECTED CONSTITUENTS
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituent	Units	No. Samples	No. Detects	FOD	Max Conc.	UCL	Location of Max	ESV	SQ	BCOC	COPEC	Rationale
BTEX												
Benzene	mg/kg	20	3	15%	7.6	1.21	SC-5 (base)	0.05	152	No	**Yes**	**SQ > 1**
Ethylbenzene	mg/kg	20	7	35%	27	10.87	SC-5 (base)	0.05	540	No	**Yes**	**SQ > 1**
Toluene	mg/kg	20	10	50%	130	54.71	SC-5 (base)	200	1	No	No	SQ < 1
Xylene	mg/kg	20	11	55%	270	99.67	SC-5 (base)	0.05	5400	No	**Yes**	**SQ > 1**
Petroleum Products												
Total Petroleum Hydrocarbons - Extractable (DRO)	mg/kg	20	12	60%	640	340.8	SC-5 (base)	n/a	n/c	No	No	see text
Total Petroleum Hydrocarbons - Motor Oil	mg/kg	20	---	---	---	---	---	n/a	n/c	No	No	see text
Total Petroleum Hydrocarbons - Purgeable (GRO)	mg/kg	20	10	50%	3800	1848	SC-5 (base)	n/a	n/c	No	No	see text

Notes:

Bold Font identifies constituent retained as a Constituent of Potential Ecological Concern (COPEC)

n/a - Ecological screening value not available

n/c - Not calculated

BCOC - Bioaccumulative Chemical of Concern (TCEQ 2006)

COPEC - Constituent of Potential Ecological Concern (see Table 6.2 for sources of ESVs)

ESV - Ecological Screening Value

SQ - Screening Quotient

FOD - Frequency of Detection

TABLE 6.5

PRELIMINARY CONSTITUENTS OF POTENTIAL ECOLOGICAL CONCERN
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituent of Potential Ecological Concern	SQ > 1	LOD > ESV
BTEX		
Benzene	152	---
Ethylbenzene	540	---
Xylene	5400	---

Notes:

ESV - Ecological Screening Value
HMW - High Molecular Weight
LOD - Limit of Detection
SQ - Screening Quotient

TABLE 6.6

REFINEMENT BENCHMARK VALUES FOR ECOLOGICAL RECEPTORS EXPOSED TO SOIL
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Compound	Units	Plants				Deer Mouse				Horned Lark				Kit Fox[a]				Red-Tailed Hawk[a]				Pronghorn Antelope[a]			
						Rodent Omnivore; major food source for larger omnivores and carnivores				Surrogate for American Robin (Avian Omnivore)				Surrogate for Red Fox (Mammalian to Carnivore)				Surrogate for American Kestral (Avian Top Carnivore)				Large Herbivore			
		USEPA	ORNL	CCME	NMED	USEPA	ORNL	CCME	NMED	USEPA	ORNL	CCME	NMED	USEPA	ORNL	CCME	NMED	USEPA	ORNL	CCME	NMED	USEPA	ORNL	CCME	NMED
BTEX																									
Benzene	mg/kg	n/a	n/a	n/a	n/a	n/a	n/a	n/a	240	n/a	n/a	n/a	n/a	n/a	n/a	n/a	1070	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ethylbenzene	mg/kg	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Xylene	mg/kg	n/a	n/a	n/a	100	n/a	n/a	n/a	19.1	n/a	n/a	n/a	506	n/a	n/a	n/a	84.8	n/a	n/a	n/a	3890	n/a	n/a	n/a	n/a

Notes:

[a] - receptor ranges are larger than the Site, therefore, they are not evaluated

n/a - Ecological Screening Value is not available

References:

NMED. (2015) Risk Assessment Guidance for Site Investigations and Remediation. Volume II, Screening-Level Ecological Risk Assessments. July 2015.

TABLE 6.7

REFINEMENT - PLANT COMMUNITY
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituent	Units	Refinement Benchmark (RB)	No. Samples	No. Detects	FOD	Max. Conc.	RQ (Max. Conc.)	95% UCL	RQ (95% UCL)	No. Samples > RB	% Samples > RB	Retained as COPEC	Rationale
0-5 ft bgs													
BTEX													
Benzene	mg/kg	n/a	16	3	19%	7.6	n/c	1.513	n/c	n/a	na	No	b
Ethylbenzene	mg/kg	n/a	16	6	38%	27	n/c	5.719	n/c	n/a	n/a	No	b
Xylene	mg/kg	100	16	6	38%	270	2.70	70.1	0.7	3	19%	No	< 20% > RB
0-10 ft bgs													
BTEX													
Benzene	mg/kg	n/a	20	3	15%	7.6	n/c	1.21	n/c	n/a	n/a	No	b
Ethylbenzene	mg/kg	n/a	20	7	35%	27	n/c	10.87	n/c	n/a	n/a	No	b
Xylene	mg/kg	100	20	11	55%	270	2.70	99.67	1.0	3	15%	No	< 20% > RB

Notes:

Bold Font identifies constituent retained as a Constituent of Potential Ecological Concern (COPEC)

[b] - See discussion in text for rationale for eliminating as a COPEC

COPEC - Constituent of Potential Ecological Concern

FOD - Frequency of Detection

RB - Refinement Benchmark (see Table 4.4 for RB sources)

RQ - Refinement Quotient

UCL - Upper Confidence Limit

TABLE 6.8

REFINEMENT - AVIAN RECEPTORS (HORNED LARK-AVIAN CARNIVORE
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituent	Units	Refinement Benchmark (RB)	No. Samples	No. Detects	FOD	Max. Conc.	RQ (Max. Conc.)	95% UCL	RQ (95% UCL)	No. Samples > RB	% Samples > RB	Retained as COPEC	Rationale
0-5 ft bgs													
<u>BTEX</u>													
Benzene	mg/kg	n/a	16	3	19%	7.6	n/c	1.513	n/c	n/a	n/a	No	b
Ethylbenzene	mg/kg	n/a	16	6	38%	27	n/c	5.719	n/c	n/a	n/a	No	b
Xylene	mg/kg	506	16	6	38%	270	0.53	70.1	0.14	0	0%	No	RQ < 1
0-10 ft bgs													
<u>BTEX</u>													
Benzene	mg/kg	n/a	20	3	15%	7.6	n/c	1.21	n/c	n/a	n/a	No	b
Ethylbenzene	mg/kg	n/a	20	7	35%	27	n/c	10.87	n/c	n/a	n/a	No	b
Xylene	mg/kg	506	20	11	55%	270	0.53	99.67	0.20	0	0%	No	RQ < 1

<u>Notes:</u>

Bold Font identifies constituent retained as a Constituent of Potential Ecological Concern (COPEC)

[b] - See discussion in text for rationale for eliminating as a COPEC

COPEC - Constituent of Potential Ecological Concern

FOD - Frequency of Detection

RB - Refinement Benchmark (see Table 4.4 for RB sources)

RQ - Refinement Quotient

UCL - Upper Confidence Limit

TABLE 6.9

REFINEMENT - MAMMALIAN RECEPTORS (DEER MOUSE-RODENT OMNIVORE)
SAN JUAN 28-6 #155N, S28, T27N, R6W
ECOLOGICAL RISK ASSESSMENT
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO

Constituent	Units	Refinement Benchmark (RB)	No. Samples	No. Detects	FOD	Max. Conc.	RQ (Max. Conc.)	95% UCL	RQ (95% UCL)	No. Samples > RB	% Samples > RB	Retained as COPEC	Rationale
0-5 ft bgs													
BTEX													
Benzene	mg/kg	240	16	3	19%	7.6	0.03	1.513	0.01	0	0%	No	RQ < 1
Ethylbenzene	mg/kg	n/a	16	6	38%	27	n/c	5.719	n/c	n/a	n/a	No	b
Xylene	mg/kg	19.1	16	6	38%	270	14.14	70.1	3.7	3	19%	No	b
0-10 ft bgs													
BTEX													
Benzene	mg/kg	240	20	3	15%	7.6	0.03	1.21	0.01	0	0%	No	RQ < 1
Ethylbenzene	mg/kg	n/a	20	7	35%	27	n/c	10.87	n/c	n/a	n/a	Yes	b
Xylene	mg/kg	19.1	20	11	55%	270	14.14	99.67	5.2	3	15%	No	b

Notes:

Bold Font identifies constituent retained as a Constituent of Potential Ecological Concern (COPEC)

[b] - See discussion in text for rationale for eliminating as a COPEC

COPEC - Constituent of Potential Ecological Concern

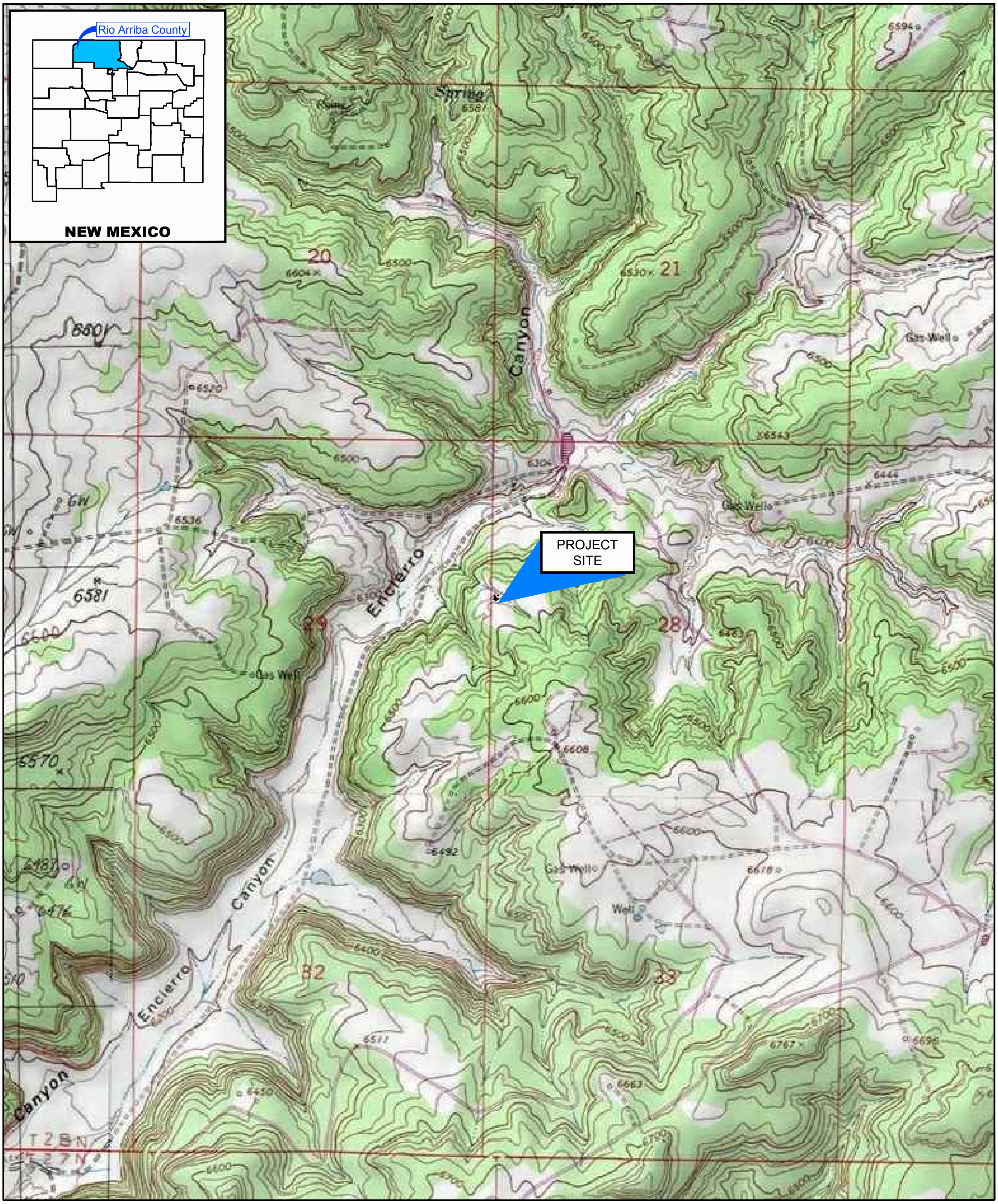
FOD - Frequency of Detection

RB - Refinement Benchmark (see Table 4.4 for RB sources)

RQ - Refinement Quotient

UCL - Upper Confidence Limit

Appendix F - Figures



Source: USGS 7.5 Minute Quad "Fourmile Canyon, Santos Peak, Gould Pass, and Delgadito Mesa, New Mexico"

Lat/Long: 36.63291° North, 107.48120° West

0 1000 2000ft

Coordinate System:
NAD 1983 (2011) StatePlane-
New Mexico Central (US Feet)

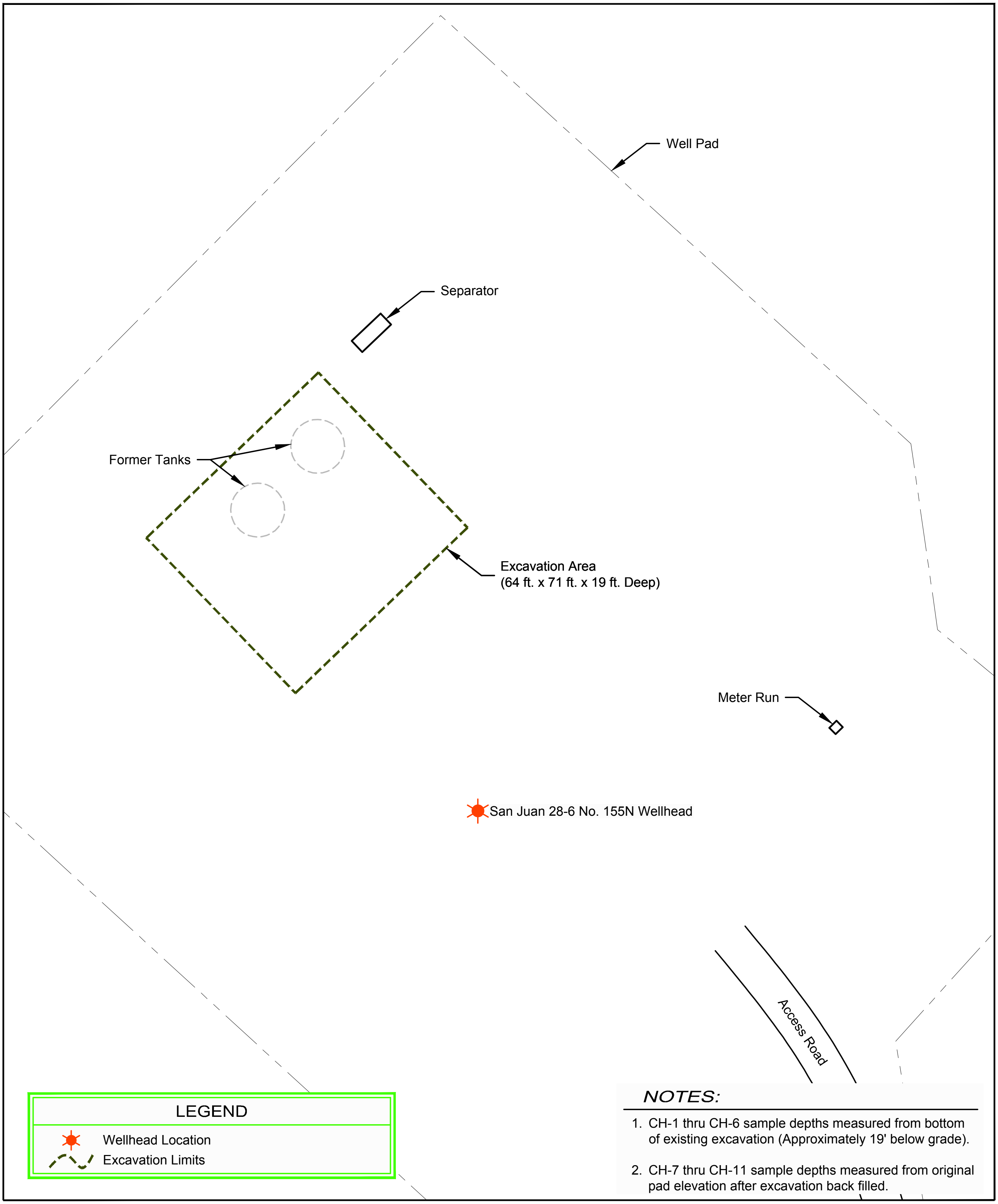
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO
SAN JUAN 28-6 No. 155N

11119528-2ASO1
Aug 12, 2016

SITE LOCATION MAP

FIGURE 1.1

CAD File: I:\CAD\Files\Eight Digit Job Numbers\1111----\11119528-CoP-San Juan 28-6 Unit 155N\11119528-00\11119528-2ASO1(001)_HHRA_Eco\11119528-2ASO1(001)GN-DL001.dwg



NOTES:

1. CH-1 thru CH-6 sample depths measured from bottom of existing excavation (Approximately 19' below grade).
2. CH-7 thru CH-11 sample depths measured from original pad elevation after excavation back filled.

Lat/Long: 36.63291° North, 107.48120° West

0 20 40ft

Coordinate System:
NAD 1983 (2011) StatePlane-
New Mexico Central (US Feet)

CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO
SAN JUAN 28-6 No. 155N

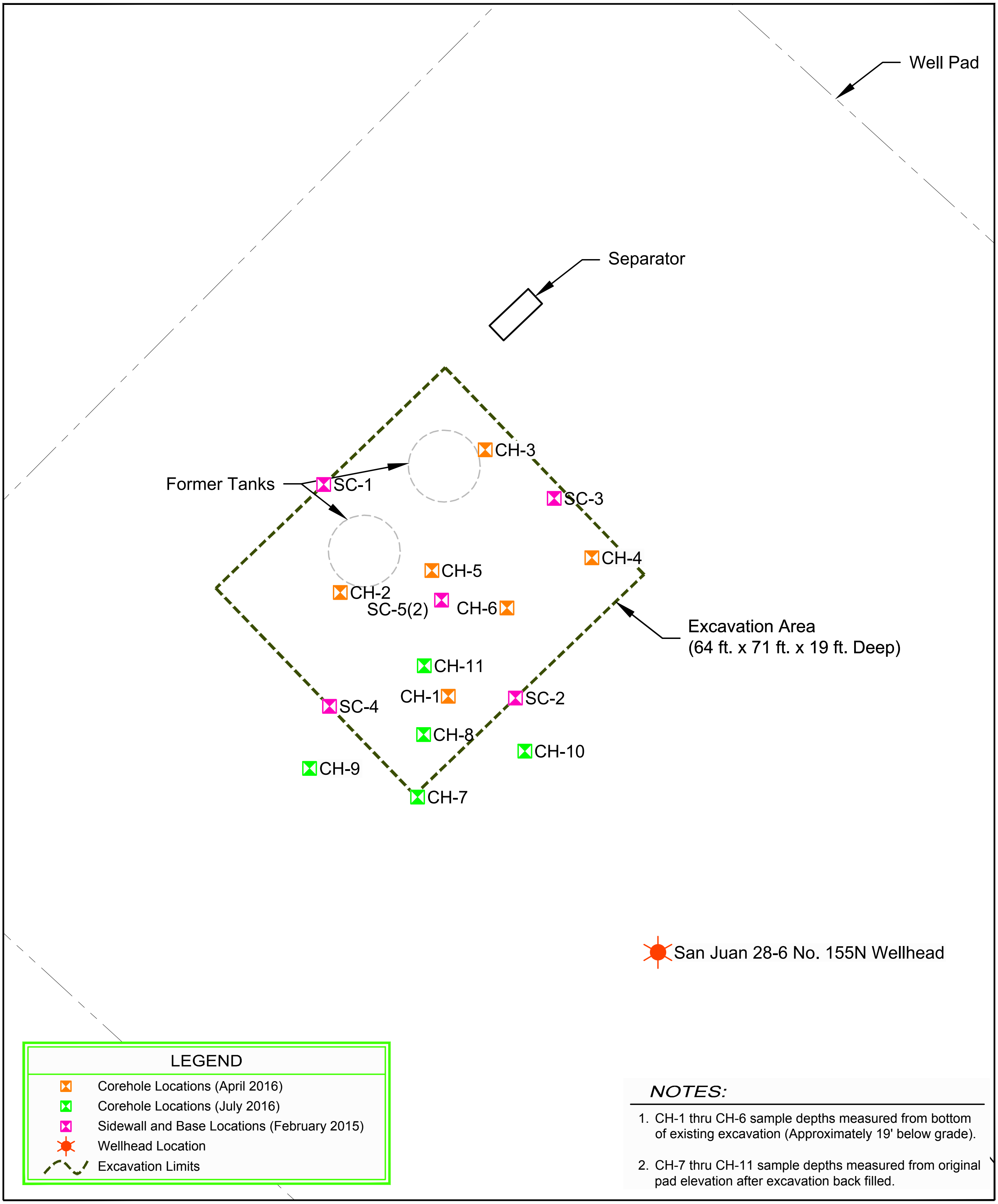
11119528-2ASO1

Aug 12, 2016

SITE PLAN

FIGURE 1.2

CAD File: I:\CAD\Files\Eight Digit Job Numbers\1111----\11119528-CoP-San Juan 28-6 Unit 155N\11119528-00\11119528-2ASO1(001)_HHRA_Eco\11119528-2ASO1(001)GN-DL001.dwg



LEGEND

🟧	Corehole Locations (April 2016)
🟩	Corehole Locations (July 2016)
🟪	Sidewall and Base Locations (February 2015)
✹	Wellhead Location
⌇	Excavation Limits

NOTES:

1. CH-1 thru CH-6 sample depths measured from bottom of existing excavation (Approximately 19' below grade).
2. CH-7 thru CH-11 sample depths measured from original pad elevation after excavation back filled.

Lat/Long: 36.63291° North, 107.48120° West

0 10 30ft

Coordinate System:
NAD 1983 (2011) StatePlane-
New Mexico Central (US Feet)

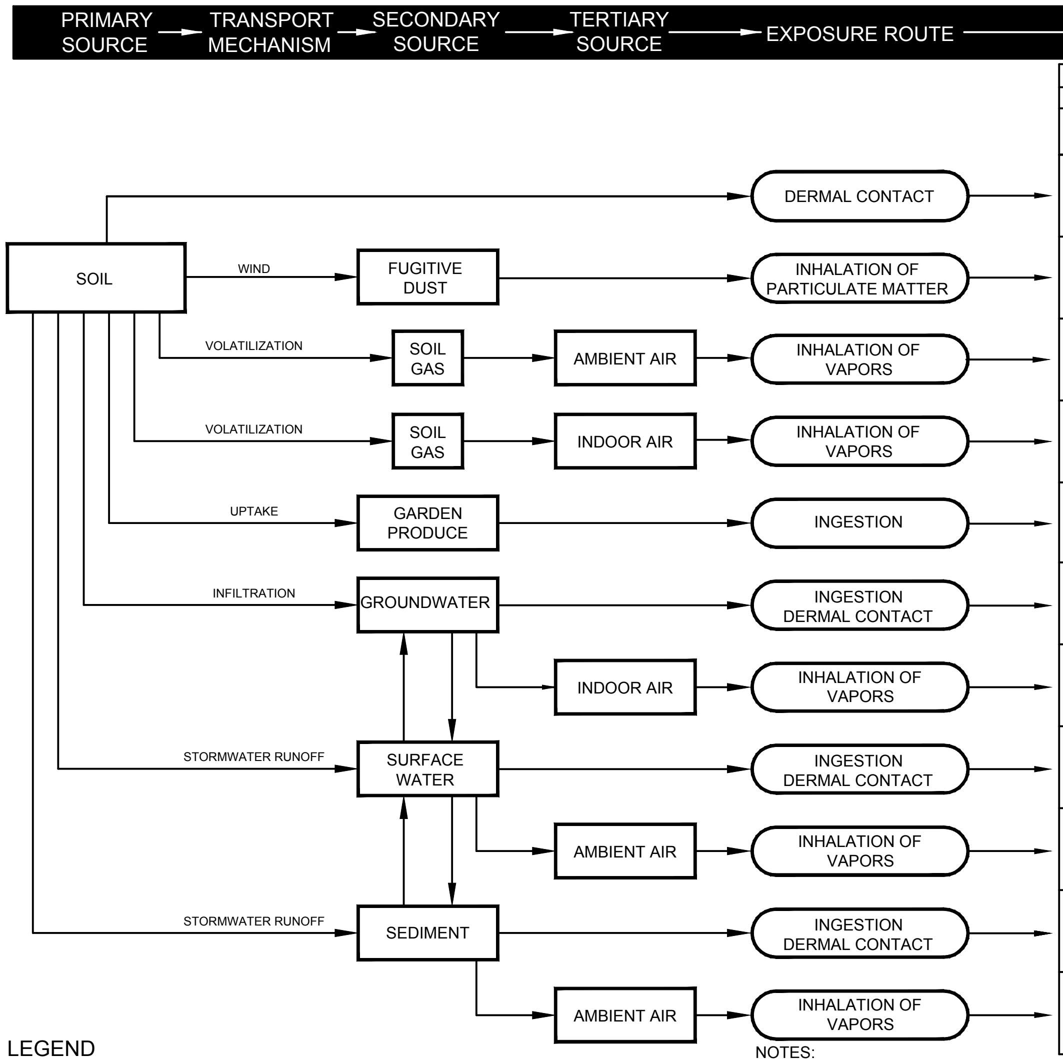
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO
SAN JUAN 28-6 No. 155N

11119528-2ASO1
Aug 12, 2016

SAMPLE LOCATIONS

FIGURE 2.1

CAD File: I:\CAD\Files\Eight Digit Job Numbers\1111----\11119528-CoP-San Juan 28-6 Unit 155N\11119528-00\11119528-2ASO1(001)_HHRA_Eco\11119528-2ASO1(001)GN-DL002_BTEX.dwg



	POTENTIALLY-EXPOSED CURRENT OR FUTURE RECEPTORS				
	155N SITE				
	INDOOR WORKER	OUTDOOR WORKER	CONSTRUCTION / UTILITY WORKER	TRESPASSER	RESIDENT
DERMAL CONTACT	–	● (1)	● (1)	● (1)	● (1)
INHALATION OF PARTICULATE MATTER	● (1)	● (1)	● (1)	● (1)	● (1)
INHALATION OF VAPORS	● (2)	● (2)	● (2)	● (2)	● (2)
INHALATION OF VAPORS	● (2)	–	–	–	● (2)
INGESTION	–	–	–	–	● (2)
INGESTION DERMAL CONTACT	● (2)	● (2)	● (2)	● (2)	● (2)
INHALATION OF VAPORS	● (2)	–	–	–	● (2)
INGESTION DERMAL CONTACT	–	● (3)	● (3)	● (3)	● (3)
INHALATION OF VAPORS	● (3)	● (3)	● (3)	● (3)	● (3)
INGESTION DERMAL CONTACT	–	● (3)	● (3)	● (3)	● (3)
INHALATION OF VAPORS	● (3)	● (3)	● (3)	● (3)	● (3)

LEGEND

● POTENTIALLY-COMPLETE EXPOSURE PATHWAY CONSIDERED IN HHRA

– INCOMPLETE EXPOSURE PATHWAY

NOTES:

1. (1) BASED ON THE IDENTIFIED CHEMICALS OF POTENTIAL CONCERN.
2. (2) PATHWAY CONSIDERED POTENTIALLY COMPLETE AS A CONSERVATIVE APPROACH.
3. (3) PATHWAY CONSIDERED OCCASIONALLY COMPLETE DUE TO SPORADIC WET EVENTS AS A CONSERVATIVE APPROACH.

ConocoPhillips

GHD

CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO
SAN JUAN 28-6 No. 155N

11119528-00
Aug 18, 2016

CONCEPTUAL SITE MODEL

FIGURE 5.1

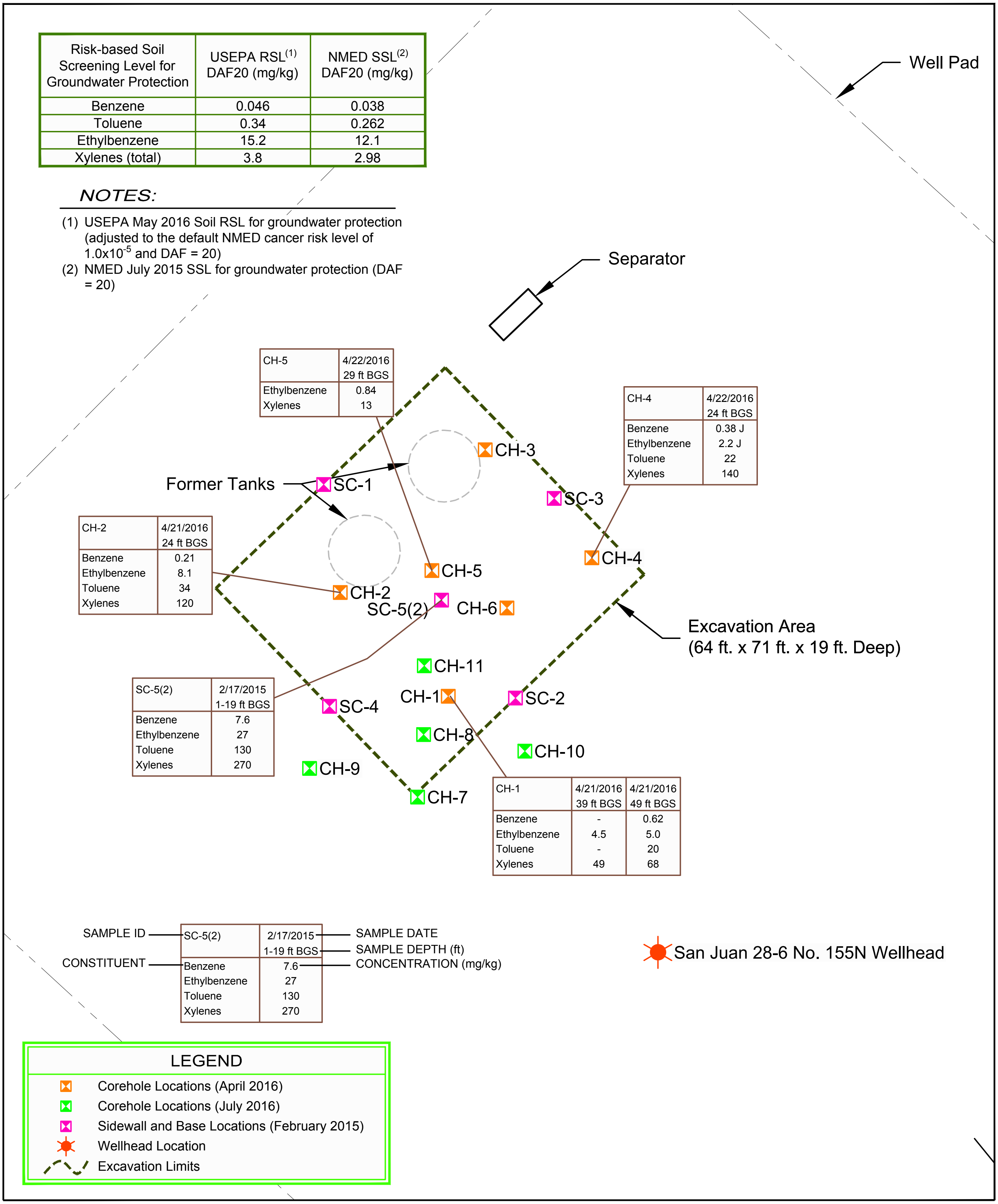
CAD File: I:\CAD\Files\Eight Digit Job Numbers\1111----\11119528-CoP-San Juan 28-6 Unit 155N\11119528-00\11119528-00(002)\11119528-00(002)GN-DL001.dwg

Risk-based Soil Screening Level for Groundwater Protection	USEPA RSL$^{(1)}$ DAF20 (mg/kg)	NMED SSL$^{(2)}$ DAF20 (mg/kg)
Benzene	0.046	0.038
Toluene	0.34	0.262
Ethylbenzene	15.2	12.1
Xylenes (total)	3.8	2.98

NOTES:

(1) USEPA May 2016 Soil RSL for groundwater protection (adjusted to the default NMED cancer risk level of 1.0×10^{-5} and DAF = 20)

(2) NMED July 2015 SSL for groundwater protection (DAF = 20)



CH-5	4/22/2016 29 ft BGS
Ethylbenzene	0.84
Xylenes	13

CH-4	4/22/2016 24 ft BGS
Benzene	0.38 J
Ethylbenzene	2.2 J
Toluene	22
Xylenes	140

CH-2	4/21/2016 24 ft BGS
Benzene	0.21
Ethylbenzene	8.1
Toluene	34
Xylenes	120

SC-5(2)	2/17/2015 1-19 ft BGS
Benzene	7.6
Ethylbenzene	27
Toluene	130
Xylenes	270

CH-1	4/21/2016 39 ft BGS	4/21/2016 49 ft BGS
Benzene	-	0.62
Ethylbenzene	4.5	5.0
Toluene	-	20
Xylenes	49	68

SC-5(2)	2/17/2015 1-19 ft BGS
Benzene	7.6
Ethylbenzene	27
Toluene	130
Xylenes	270

LEGEND

☒	Corehole Locations (April 2016)
☒	Corehole Locations (July 2016)
☒	Sidewall and Base Locations (February 2015)
✹	Wellhead Location
╌	Excavation Limits

Lat/Long: 36.63291° North, 107.48120° West

0 10 30ft

Coordinate System:
NAD 1983 (2011) StatePlane-
New Mexico Central (US Feet)

N

CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO
SAN JUAN 28-6 No. 155N

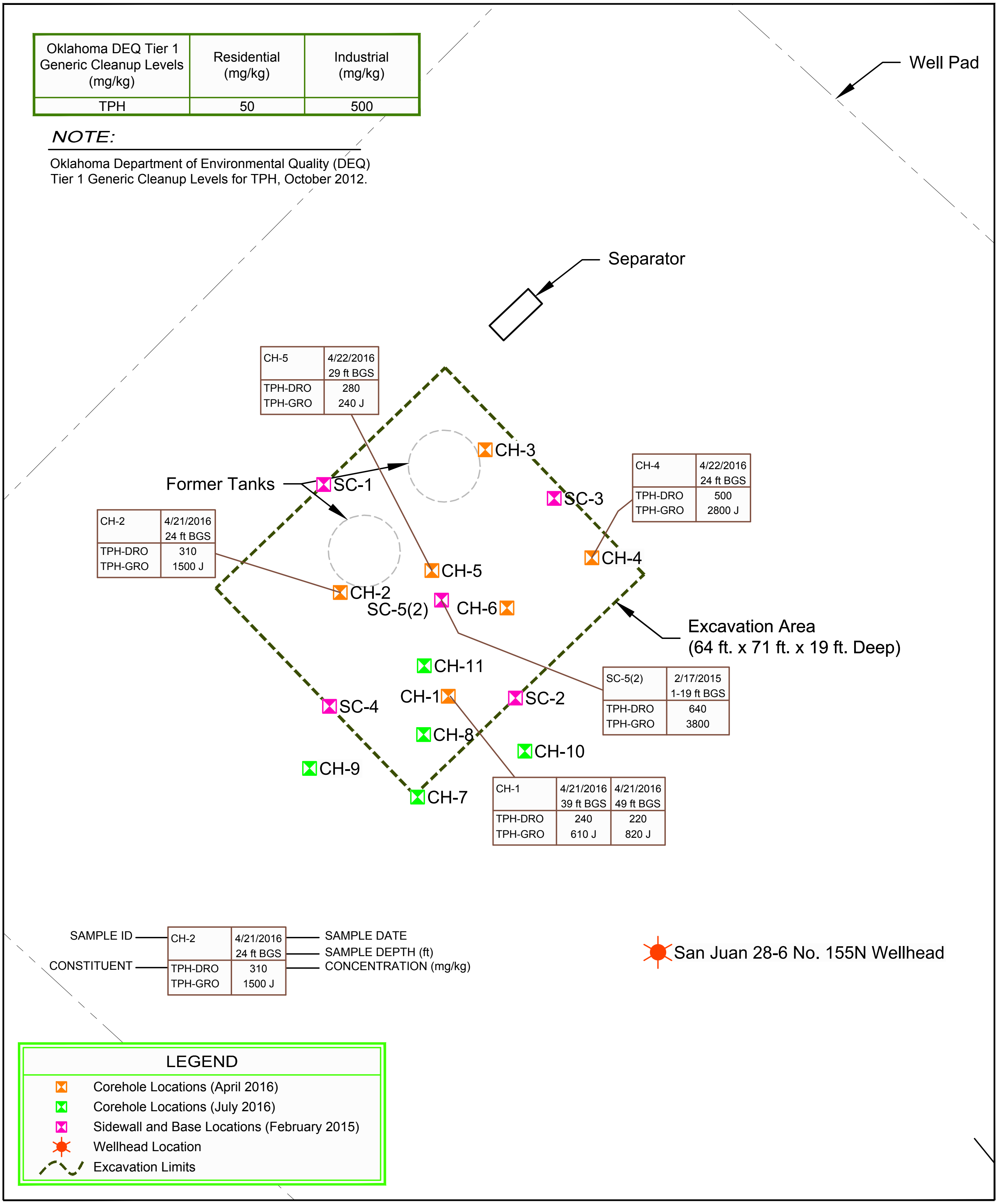
BTEX EXCEEDANCES OF SOIL SCREENING LEVELS

11119528-2ASO1

Aug 18, 2016

FIGURE 5.2

CAD File: I:\CAD\Files\Eight Digit Job Numbers\1111----\11119528-CoP-San Juan 28-6 Unit 155N\11119528-00\11119528-2ASO1(001)_HHRA_Eco\11119528-2ASO1(001)GN-DL002_BTEX.dwg



Oklahoma DEQ Tier 1 Generic Cleanup Levels (mg/kg)	Residential (mg/kg)	Industrial (mg/kg)
TPH	50	500

NOTE:

Oklahoma Department of Environmental Quality (DEQ)
Tier 1 Generic Cleanup Levels for TPH, October 2012.

Lat/Long: 36.63291° North, 107.48120° West

0 10 30ft

Coordinate System:
NAD 1983 (2011) StatePlane-
New Mexico Central (US Feet)

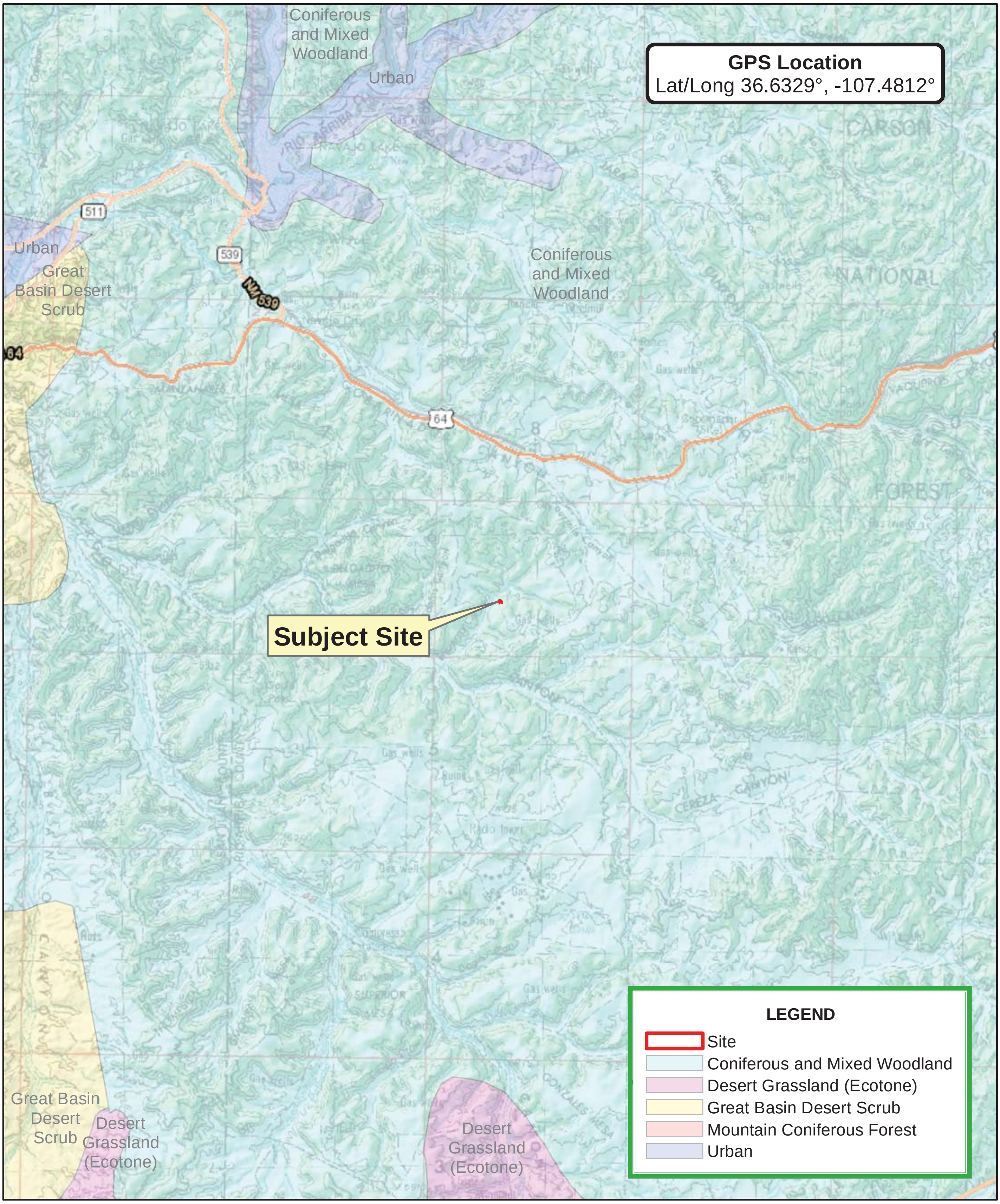
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO
SAN JUAN 28-6 No. 155N

TPH EXCEEDANCES OF SOIL
SCREENING LEVELS

11119528-2ASO1
Aug 12, 2016

FIGURE 5.3

CAD File: I:\CAD\Files\Eight Digit Job Numbers\1111----\11119528-CoP-San Juan 28-6 Unit 155N\11119528-00\11119528-2ASO1(001)_HHRA_Eco\11119528-2ASO1(001)GN-DL003_TPH.dwg



Source: Earth Data Analysis Center, University of New Mexico

Coordinate System:
NAD 1983 2011 StatePlane New
Mexico Central FIPS 3002 Ft US

GHD

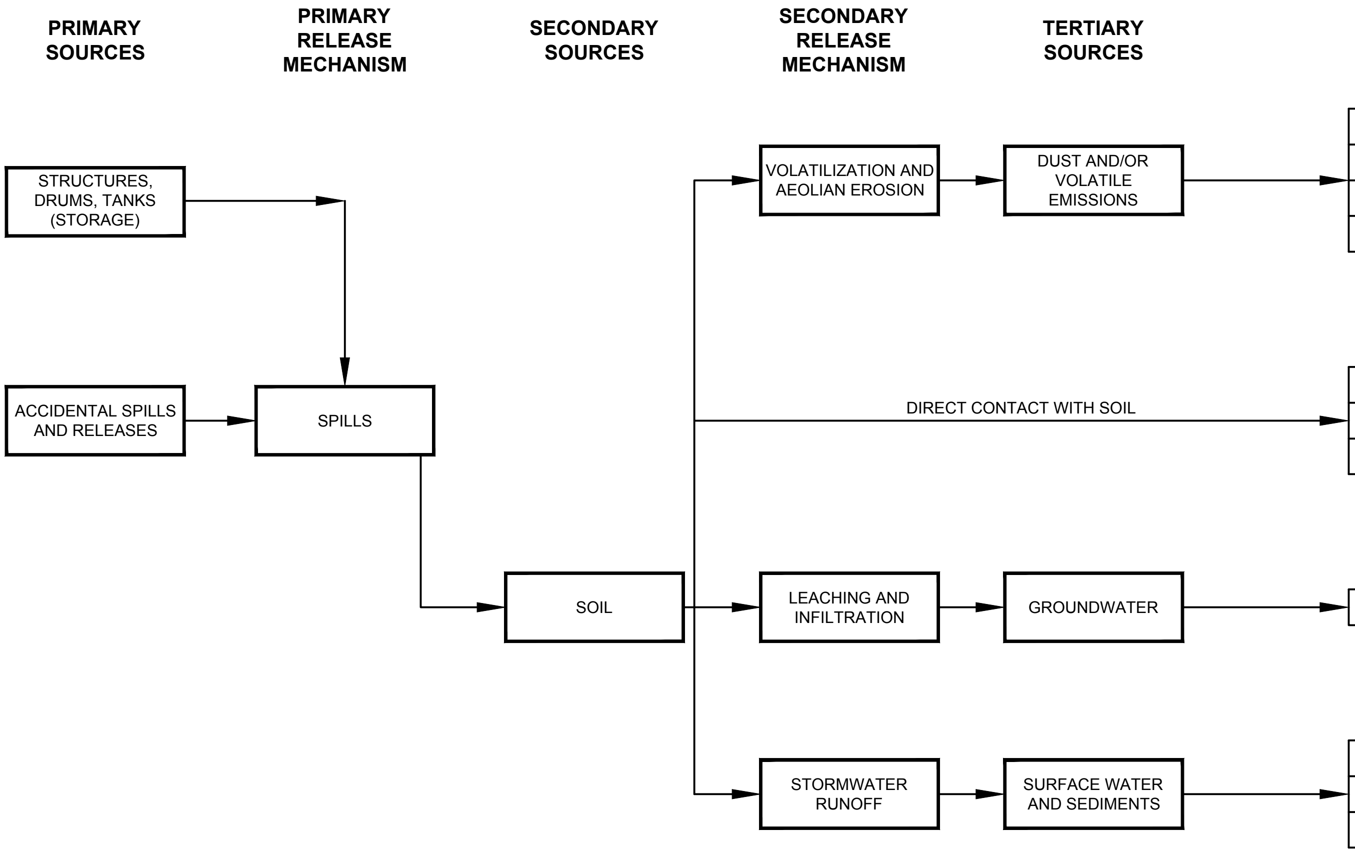
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO
SAN JUAN 28-6 NO. 155N

GENERAL VEGETATION
CLASSIFICATION MAP

11119528-00
Aug 11, 2016

FIGURE 6.1

GIS File: I:\GIS\Projects\8 digits\1111----\11119528-CoP_San Juan\11119528-00(001)_HHRA ECO\11119528-00(001)GIS-DL001_Veg.mxd



	RECEPTOR			
	TERRESTRIAL		AQUATIC	
EXPOSURE ROUTE	FLORA	FAUNA	FLORA	FAUNA
INGESTION	–	●	–	–
INHALATION	–	–	–	–
DIRECT CONTACT	●	●	–	–

INGESTION	–	●	–	–
DIRECT CONTACT	●	●	–	–
ROOT CONTACT	●	–	–	–

ROOT CONTACT	●	–	–	–

INGESTION	–	●	–	●
ROOT CONTACT	●	–	●	–
DIRECT CONTACT	●	●	●	●

LEGEND

● POTENTIALLY-COMPLETE EXPOSURE PATHWAY CONSIDERED IN HHRA

– INCOMPLETE EXPOSURE PATHWAY

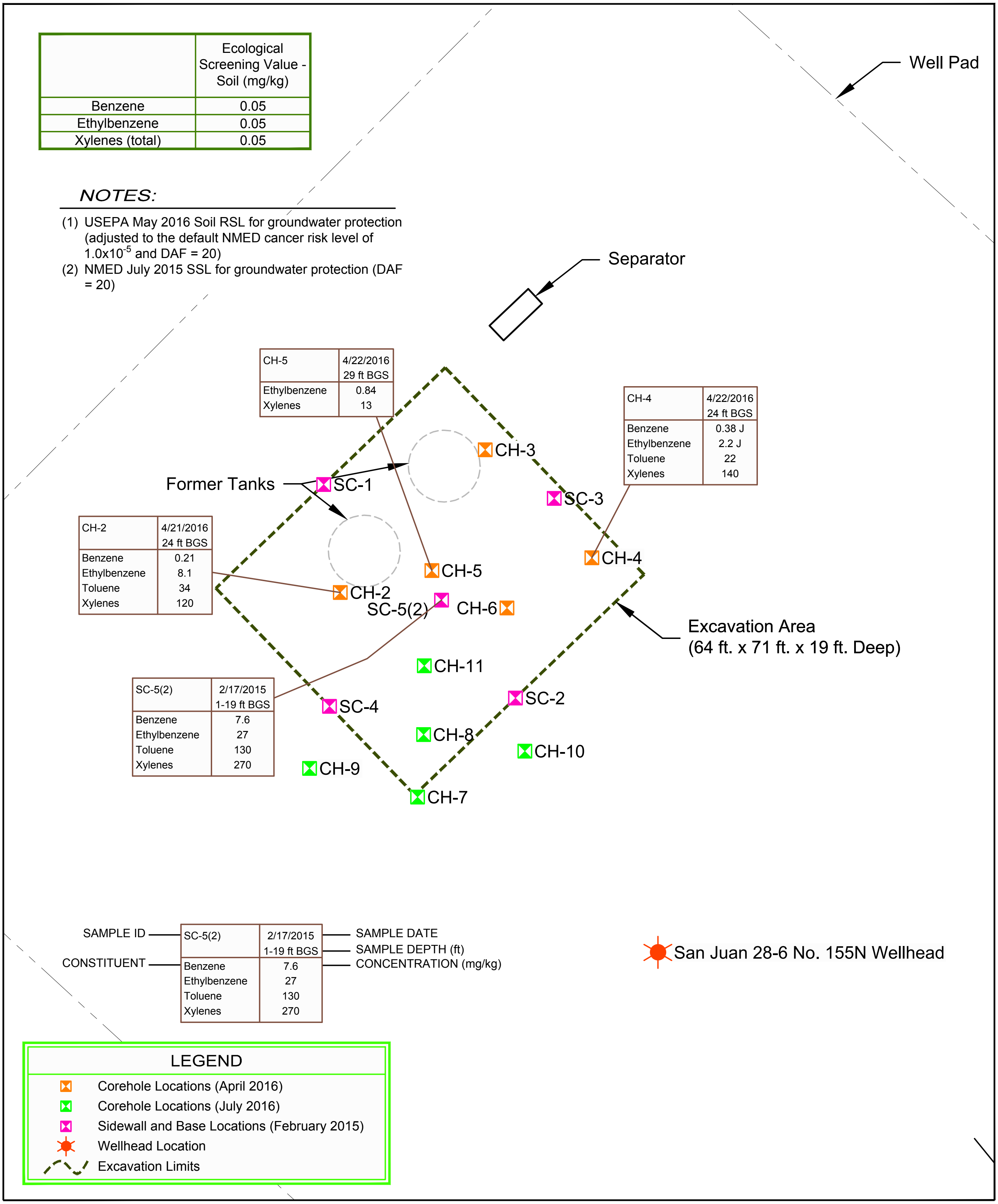
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO
SAN JUAN 28-6 No. 155N

CONCEPTUAL SITE MODEL FOR ECOLOGICAL RECEPTORS

11119528-00
Aug 18, 2016

FIGURE 6.2

CAD File: I:\CAD\Files\Eight Digit Job Numbers\1111----\11119528-CoP-San Juan 28-6 Unit 155N\11119528-00\11119528-00(002)\11119528-00(002)GN-DL001.dwg



	Ecological Screening Value - Soil (mg/kg)
Benzene	0.05
Ethylbenzene	0.05
Xylenes (total)	0.05

NOTES:

(1) USEPA May 2016 Soil RSL for groundwater protection (adjusted to the default NMED cancer risk level of 1.0×10^{-5} and DAF = 20)

(2) NMED July 2015 SSL for groundwater protection (DAF = 20)

CH-5	4/22/2016 29 ft BGS
Ethylbenzene	0.84
Xylenes	13

CH-4	4/22/2016 24 ft BGS
Benzene	0.38 J
Ethylbenzene	2.2 J
Toluene	22
Xylenes	140

CH-2	4/21/2016 24 ft BGS
Benzene	0.21
Ethylbenzene	8.1
Toluene	34
Xylenes	120

SC-5(2)	2/17/2015 1-19 ft BGS
Benzene	7.6
Ethylbenzene	27
Toluene	130
Xylenes	270

SAMPLE ID — SC-5(2) — 2/17/2015 — SAMPLE DATE

1-19 ft BGS — SAMPLE DEPTH (ft)

CONSTITUENT — Benzene — 7.6 — CONCENTRATION (mg/kg)

SC-5(2)	2/17/2015 1-19 ft BGS
Benzene	7.6
Ethylbenzene	27
Toluene	130
Xylenes	270

LEGEND

🟧	Corehole Locations (April 2016)
🟩	Corehole Locations (July 2016)
🟪	Sidewall and Base Locations (February 2015)
✹	Wellhead Location
⁓	Excavation Limits

Lat/Long: 36.63291° North, 107.48120° West

0 10 30ft

Coordinate System:
NAD 1983 (2011) StatePlane-
New Mexico Central (US Feet)

N

GHD

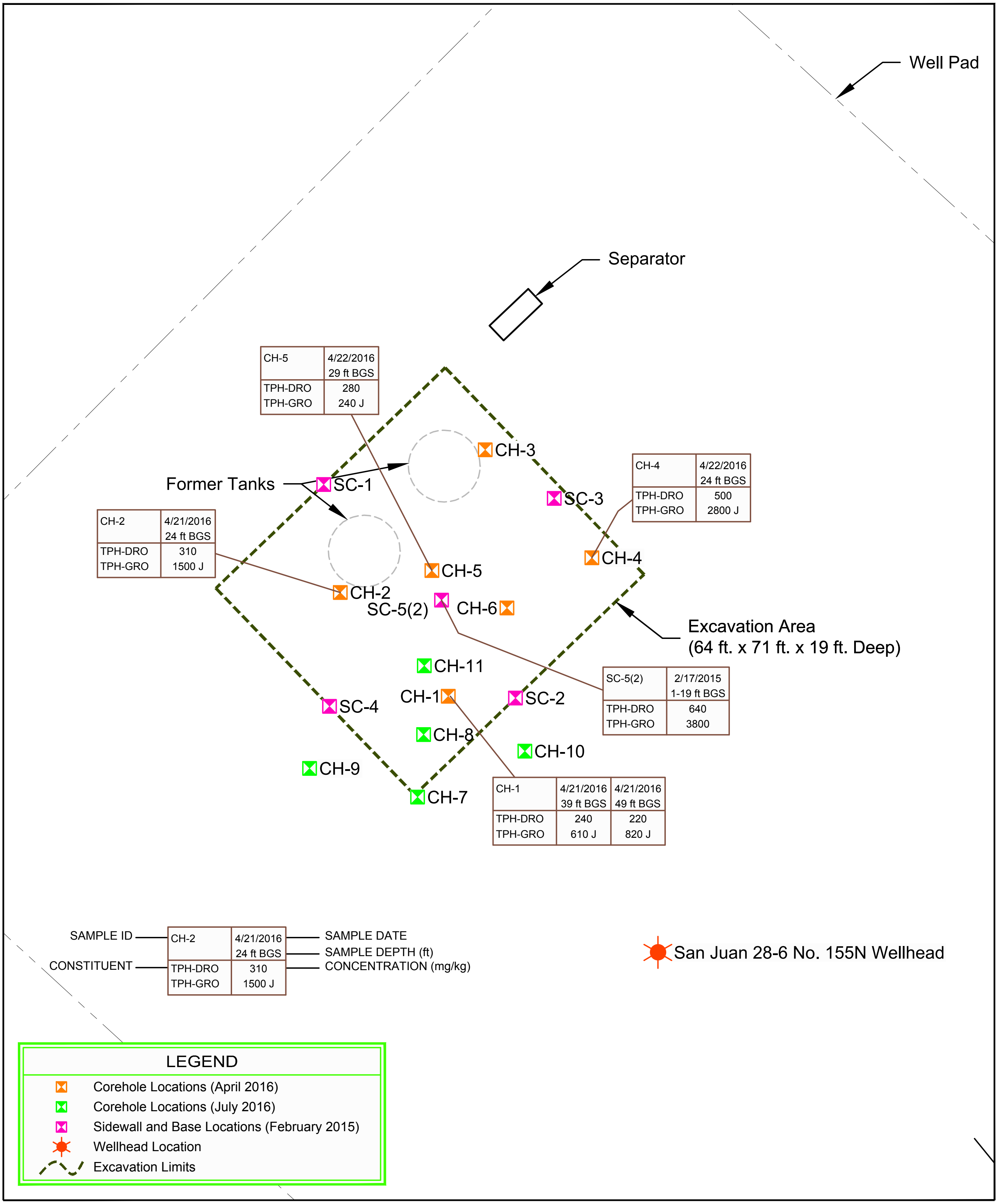
CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO
SAN JUAN 28-6 No. 155N

BTEX EXCEEDANCES OF SOIL SCREENING LEVELS

11119528-2ASO1
Aug 18, 2016

FIGURE 6.3

CAD File: I:\CAD\Files\Eight Digit Job Numbers\1111----\11119528-CoP-San Juan 28-6 Unit 155N\11119528-00\11119528-2ASO1(001)_HHRA_Eco\11119528-2ASO1(001)GN-DL004_BTEX_Eco.dwg



Lat/Long: 36.63291° North, 107.48120° West

0 10 30ft

Coordinate System:
NAD 1983 (2011) StatePlane-
New Mexico Central (US Feet)

CONOCOPHILLIPS COMPANY
RIO ARRIBA COUNTY, NEW MEXICO
SAN JUAN 28-6 No. 155N

TPH CONCENTRATIONS IN SOIL

11119528-2ASO1
Aug 12, 2016

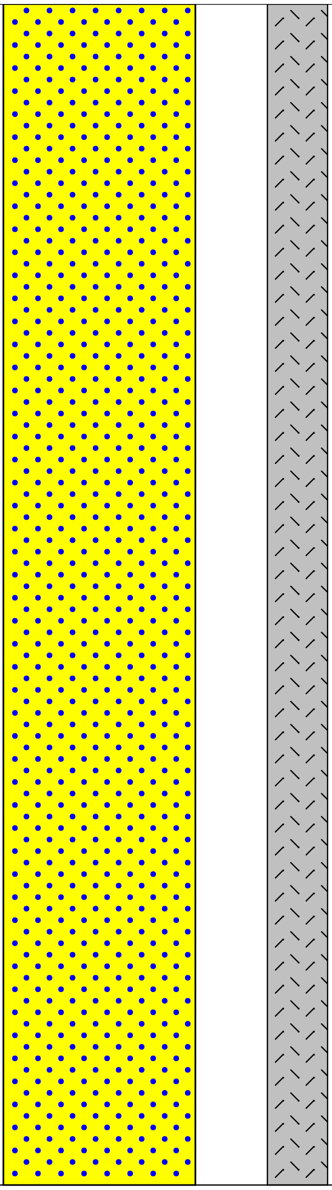
FIGURE 6.4

CAD File: I:\CAD\Files\Eight Digit Job Numbers\1111----\11119528-CoP-San Juan 28-6 Unit 155N\11119528-00\11119528-2ASO1(001)_HHRA_Eco\11119528-2ASO1(001)GN-DL003_TPH.dwg

Appendix G – Logs for Borings CH-1 through CH-6

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba County, New Mexico
FIELD LOGGED BY: Cale Kanack
SURFACE ELEVATION (msl): Unavailable
GROUNDWATER ELEVATION (msl): N/A
REMARKS: * Depths measured from bottom of existing excavation (approximately 19' below grade)
COORDINATES: Unavailable

SOIL BORING NO: CH-1
DRILL TYPE: Air Rotary
CME-850
BORE HOLE DIAMETER: 6"
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 4-21-16 / 1030
DATE/TIME HOLE COMPLETED: 4-22-16 / 1600



DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
0					Sandstone: Light brown, fine grained, well cemented			
					Fine to medium grained			
-5								
					Very fine grained			
-10								
-15					Fine to medium grained, moderately cemented Color change to lighter brown			
-20	X	CH-1-20'					64.5	850
					Fine grained, well cemented			
-25					Fine to medium grained			
-30	X	CH-1-30'					93.62	1040
-35					12" lense clay w/sand			
-40	X	CH-1-40'					<0.212	<62.3

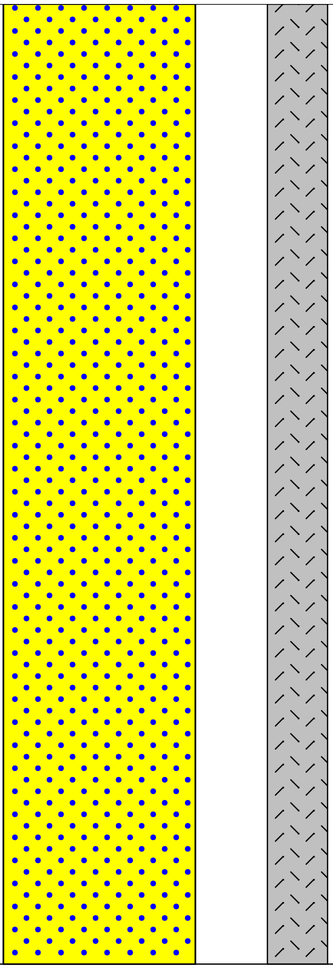
TD = 40 feet *

Services Inc.

BORING LOG AND WELL COMPLETION FORM

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba County, New Mexico
FIELD LOGGED BY: Cale Kanack
SURFACE ELEVATION (msl): Unavailable
GROUNDWATER ELEVATION (msl): N/A
REMARKS: * Depths measured from bottom of existing excavation (approximately 19' below grade)
COORDINATES: Unavailable

SOIL BORING NO: CH-2
DRILL TYPE: Air Rotary
CME-850
BORE HOLE DIAMETER: 6"
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 4-21-16 / 1630
DATE/TIME HOLE COMPLETED: 4-21-16 / 1815



DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
0					Sandstone: Light brown, fine grained, very well cemented			
-5	X	CH-2-5'					162.31	1810
-10								
					Light brown/tan, very fine grained, well cemented			
-15	X	CH-2-15'					<0.207	15

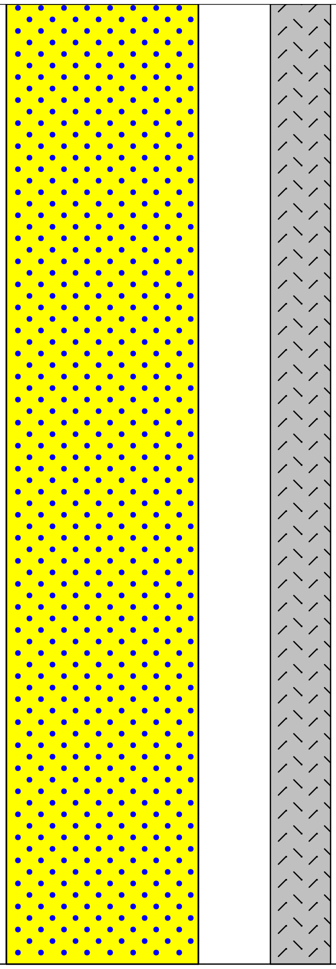
TD = 15 feet *

Services Inc.

BORING LOG AND
WELL COMPLETION FORM

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba County, New Mexico
FIELD LOGGED BY: Cale Kanack
SURFACE ELEVATION (msl): Unavailable
GROUNDWATER ELEVATION (msl): N/A
REMARKS: * Depths measured from bottom of existing excavation (approximately 19' below grade)
COORDINATES: Unavailable

SOIL BORING NO: CH-3
DRILL TYPE: Air Rotary
CME-850
BORE HOLE DIAMETER: 6"
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 4-22-16 / 0845
DATE/TIME HOLE COMPLETED: 4-22-16 / 0945



DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
0					Sandstone: Light brown/tan, very fine grained, very well cemented			
-5	X	CH-3-5'					<0.219	<62.5
					Light brown, fine to medium grained, moderately cemented			
	X	CH-3-10'					<0.220	<63.7
-10								

TD = 10 feet *

GHD Services Inc.

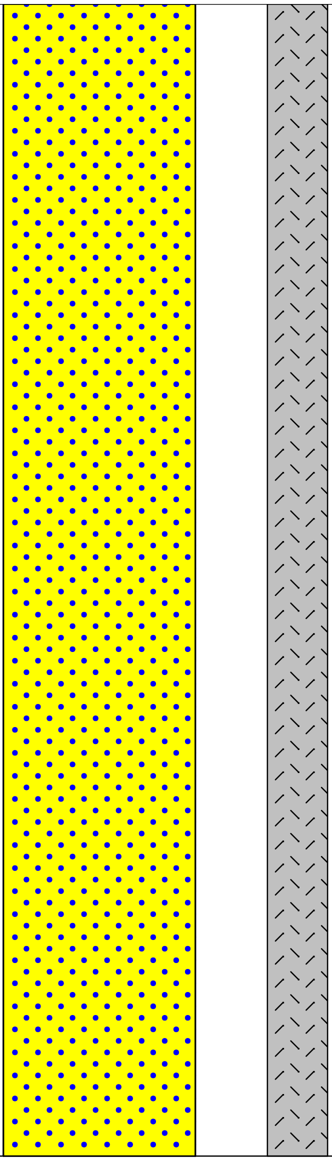
BORING LOG AND WELL COMPLETION FORM

page 1 of 1

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba County, New Mexico
FIELD LOGGED BY: Cale Kanack
SURFACE ELEVATION (msl): Unavailable
GROUNDWATER ELEVATION (msl): N/A
REMARKS: * Depths measured from bottom of existing excavation (approximately 19' below grade)
COORDINATES: Unavailable

SOIL BORING NO: CH-4
DRILL TYPE: Air Rotary
CME-850
BORE HOLE DIAMETER: 6"
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 4-22-16 / 1005
DATE/TIME HOLE COMPLETED: 4-22-16 / 1115

DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
0					Sandstone: Light brown/tan, very fine grained, very well cemented			
-5	X	CH-4-5'					164.58	3300
					Brown, fine to medium grained, very well cemented			
-10								
-15	X	CH-4-15'					<0.225	<61.4



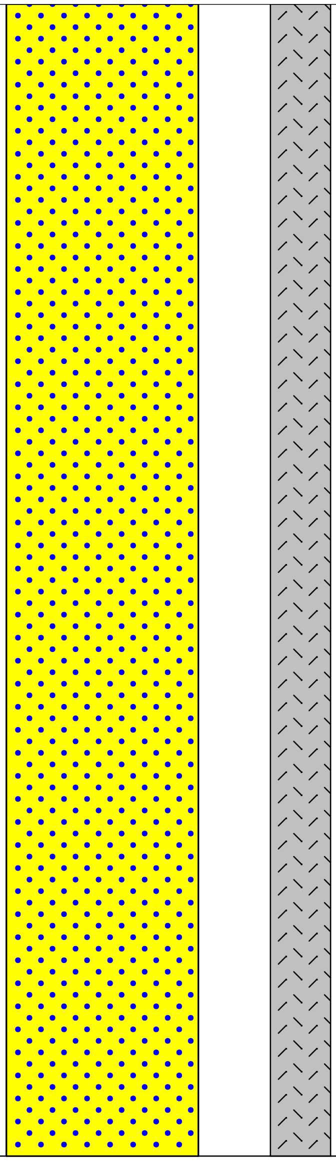
TD = 15 feet *

GHD Services Inc.

BORING LOG AND WELL COMPLETION FORM

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba County, New Mexico
FIELD LOGGED BY: Cale Kanack
SURFACE ELEVATION (msl): Unavailable
GROUNDWATER ELEVATION (msl): N/A
REMARKS: * Depths measured from bottom of existing excavation (approximately 19' below grade)
COORDINATES: Unavailable

SOIL BORING NO: CH-5
DRILL TYPE: Air Rotary
CME-850
BORE HOLE DIAMETER: 6"
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 4-22-16 / 1135
DATE/TIME HOLE COMPLETED: 4-22-16 / 1330



DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
0					Sandstone: Light brown, fine grained, well cemented			
-5								
					Fine to medium grained, moderately well cemented			
-10	X	CH-5-10'			Well cemented		14.3	520
	X	CH-5-15'					<0.22	15
-15								

TD = 15 feet *

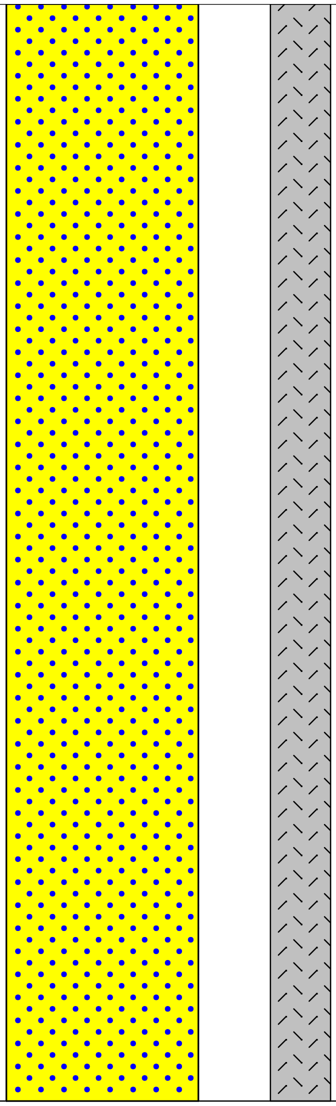
GHD Services Inc.

BORING LOG AND WELL COMPLETION FORM

page 1 of 1

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba County, New Mexico
FIELD LOGGED BY: Cale Kanack
SURFACE ELEVATION (msl): Unavailable
GROUNDWATER ELEVATION (msl): N/A
REMARKS: * Depths measured from bottom of existing excavation (approximately 19' below grade)
COORDINATES: Unavailable

SOIL BORING NO: CH-6
DRILL TYPE: Air Rotary
CME-850
BORE HOLE DIAMETER: 6"
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 4-22-16 / 1420
DATE/TIME HOLE COMPLETED: 4-22-16 / 1530



DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
0					Sandstone: Light brown, fine to medium grained, well cemented			
-5	X	CH-6-5'					0.53	<60
					Medium grained			
-10	X	CH-6-10'					<0.212	<61.1

TD = 10 feet *

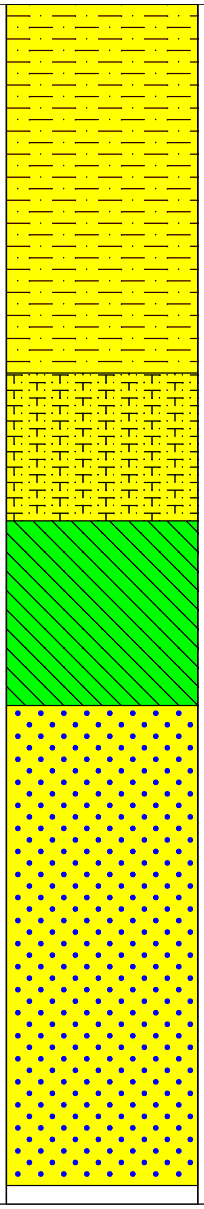
GHD Services Inc.

BORING LOG AND WELL COMPLETION FORM

Appendix H – Logs for Borings B-7 through B-11

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba, New Mexico
FIELD LOGGED BY: Jeff Walker
SURFACE ELEVATION (msl):
GROUNDWATER ELEVATION (msl): N/A
REMARKS:
COORDINATES: 36.63294, -107.48142

SOIL BORING NO: CH-7
DRILL TYPE: Stratex/Air Rotary
CME-85
BORE HOLE DIAMETER:
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 6/28/2016
DATE/TIME HOLE COMPLETED: 7/6/2016 at 0800



DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
0					Silt: some fine sand, brown, slightly moist to wet, medium dense, no odor			
-5								
					slightly sandier, Ca Carb/Sulf staining, trace clay, moist			
-10					Silty Sand: fine grained, brown, moist, no odor	0		
-15					Clay: firm, mottled gray/white/greenish yellow shale texture, moist	1.1		
-20					Sandstone: yellow brown, light to moderate cemented, fine grained, slight odor	1.1		
-25					competent-well cemented	1.7		
					no odor, minor iron banding			
-30						0		
	X	CH7-32						

TD = 32 feet bgs

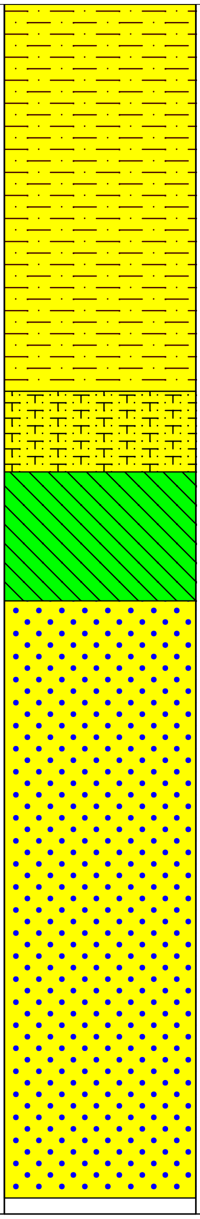
GHD Services Inc.

BORING LOG AND WELL COMPLETION FORM

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba, New Mexico
FIELD LOGGED BY: Jeff Walker
SURFACE ELEVATION (msl): No survey data available
GROUNDWATER ELEVATION (msl):
REMARKS:

COORDINATES: 36.63298, -107.48141

SOIL BORING NO: CH-8
DRILL TYPE: Stratex/Air Rotary
CME-85
BORE HOLE DIAMETER:
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 7/6/2016 at 930
DATE/TIME HOLE COMPLETED:

DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
0					Silt: trace sand/clay, fine sand, brown, dry, dense, no odor			
-5								
-10					Silty Sand: fine, some clay and sandstone gravel, brown, slightly moist, no odor			
-15					Clay: firm, brown, moist, no odor			
					gray, shale texture	0.3		
-20					Sandstone: light brown to yellow brown, fine grained, well cemented, slight odor			
						0.3		
-25					light brown-tan-rust, trace black specs, no odor	0.5		
-30								
-35					poor recovery, sandy interval but some competent core recovered			
	X	CH8-37					<0.0256	11.0

TD = 37 feet bgs

GHD Services Inc.

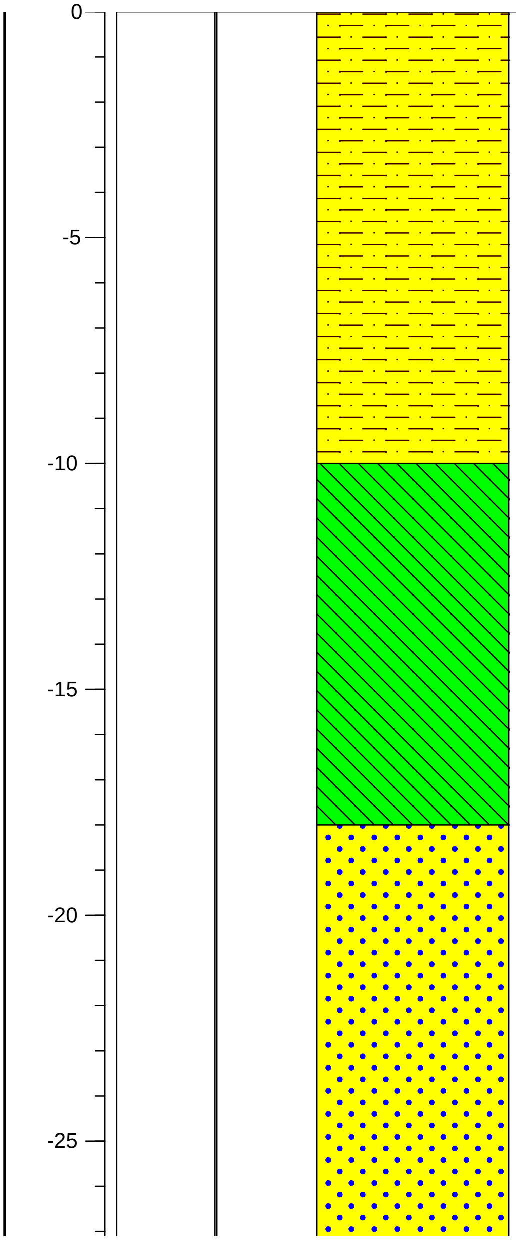
BORING LOG AND WELL COMPLETION FORM

page 1 of 1

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba, New Mexico
FIELD LOGGED BY: Jeff Walker
SURFACE ELEVATION (msl): No survey data available
GROUNDWATER ELEVATION (msl):
REMARKS:
COORDINATES: 36.63301, -107.48151

SOIL BORING NO: CH-9
DRILL TYPE: Stratex/ Air Rotary
CME-85
BORE HOLE DIAMETER:
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 7/6/2016 @ 1425
DATE/TIME HOLE COMPLETED: 7/16/2016 @ 1630

DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
					Silt: sandy, fine, brown to red brown, slightly moist to dry, no odor			
					some clay, slightly moist to moist			
					Clay: firm, brown, moist, no odor			
					grey to greenish, weathered shale texture, moist			
					Sandstone: light brown to yellow brown, fine, well cemented			
					50% recovery, well cemented, no odor	0.1		
					30% recovery			
					85% recovery, trace sand and gravel	0.6		



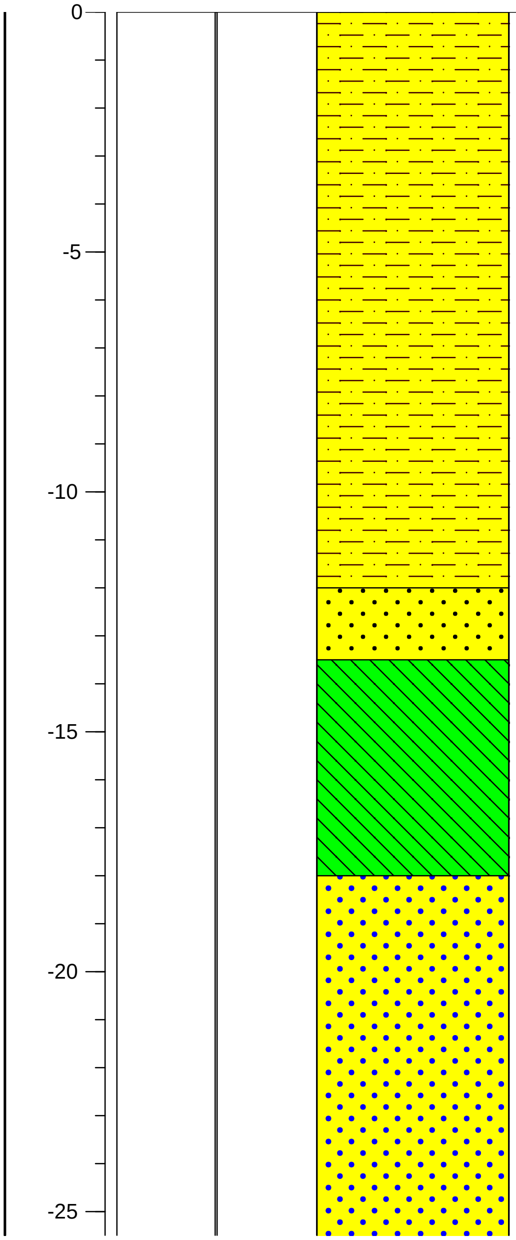
TD = 42.5 feet bgs

GHD Services Inc.

BORING LOG AND WELL COMPLETION FORM

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba, New Mexico
FIELD LOGGED BY: Jeff Walker
SURFACE ELEVATION (msl): No survey data available
GROUNDWATER ELEVATION (msl):
REMARKS:
COORDINATES: 36.63297, -107.48130

SOIL BORING NO: CH-10
DRILL TYPE: Stratex/Air Rotary
CME-85
BORE HOLE DIAMETER:
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 7/7/2016 @ 0630
DATE/TIME HOLE COMPLETED:



DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
					Silt: trace fine sand, brown, slightly moist, firm			
					Sand: trace to some silt, light brown, fine grain, lightly moist, no odor			
					Clay: greenish gray to brown, firm, slightly moist, no odor, weathered shale texture			
					Sandstone: light brown to yellow brown, well cemented, fine grained, quarts rich with minor black ~70% recovery, rounded/subrounded grains 75% recovery, very well cemented	0.4 3.1		

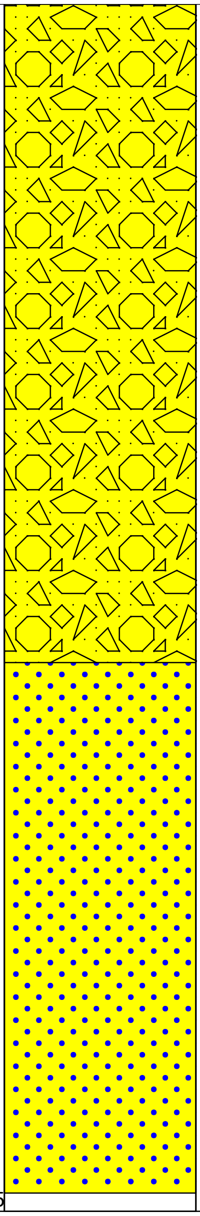
TD = 42.5 feet bgs

Services Inc.

BORING LOG AND WELL COMPLETION FORM

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba, New Mexico
FIELD LOGGED BY: Jeff Walker
SURFACE ELEVATION (msl): No survey data available
GROUNDWATER ELEVATION (msl):
REMARKS:
COORDINATES:

SOIL BORING NO: CH-11
DRILL TYPE: Stratex/Air Rotary
CME-85
BORE HOLE DIAMETER:
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 7/7/2016 @ 930
DATE/TIME HOLE COMPLETED:



DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
0					Imported Backfill			
-5								
-10								
-15								
					Sandstone: brown, well cemented, HC odor			
-20						155		
					very well cemented, blocky			
-25						9.7		
-30						0.7		
	X	CH11-32.5					<0.0275	<11.45

TD = 32.5 feet bgs

GHD Services Inc.

BORING LOG AND WELL COMPLETION FORM

page 1 of 1

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba, New Mexico
FIELD LOGGED BY: Jeff Walker
SURFACE ELEVATION (msl): No survey data available
GROUNDWATER ELEVATION (msl):
REMARKS:
COORDINATES: 36.63297, -107.48130

SOIL BORING NO: CH-10
DRILL TYPE: Stratex/Air Rotary
CME-85
BORE HOLE DIAMETER:
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 7/7/2016 @ 0630
DATE/TIME HOLE COMPLETED:

DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
-30					50% recovery, core not as massive, less cemented	0.8		
					50% recovery, tan to rust, iron banding			
-35						0.4		
-40						0.3		
	X	CH10-42.5					0.017	<12.2

TD = 42.5 feet bgs

GHD Services Inc.

BORING LOG AND WELL COMPLETION FORM

PROJECT NAME: San Juan 28-6 #155N
LOCATION: Rio Arriba, New Mexico
FIELD LOGGED BY: Jeff Walker
SURFACE ELEVATION (msl): No survey data available
GROUNDWATER ELEVATION (msl):
REMARKS:
COORDINATES: 36.63301, -107.48151

SOIL BORING NO: CH-9
DRILL TYPE: Stratex/ Air Rotary
CME-85
BORE HOLE DIAMETER:
DRILLED BY: Yellow Jacket Drilling
DATE/TIME HOLE STARTED: 7/6/2016 @ 1425
DATE/TIME HOLE COMPLETED: 7/16/2016 @ 1630

DEPTH (bgs) - ft	SAMPLE TO LAB	SAMPLE ID	STRATAGRAPHIC SEQUENCE	COMPLETION INFORMATION	CLASSIFICATION AND DESCRIPTION	PID (ppm)	Total BTEX (mg/kg)	Total TPH (mg/kg)
			▨		tan to rust, some greenish, 80% recovery			
-30			▨		less competent	0.5		
-35			▨					
-40			▨					
	X	CH9-32					0.017	<12.2

TD = 42.5 feet bgs

GHD Services Inc.

BORING LOG AND WELL COMPLETION FORM