LT Environmental, Inc.
Advancing Opportunity

SAMPLING AND ANALYSIS PLAN

NEU #315H Release Response
API 30-043-21888
NMOCD Incident # NCS1905249442

APRIL 19, 2019

Prepared for:

ENDURING RESOURCES, LLC
Sandoval County, New Mexico

Prepared by:

LT ENVIRONMENTAL, INC.
848 East Second Avenue
Durango, Colorado 81301
970.385.1096

Smith, Cory, EMNRD

From: Smith, Cory, EMNRD
Sent: Monday, April 22, 2019 10:13 AM
To: 'Andrea Felix'; Dunkelman, Tom
Cc: Ashley Ager; Maureen Joe; sscott@blm.gov; rafields@blm.gov; Mindy Paulek; Gould, Cassandra; Medley, Wyatt T CIV USARMY CESPA (USA); nnepawq@frontiernet.net; Pease, Amanda; Leigh Thomas; Abiodun Emmanuel Adeloye; Alex Campbell; John Conley; James McDaniel; Jacob Ellis; johnny@adobecontractorsinc.com; Daniel Burns; Tim Friesenhahn; Stroud, Fred; Helmlinger, Andrew; Meer, Daniel; Keller, Lynn; Steve Austin (nnepawq@frontiernet.net)
Subject: RE: Enduring Resources NEU 315H spill update

All,

OCD approves the Resubmitted SAPP/QAPP

OCD approval does not relieve Enduring of any requirements imposed by other regulatory agencies.

Cory Smith
Environmental Specialist
Oil Conservation Division
Energy, Minerals, & Natural Resources
1000 Rio Brazos, Aztec, NM 87410
(505)334-6178 ext 115
cory.smith@state.nm.us

From: Andrea Felix <AFelix@enduringresources.com>
Sent: Saturday, April 20, 2019 12:23 PM
To: Dunkelman, Tom <Dunkelman.Tom@epa.gov>
Cc: Ashley Ager <aager@ltenv.com>; Maureen Joe <maureen.joe@bia.gov>; Smith, Cory, EMNRD <Cory.Smith@state.nm.us>; sscott@blm.gov; rafields@blm.gov; Mindy Paulek <mindy@eis-llc.com>; Gould, Cassandra <cassandra.gould@bia.gov>; Medley, Wyatt T CIV USARMY CESPA (USA) <Wyatt.T.Medley@usace.army.mil>; nnepawq@frontiernet.net; Pease, Amanda <Pease.Amanda@epa.gov>; Leigh Thomas <l1thomas@blm.gov>; Abiodun Emmanuel Adeloye <aadeloye@blm.gov>; Alex Campbell <ACampbell@enduringresources.com>; John Conley <JConley@enduringresources.com>; James McDaniel <JMcDaniel@enduringresources.com>; Jacob Ellis <JEllis@enduringresources.com>; johnny@adobecontractorsinc.com; Daniel Burns <dburns@ltenv.com>; Tim Friesenhahn <TFriesenhahn@enduringresources.com>; Stroud, Fred <Stroud.Fred@epa.gov>; Helmlinger, Andrew <Helmlinger.Andrew@epa.gov>; Meer, Daniel <Meer.Daniel@epa.gov>; Keller, Lynn <Keller.Lynn@epa.gov>
Subject: [EXT] Re: Enduring Resources NEU 315H spill update

Thank you Tom for your teams quick attention and response.

We appreciate the efforts made.

Thank you!

Andrea Felix

Sent from my iPhone

On Apr 20, 2019, at 12:15 PM, Dunkelman, Tom <Dunkelman.Tom@epa.gov> wrote:

> EPA has reviewed the Sampling and Analysis Plan and the Quality Assurance Project Plan for the NEU 315H release. These plans were submitted on April 19, 2019. Both plans are approved by EPA.
>
> In a separate email, I will send a signed copy of the QAPP to Ms. Ager.
>
> Tom Dunkelman
> U.S. EPA On-Scene Coordinator
> dunkelman.tom@epa.gov
> (775) 721-4712
>
> On Apr 19, 2019, at 12:37 PM, Ashley Ager <aager@ltenv.com> wrote:
>
> > All,
> >
> > Please see the attached *Sampling and Analysis Plan* and *Quality Assurance Project Plan* for the NEU 315H release. These two plans were written to address EPA's comments to the original submittal of the *Proposed Confirmation and Site Characterization Soil Sampling Plan* and should replace the original document.
> >
> > Since we are submitting these plans for your review by April 22, 2019, we respectfully ask that regulatory reviews be completed next week (by April 26, 2019) as previously requested by Enduring on April 8, 2019. The quick turnaround is requested to take advantage of dry weather conditions and implement the sampling event as soon as possible.
> >
> > We appreciate the opportunity to provide these reports on behalf of Enduring Resources. Please let myself or Andrea Felix know if you have questions or require clarifications.
> >
> > Thank You,
> > Ashley
> >
> > **Ashley Ager**
> > **Senior Geologist**
> > **LT Environmental, Inc.**
> > (970) 385-1096 office
> > (970) 946-1093 mobile
> >
> > ---
> >
> > **From:** Andrea Felix <AFelix@enduringresources.com>
> > **Sent:** Tuesday, April 16, 2019 7:40 AM
> > **To:** Dunkelman, Tom <Dunkelman.Tom@epa.gov>; Maureen Joe <maureen.joe@bia.gov>; Smith, Cory, EMNRD <Cory.Smith@state.nm.us>; sscott@blm.gov; rafields@blm.gov; Mindy Paulek <mindy@eis-llc.com>; Gould, Cassandra <cassandra.gould@bia.gov>; Medley, Wyatt T CIV USARMY CESPA (USA) <Wyatt.T.Medley@usace.army.mil>; nnepawq@frontiernet.net; Pease, Amanda <Pease.Amanda@epa.gov>; Leigh Thomas <l1thomas@blm.gov>; Abiodun Emmanuel Adeloye <aadeloye@blm.gov>; Alex Campbell <ACampbell@enduringresources.com>;

John Conley <JConley@enduringresources.com>; James McDaniel <JMcDaniel@enduringresources.com>; Jacob Ellis <JEllis@enduringresources.com>; Ashley Ager <aager@ltenv.com>; johnny@adobecontractorsinc.com; Daniel Burns <dburns@ltenv.com>; Tim Friesenhahn <TFriesenhahn@enduringresources.com>; Stroud, Fred <Stroud.Fred@epa.gov>; Helmlinger, Andrew <Helmlinger.Andrew@epa.gov>; nnepawq@frontiernet.net; Meer, Daniel <Meer.Daniel@epa.gov>; Keller, Lynn <Keller.Lynn@epa.gov>
Subject: RE: Enduring Resources NEU 315H spill update

Good morning,

We continue to be in the continuous monitoring phase of the incident and have no new items to report.

The team is still on track to have the updated plan to everyone by April 22nd.

Thank you,

Andrea R Felix, RWA
Regulatory Manager
Enduring Resources
200 Energy Court
Farmington, NM 87401
Office: 505-636-9741
Cell: 505-386-8205

From: Andrea Felix
Sent: Monday, April 08, 2019 3:23 PM
To: 'Dunkelman, Tom' <Dunkelman.Tom@epa.gov>; 'Maureen Joe' <maureen.joe@bia.gov>; 'Smith, Cory, EMNRD' <Cory.Smith@state.nm.us>; 'sscott@blm.gov' <sscott@blm.gov>; 'rafields@blm.gov' <rafields@blm.gov>; Mindy Paulek <mindy@eis-llc.com>; 'Gould, Cassandra' <cassandra.gould@bia.gov>; 'Medley, Wyatt T CIV USARMY CESPA (USA)' <Wyatt.T.Medley@usace.army.mil>; 'nnepawq@frontiernet.net' <nnepawq@frontiernet.net>; 'Pease, Amanda' <Pease.Amanda@epa.gov>; 'Leigh Thomas' <l1thomas@blm.gov>; 'Abiodun Emmanuel Adeloye' <aadeloye@blm.gov>; Alex Campbell <ACampbell@enduringresources.com>; John Conley <JConley@enduringresources.com>; James McDaniel <JMcDaniel@enduringresources.com>; Jacob Ellis <JEllis@enduringresources.com>; 'Ashley Ager' <aager@ltenv.com>; 'johnny@adobecontractorsinc.com' <johnny@adobecontractorsinc.com>; 'dburns@ltenv.com' <dburns@ltenv.com>; Tim Friesenhahn <TFriesenhahn@enduringresources.com>; 'Stroud, Fred' <Stroud.Fred@epa.gov>; 'Helmlinger, Andrew' <Helmlinger.Andrew@epa.gov>; 'nnepawq@frontiernet.net' <nnepawq@frontiernet.net>; 'Meer, Daniel' <Meer.Daniel@epa.gov>; 'Keller, Lynn' <Keller.Lynn@epa.gov>
Subject: RE: Enduring Resources NEU 315H spill update

Good afternoon everyone,

Currently we are in the continuous monitoring phase of the incident and have no new items to report.

Our team is working on amending the soil sampling plan to include the information and formatting provided by EPA. We expect to have this plan to everyone by Monday April 22nd, 2019; we would like to move forward with sampling as soon as possible while we have the weather in our favor.

In an effort of forward planning and scheduling is a week (April 22-26) enough time for your teams to review and advise if you approve or not? Please advise.

Thank you,

Andrea R Felix, RWA
Regulatory Manager
Enduring Resources
200 Energy Court
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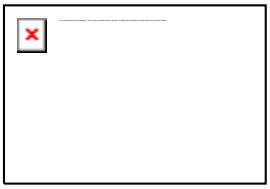
Office: 505-636-9741
Cell: 505-386-8205



From: Andrea Felix
Sent: Wednesday, April 03, 2019 5:05 PM
To: 'Dunkelman, Tom' <Dunkelman.Tom@epa.gov>
Cc: Maureen Joe <maureen.joe@bia.gov>; Smith, Cory, EMNRD <Cory.Smith@state.nm.us>; sscott@blm.gov; rafields@blm.gov; Mindy Paulek <mindy@eis-llc.com>; Gould, Cassandra <cassandra.gould@bia.gov>; Medley, Wyatt T CIV USARMY CESPA (USA) <Wyatt.T.Medley@usace.army.mil>; nnepawq@frontiernet.net; Pease, Amanda <Pease.Amanda@epa.gov>; Leigh Thomas <l1thomas@blm.gov>; Abiodun Emmanuel Adeloye <aadeloye@blm.gov>; Alex Campbell <ACampbell@enduringresources.com>; John Conley <JConley@enduringresources.com>; James McDaniel <JMcDaniel@enduringresources.com>; Jacob Ellis <JEllis@enduringresources.com>; Ashley Ager <aager@ltenv.com>; johnny@adobecontractorsinc.com; dburns@ltenv.com; Tim Friesenhahn <TFriesenhahn@enduringresources.com>; Stroud, Fred <Stroud.Fred@epa.gov>; Helmlinger, Andrew <Helmlinger.Andrew@epa.gov>; nnepawq@frontiernet.net; Meer, Daniel <Meer.Daniel@epa.gov>; Keller, Lynn <Keller.Lynn@epa.gov>
Subject: RE: Enduring Resources NEU 315H spill update

Tom,

Thank you for the information and links for the "Guidance on Systematic Planning Using the Data Quality Objectives Process" and "EPA Requirements for Quality Assurance Project Plans", this new information is welcomed and our team has begun to go through it as well as your comments.

Based on this new information we are suspending the sampling start date so we can work through what you provided in comparison to the plan approved by NMOCD.

Thank you,

Andrea R Felix, RWA
Regulatory Manager
Enduring Resources
200 Energy Court
Farmington, NM 87401
Office: 505-636-9741
Cell: 505-386-8205

From: Dunkelman, Tom [mailto:Dunkelman.Tom@epa.gov]
Sent: Wednesday, April 03, 2019 2:46 PM
To: Andrea Felix <AFelix@enduringresources.com>
Cc: Maureen Joe <maureen.joe@bia.gov>; Smith, Cory, EMNRD <Cory.Smith@state.nm.us>; sscott@blm.gov; rafields@blm.gov; Mindy Paulek <mindy@eis-llc.com>; Gould, Cassandra <cassandra.gould@bia.gov>; Medley, Wyatt T CIV USARMY CESPA (USA) <Wyatt.T.Medley@usace.army.mil>; nnepawq@frontiernet.net; Pease, Amanda <Pease.Amanda@epa.gov>; Leigh Thomas <l1thomas@blm.gov>; Abiodun Emmanuel Adeloye <aadeloye@blm.gov>; Alex Campbell <ACampbell@enduringresources.com>; John Conley <JConley@enduringresources.com>; James McDaniel <JMcDaniel@enduringresources.com>; Jacob Ellis <JEllis@enduringresources.com>; Ashley Ager <aager@ltenv.com>; johnny@adobecontractorsinc.com; dburns@ltenv.com; Tim Friesenhahn <TFriesenhahn@enduringresources.com>; Stroud, Fred <Stroud.Fred@epa.gov>; Helmlinger, Andrew <Helmlinger.Andrew@epa.gov>; nnepawq@frontiernet.net; Meer, Daniel <Meer.Daniel@epa.gov>; Keller, Lynn <Keller.Lynn@epa.gov>
Subject: Re: Enduring Resources NEU 315H spill update

Ms. Felix

As has been communicated to you and other representatives of Enduring Resources on several occasions by multiple EPA employees including Amanda Pease, Fred Stroud and myself, EPA has requested that the Agency be provided with copies of all plans related to the NEU 315H spill for review and comment. In your March 25 update you indicated that, "LT will finalize sampling plan for submittal to NMOCD and other agencies for approval to begin process of assessment/closure sampling in wash area." This sampling plan was submitted to NMOCD on March 27, but was not submitted to EPA until very late in the day on April 2, and only after EPA again requested to see the plan. Furthermore, in your submittal email on April 2, you gave EPA until April 4 to submit comments on the sampling plan. EPA does not appreciate the fact that the Agency was not provided with a copy of the sampling plan when it was initially distributed and that the Agency was told it had two days to provide comments.

Please see the attached EPA comments on the Proposed Confirmation and Site Characterization Soil Sampling Plan, NEU #315H Release Response, submitted by LT Environmental on Behalf of Enduring Resources. Sampling should not occur until the EPA comments have been addressed and EPA has provided its approval of the sampling plan. If you have any questions, please feel free to contact me.

Tom Dunkelman
U.S. EPA On-Scene Coordinator
dunkelman.tom@epa.gov
(775) 721-4712

On Apr 2, 2019, at 3:57 PM, Andrea Felix <AFelix@enduringresources.com> wrote:

> Good afternoon everyone,
>
> Please see attached soil sampling plan for the NEU #315H release, this plan has been approved by NMOCD with the following conditions. I have also attached NMOCD's email approving the plan for your information. Maureen Joe, FIMO Director, has communicated to Enduring that she has delegated her authority for approval of the sampling plan to Cory Smith with NMOCD.
>
> - Enduring will collect a 10pt surface composite for every 2,000sqft
>   - Enduring will add 2 additional 2,000 Sqft sampling zones past dam number 5
> - Enduring will collect a grab sample at 6"- 1' depth every other 2,000 sqft section
>   - If field readings are over 100PPM OCD will consider soils impacted unless sampled.

- Enduring will clearly mark sampling zones prior to confirmation sampling. These zones need to be able to withstand any additional remediation/weather until the final walk through.
- Following the complete of confirmation sampling and any additional remediation Enduring will schedule with OCD a final walk through when the wash is DRY where additional grab samples may be requested. The walk through should be scheduled no later then 20-30 days (Weather permitting) following the completion of confirmation sampling/remediation.

Please review the attached and advise if you have any comments/ suggestions by EOB Thursday April 4th, 2019.

Enduring plans to begin sampling on Monday April 8th, 2019. We welcome anyone who is interested in attending the sampling to join us.

Again we appreciate the collaboration put forth by you and your teams during this process.

Thank you,

Andrea R Felix, RWA
Regulatory Manager
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Farmington, NM 87401
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Cell: 505-386-8205

From: Andrea Felix
Sent: Monday, April 01, 2019 5:44 PM
To: Maureen Joe <maureen.joe@bia.gov>; Smith, Cory, EMNRD <Cory.Smith@state.nm.us>; sscott@blm.gov; rafields@blm.gov; Mindy Paulek <mindy@eis-llc.com>; Gould, Cassandra <cassandra.gould@bia.gov>; Medley, Wyatt T CIV USARMY CESPA (USA) <Wyatt.T.Medley@usace.army.mil>; Steve Austin <nnepawq@frontiernet.net>; Pease.Amanda@epa.gov; Dunkelman.Tom@epa.gov; Leigh Thomas <l1thomas@blm.gov>; Abiodun Emmanuel Adeloye <aadeloye@blm.gov>
Cc: Alex Campbell <ACampbell@enduringresources.com>; John Conley <JConley@enduringresources.com>; James McDaniel <JMcDaniel@enduringresources.com>; Jacob Ellis <JEllis@enduringresources.com>; Ashley Ager <aager@ltenv.com>; johnny@adobecontractorsinc.com; dburns@ltenv.com; Tim

Friesenhahn <TFriesenhahn@enduringresources.com>
Subject: Re: Enduring Resources NEU 315H spill update

Good afternoon everyone,

Please see update below as of 5:36 pm Monday April 1st, 2019.

Work completed:

- Wash drying up, but some water was still pooled up behind dams from weekend rain event early in the week
- Contractor addressed several additional areas of concern in the wash identified during field screening activities
- Additional impacted soil was transported to Envirotech's land farm for disposal
- Vac trucks were utilized to pull pooled water from the dammed areas for disposal to facilitate drying out the dam areas
- Hand shovels were utilized to remove remaining impacted soil identified in areas that were too wet to access with equipment
- All visual and field identified impacts identified have been excavated and removed
- A Site Characterization Plan/Sampling Plan was submitted to the NMOCD for approval on 3/27/19

Field activities are currently shut down awaiting NMOCD approval of Site Characterization Plan/Sampling Plan.

Upon approval of plan by NMOCD I will distribute to everyone for your records.

Thank you,

Andrea Felix

Sent from my iPhone

On Mar 25, 2019, at 6:38 PM, Andrea Felix <AFelix@enduringresources.com> wrote:

> Good afternoon everyone,
>
> Please see update below as of 6:36pm Monday March 25, 2019.
>
> Work completed:
>
> - Impacted soil was removed in wash and at dam locations on 3/18-20/2019 using hand shovels

and skid steers in wash and excavation equipment at dam locations.

- Work was shut down on 3/21/2019 due to wet conditions caused by rain
- Water samples were collected in the wash during rain event downstream of dam 5 on 3/21 and 3/22
- All water samples collected to date have been below WQCC standards for BTEX and chlorides.
- Vac trucks continued to skim minimal oil at dams 2 and 3A during rain event
- LTE utilized field screening measures to identify a few areas in the wash that they believe will require some additional excavation
- Drone flown by Enduring to update excavation figures in wash area
- To date, an estimated 1,960 CY soil, 1,342 bbls sludge and oil has been removed and disposed of at Envirotech

Work planned for the week:

- LTE will assess wash area for areas of concern that may need additional attention
- Areas that LTE has already identified in need of additional excavation using field screening will be removed this week
- LT will finalize sampling plan for submittal to NMOCD and other agencies for approval to begin process of assessment/closure sampling in wash area

Thank you,

Andrea R Felix, RWA
Regulatory Manager
Enduring Resources
200 Energy Court
Farmington, NM 87401
Office: 505-636-9741
Cell: 505-386-8205
<image004.jpg>

From: Andrea Felix
Sent: Monday, March 18, 2019 1:24 PM
To: Maureen Joe <maureen.joe@bia.gov>; Smith, Cory, EMNRD <Cory.Smith@state.nm.us>; sscott@blm.gov; rafields@blm.gov; mindy@eis-llc.com; Gould, Cassandra <cassandra.gould@bia.gov>; Medley, Wyatt T CIV USARMY CESPA (USA) <Wyatt.T.Medley@usace.army.mil>; Steve Austin

<nnepawq@frontiernet.net>; Pease.Amanda@epa.gov; Dunkelman.Tom@epa.gov; Leigh Thomas <l1thomas@blm.gov>; Abiodun Emmanuel Adeloye <aadeloye@blm.gov>
Cc: Alex Campbell <ACampbell@enduringresources.com>; John Conley <JConley@enduringresources.com>; James McDaniel <JMcDaniel@enduringresources.com>; Jacob Ellis <JEllis@enduringresources.com>; Ashley Ager <aager@ltenv.com>; johnny@adobecontractorsinc.com; dburns@ltenv.com
Subject: RE: Enduring Resources NEU 315H spill update

Good afternoon everyone,

Please see update below as of 1:19pm Monday March 18th, 2019.

Work completed

- Additional soil excavation activities on hold last week due to wet conditions
- Continued monitoring of dams, and oil absorbent boom were swapped out as needed
- Dams held, and oil was skimmed from behind the dams
- Underflow Dam 5 is working properly, and water samples were collected in the wash downstream of Dam 5 for analysis
- All samples to date have been below NMOCD regulatory requirements for water
- To date, 873 CY of impacted soil has been removed from the spill area
- To date, 1,342 bbls of sludge and oil have been removed from the spill area

Work planned for the week

- Additional soil removal is scheduled to begin today (3/18) in the wash
- Soil removal will be done using hand shovels and skid steers
- Additional excavation will occur along roadside where oil pooled
- Vac trucks and hydrovacs will continue to be used to skim oil and remove impacted mud and sludge
- Additional water samples will be collected from wash if underflow dams have water flowing through them
- Sampling and remediation plan being prepared for submittal to agencies

Attached is the updated USACE disturbance tracker managed by EIS.

Thank you,

Andrea R Felix, RWA
Regulatory Manager
Enduring Resources
200 Energy Court
Farmington, NM 87401
Office: 505-636-9741
Cell: 505-386-8205
<image003.jpg>

From: Andrea Felix
Sent: Monday, March 11, 2019 4:30 PM
To: Maureen Joe <maureen.joe@bia.gov>; Smith, Cory, EMNRD <Cory.Smith@state.nm.us>; sscott@blm.gov; rafields@blm.gov; mindy@eis-llc.com; Gould, Cassandra <cassandra.gould@bia.gov>; Medley, Wyatt T CIV USARMY CESPA (USA) <Wyatt.T.Medley@usace.army.mil>; eedeloye@blm.gov; Steve Austin <nnepawq@frontiernet.net>; Pease.Amanda@epa.gov; Dunkelman.Tom@epa.gov; Leigh Thomas <l1thomas@blm.gov>; Abiodun Emmanuel Adeloye <aadeloye@blm.gov>
Cc: Alex Campbell <ACampbell@enduringresources.com>; John Conley <JConley@enduringresources.com>; James McDaniel <JMcDaniel@enduringresources.com>; Jacob Ellis <JEllis@enduringresources.com>; Ashley Ager <aager@ltenv.com>; johnny@adobecontractorsinc.com; dburns@ltenv.com
Subject: RE: Enduring Resources NEU 315H spill update

Good afternoon everyone,

Please see below update as of 4:21pm Monday March 11, 2019

Work completed

- Total soil excavated to date: 402 CY
- Sludge and oil removed: 1,180 bbls
- Excavation continues in wash area with hand shovels
- Additional dam built (3B) near original dam site 3
- Dams held through week and skimming activities continued

- Drone being used to fly area for Army Corp permitting
- Preparing to monitor and skim dams with potential weather coming in Monday-Wednesday this week

Work planned for the week

- Remediation plan in progress for long term remediation for submittal to agencies
- Continued daily monitoring
- additional hand excavation activities likely to continue later this week weather dependent

Attached is the most updated USACE disturbance tracker managed by EIS.

Thank you,

Andrea R Felix, RWA
Regulatory Manager
Enduring Resources
200 Energy Court
Farmington, NM 87401
Office: 505-636-9741
Cell: 505-386-8205
<image003.jpg>

From: Andrea Felix
Sent: Monday, March 04, 2019 4:36 PM
To: Maureen Joe <maureen.joe@bia.gov>; 'Smith, Cory, EMNRD' <Cory.Smith@state.nm.us>; 'eedeloye@blm.gov' <eedeloye@blm.gov>; sscott@blm.gov; rafields@blm.gov; 'nnepaw@frontiernet.net' <nnepaw@frontiernet.net>; 'wyatt.medley@usace.army.mil' <wyatt.medley@usace.army.mil>; 'mindy@eis-llc.com' <mindy@eis-llc.com>; 'Gould, Cassandra' <cassandra.gould@bia.gov>
Cc: Alex Campbell <ACampbell@enduringresources.com>; John Conley <JConley@enduringresources.com>; James McDaniel <JMcDaniel@enduringresources.com>; Jacob Ellis <JEllis@enduringresources.com>; 'Ashley Ager' <aager@ltenv.com>; johnny@adobecontractorsinc.com
Subject: Enduring Resources NEU 315H spill update

Good afternoon everyone,

We will begin to send a weekly update on the clean-up status for the NEU 315H spill to this group on Mondays

of each week. If a situation arises that an update needs to be sent sooner we will do so.

As of 4:26pm Monday March 4th, 2019

Work completed

- Continued upgrades have been made to Dams 4 and 5
- Dam 3 was upgraded and moved slightly up gradient in the smaller wash
- Oil Absorbent Booms have been changed out daily, when saturated with oil
- Vac trucks and hydrovacs have been skimming oil from dams 1, 2, 3, 4, and 5
- Contract personnel have been removing oil along the wash using shovels, where possible
- Oil saturated area along the road has been cleaned up using a skid steer and backhoe, and soil has been hauled off
- Daily monitoring by surface water sampling down gradient of Dam 5 and pedestrian mapping of soil impacts
- Muddy road conditions have limited access by hydrovacs, vac trucks and dump trucks to area by Dams 4 and 5
- Water samples are being collected daily for BTEX and Chlorides in larger wash on downstream side of Dam 5
- To date, approximately 306 CY of soil, and 940 bbls of sludge and oil have been removed from the spill area

Work planned for this Week

- Continued oil absorbent boom replacement as needed
- Continue removing oil from dams 1, 2, 3, 4 and 5
- Continue reinforcing and repairing Dams as needed
- Utilize backhoe and hand shoveling to remove oil staining from wash area
- Continue daily monitoring by surface water sampling down gradient of Dam 5 and pedestrian mapping of soil impacts

We appreciate all the time each of you have spent working on this project with us.

Thank you,

Andrea R Felix, RWA
Regulatory Manager

Enduring Resources
200 Energy Court
Farmington, NM 87401
Office: 505-636-9741
Cell: 505-386-8205
<image003.jpg>

<NEU 315H - Proposed Sampling Plan.pdf>

<mime-attachment>

<NEU 315H SAP_Final.pdf>

<NEU 315H QAPP FINAL.pdf>

DISTRIBUTION LIST

New Mexico Oil Conservation Division

Bureau of Indian Affairs, Federal Indian Minerals Office

Navajo Nation Environmental Protection Agency

United States Environmental Protection Agency Region IX

Bureau of Land Management

United States Army Corps of Engineers

Enduring Resources, LLC

LT Environmental, Inc.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

FIGURES

TABLES

APPENDICES

LIST OF ACRONYMS

bbl(s)	Barrel(s)
bgs	Below ground surface
BLM	Bureau of Land Management
BTEX	Benzene, toluene, ethylbenzene, and total xylenes
COC	Chemical(s) of concern
DQOs	Data quality objectives
EPA	United States Environmental Protection Agency
FIMO	Federal Indian Minerals Office
FL	Field Leader
GPS	Global Positioning System
IDW	Investigation derived waste
LCS/LCSD	Laboratory control sample/laboratory control sample duplicate
MS/MSD	Matrix spike/matrix spike duplicate
MDL	Method Detection Limit(s)
mg/kg	Milligrams per kilogram
NMAC	New Mexico Administrative Code
NMOCD	New Mexico Oil Conservation Division
NNEPA	Navajo Nation Environmental Protection Agency
OSHA	Occupational Safety and Health Administration
ppm	Parts per million
PID	Photo-ionization detector
PL	Project Leader
PM	Project Manager
PO	Project Officer
QA	Quality Assurance
QAM	Quality Assurance Manager
QC	Quality Control
QAPP	Quality Assurance Project Plan
RPD	Relative percent difference
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TPH	Total petroleum hydrocarbons
VOC	Volatile organic compound

1.0 PROJECT ORGANIZATION

Key positions include personnel who are involved with data generation, data use, or decision-making. Each individual is aware of their defined roles and responsibilities and the interrelationships between project personnel. One person may fulfill multiple positions.

Quality Assurance (QA) personnel have sufficient authority, access to work areas, and organizational freedom to identify quality problems; to initiate, recommend, or provide solutions to problems through established channels; and to verify solution implementation. Such personnel ensure all work, including any processing of information, delivery of products, and installation or use of equipment, is reviewed in accordance with Quality Control (QC) objectives and all deficiencies and non-conformances are corrected. QA personnel have direct access to senior management, so the required authority is provided where needed, to carry out QA duties.

Contact information for key personnel is provided below in Table 1.

TABLE 1: KEY PERSONNEL CONTACT INFORMATION

Title/Responsibility	Name	Telephone	Electronic Mail Address
Environmental Protection Agency (EPA) Project Officer	Tom Dunkelman	(775) 721-4712	dunkelman.tom@epa.gov
New Mexico Oil Conservation Division (NMOCD) Project Officer	Cory Smith	(505) 334-6179	cory.smith@state.nm.us
Federal Indian Minerals Office (FIMO) Director	Maureen Joe	(505) 564-7671	maureen.joe@bia.gov
Navajo Nation Environmental Protection Agency (NNEPA) Project Officer	Steve Austin	(505) 368-1037	nnepawq@frontiernet.net
Bureau of Land Management (BLM) Project Officer	Abiodun Emmanuel Adeloye	(505) 564-7665	aadeloye@blm.gov
BLM Surface Supervisor	Sarah Scott	(505) 564-7689	sscott@blm.gov

LT Environmental, Inc. (LTE) Senior Geologist and Project Manager	Ashley Ager	(970) 385-1096	aager@ltenv.com
LTE Senior Engineer and Quality Assurance Manager	Alexis Fricke	(303) 962-5526	africke@ltenv.com
LTE Project Geologist and Field Leader	Danny Burns	(970) 385-1096	dburns@ltenv.com
Enduring Resources, LLC – HSE Supervisor and Project Manager	James McDaniel	(505) 636-9731	jmcdaniel@enduringresources.com
Enduring Resources, LLC – Regulatory Manager	Andrea Felix	(505) 636-9741	afelix@enduringresources.com
Enduring Resources, LLC – Vice President of Land	Alex Campbell	(303) 350-5107	acampbell@enduringresources.com
Enduring Resources, LLC – Operations Manager	John Conley	(303) 350-5718	jconley@enduringresources.com
Subcontractors			
Hall Environmental Analysis Laboratory	Andy Freeman	(505) 345-3975	andy@hallenvironmental.com
Pace National	Daphne Richards	(615) 773-9662	drichards@pacenational.com
Adobe Construction	Johnny Stinson	(505) 320-6076	johnny@adobecontractorsinc.com
M & R Trucking, Inc.	Justin Ketring	(505) 326-5541	jketring@mrtruckinc.com
Envirotech, Inc.	Felipe Aragon	(505) 632-0615	faragon@envirotech-inc.com
NRE Field Services	Dillon Gibson	(505) 258-4259	dillon@nrefieldservices.com
Western Cultural Resource Management, Inc.	Deb Gibson	(505) 326-7420	deborah.gibson@wcrminc.com
Energy Inspection Services	Mindy Paulek	(970) 759-8669	mindy@eis-llc.com

1.1 REGULATORY PROJECT OFFICERS (PO)

The assigned PO is responsible for coordinating all project-related activities on behalf of their associated agency. Specific responsibilities of the PO are as follows:

- Provide oversight of all project activities;
- Review and approve project plans (including Sampling and Analysis Plans [SAPs]) and reports and coordinate review within EPA as necessary;
- Review and approve the Quality Assurance Project Plan (QAPP).

1.2 QUALITY ASSURANCE MANAGER (QAM)

The QAM is responsible for the development, implementation, and maintenance of the comprehensive Quality System and operates independently from the unit generating data. Responsibilities of this position include communicating with all levels of program and project management to ensure a quality product is produced for delivery. Project-specific responsibilities of the QAM or designee are as follows:

- Respond to QA needs, resolve problems, and answer requests for guidance or assistance;
- Approve and maintain the QAPP; revise as necessary; submit to EPA for concurrence; provide guidance to the PM in the development of project-specific SAPs;
- Review and approve the project-specific SAPs;
- Assign qualified independent reviewers to review the technical adequacy of analytical deliverables;
- Track the progress and completion of the review and approval process;
- Ensure laboratory and analytical NMOCD and EPA protocols and procedures, as well as Standard Operating Procedures (SOPs), are being followed;
- Review the implementation of selected SAPs and the adequacy of the data or products generated based on quality objectives in coordination with the LTE PM;
- Initiate performance of field and laboratory audits and management system reviews, as appropriate;
- Maintain a current list of QAPPs and SAPs;
- Authorize, coordinate, and conduct internal and subcontractor audits of selected projects for adherence to the project plans, as appropriate;
- Review audit and nonconformance reports to determine areas of poor quality or failure to adhere to established procedures, as necessary;
- Confer with the audited entity on the steps to be taken for corrective actions and track the nonconformance until it has been corrected; evaluate the adequacy and completeness of the action taken; confer with the PL to resolve an inadequate corrective action; and confirm the adequacy and the implementation of the response action;

- Suspend or stop work upon discovering an adverse condition affecting the quality of results in coordination with the LTE PM; and
- Provide training on QA policies, procedures, and methodology.

1.3 ENDURING RESOURCES, LLC PROJECT MANAGER (ENDURING PM)

The Enduring PM reports to the regulatory POs and is responsible for the overall project management internal project team coordination. Specific responsibilities of the PM are as follows:

- Provide oversight of project activities;
- Review project plans (including SAPs) and reports;
- Ensure that regulatory review comments are addressed;
- Overall project coordination with regulatory agencies and consultants; and
- Work with the regulatory agencies to determine data quality objectives (DQOs).

1.4 LTE PROJECT MANAGER (LTE PM)

Under the direction of the Enduring PM, the LTE PM is responsible for planning, coordinating, conducting, and reporting specific technical tasks. The LTE PM is responsible for the following:

- Provide oversight on all project-related activities;
- Ensure that all project team members are adequately trained and that certifications are current;
- Manage project files and project data management;
- Conduct QA reviews and assessments on an as needed basis;
- Prepare and implement the project-specific SAPs (which incorporate applicable QAPP elements);
- Ensure that SOPs are available and in use for activities that affect product quality and that assigned staff have been trained in their implementation;
- Ensure that appropriate sampling, testing, and analysis procedures are followed and that correct laboratory QA/QC checks are implemented;
- Monitor sample preservation, handling transport, and custody throughout the project;
- Coordinate the appropriate disposition of investigation derived waste (IDW);
- Ensure that the proper number and type of QC samples are collected, identified, tracked, and sent to the laboratory for analysis;
- Coordinate and schedule sample shipment to analytical laboratories to meet holding times and analytical procedures specifications;
- Monitor subcontractors for compliance with both project and data quality requirements, records, costs, and progress of the work and re-plan and reschedule work tasks as appropriate;

- Review and approve calculations to ensure that data reduction is performed in a manner that produces quality products if required by the project;
- Verify data quality, test results, equipment calibrations, and QC documentation and maintain and regularly review all QC records if required by the project;
- Ensure that all product deliverables are subjected to independent technical review by qualified personnel within the time frame of the project schedule if required by the project;
- Plan and schedule assessments in conjunction with the QAM;
- Provide full assistance to the audit team during the conduct of project-specific QA audits;
- Review and respond to assessment findings; determine the root cause for any non-conformance; confer with the QAM on the steps to be taken for correction; and ensure that procedures are modified to reflect the corrective action and that they are distributed to all field personnel, including subcontractors;
- Coordinate data collection activities to be consistent with information requirements;
- Supervise the compilation of field data and laboratory analytical results;
- Assure that data are correctly reported; and
- Prepare or oversee the preparation of portions of the final report that summarize data results and present conclusions.

Note that responsibility may be delegated to LTE Field Leaders (FLs) or the QAM.

1.5 LTE FIELD LEADER (FL)

The LTE FL is responsible for:

- Ensure all project team members have the most recent versions of project documents (QAPP, SAP, Health and Safety Plan [HASP], and SOPs);
- Ensure SOPs are available and in use for activities that affect product quality and assigned staff have been trained in their implementation;
- Ensure that critical supplies and consumables are available for field activities;
- Notify the laboratory so supplies and consumables are available to the laboratory and that the laboratory is aware of the schedule;
- Develop and maintain technical activity files and logbooks;
- Implement technical procedures applicable to tasks;
- Coordinate the field implementation of the SAP;
- Implement corrective action and document the corrective action should a problem occur during the implementation of this SAP;
- Manage project data; and

- Develop field reports.

1.6 SUBCONTRACTORS

Enduring and LTE will delegate to others the responsibility of planning and executing certain portions of the project activities. When subcontractors are involved in activities covered by the requirements of the QAPP, the responsibility and authority of each subcontractor must be clearly established and documented. The LTE PM and FL are responsible for monitoring subcontractors for compliance with both project and data quality requirements.

2.0 PROBLEM DEFINITION AND BACKGROUND

This SAP has been prepared to address petroleum hydrocarbon-impacted soil following a release during flowback operations associated with the N Escavada Unit #315H (API #30-043-21888) production well operated by Enduring. The DQOs for this project are to:

- Define and assess the remediation activities implemented so far and determine if any areas meet the applicable standards for closure criteria;
- Define and assess the nature and extent of residual contamination in soil at the location of the release; and
- Develop sufficient information to identify and evaluate remedial alternatives and possible requirements for further action, if necessary.

2.2 BACKGROUND

On February 17, 2019, a release occurred during flowback operations at an oil and natural gas production site located on the Nacimiento Formation outcrop east-southeast of Escavada Wash in the northwest quarter of the southwest quarter (Unit L) of Section 10, Township 22 North, Range 7 West, Sandoval County, New Mexico, approximately 7.5 miles southwest of Counselor, New Mexico (Figure 1). The site and associated release footprint are within the exterior boundaries of the Navajo Reservation, but on fee surface (Indian Allotted). A cam lock on an aboveground flowline outside of the well pad containment berm failed, resulting in flowback liquids flowing off site and under an access road through culverts to an area of level topography where the fluids ran as sheet flow until channeling into a nearby drainage. This unnamed drainage is a second-order tributary to Escavada Wash, located approximately 1.25 miles east-northeast. Approximately 1,400 barrels (bbls) of flowback fluids from the wellbore were released, of which 300 bbls were estimated to be crude oil. The released liquids travelled approximately 5,500 feet down the wash until an emergency dam was built by hand for containment. The dam held temporarily, but meltwater associated with snow on the ground eventually broke the dam and fluids migrated past a confluence of the second-order tributary into a first-order tributary of Escavada Wash. Another dam was constructed downgradient of the confluence for containment. Freezing temperatures and additional snow accumulation restricted the release fluids to ponded areas and prevented additional flow downgradient in the short-term. Emergency release response activities began immediately with fluid recovery via vacuum trucks and construction of additional dikes and berms to divert fluid flow and minimize the release footprint. An NMOCD Release Notification Form C-141 was prepared and provided by Enduring to the NMOCD and all other regulatory agencies. A copy of the form is provided in Appendix A.

2.3 RELEASE RESPONSE

Wellstream fluids as defined in New Mexico Administrative Code (NMAC) Title 19, Chapter 15, Part 29, Section 12 (19.15.29.7) were released from the wellbore during flowback operations and included a combination of produced water and crude oil. Flowback operations are conducted to recover fluids used to hydraulically fracture the reservoir and Enduring used biocide, scale inhibitor, and friction reducer during hydraulic fracturing of the well. Although the duration of flowback operations (approximately 3 weeks) and volume recovered at the time of the release (10,519 bbls) suggest those secondary

constituents would already have been recovered, their potential presence is included in the NMOCD definition of wellstream as suspended constituents combined with oil and water coming from the well bore during production of the well. Releases of wellstream fluids are regulated by the NMOCD under 19.15.29 NMAC and contaminants of concern are identified in Table 1 of 19.15.29.12 NMAC as benzene, toluene, ethylbenzene, and total xylenes (BTEX), total petroleum hydrocarbons (TPH - the total sum of gasoline range organics, diesel range organics, and motor oil range organics), and chloride.

To minimize migration of wellstream fluids further downstream, several underflow dams were constructed throughout the second- and first-order tributaries to Escavada Wash. Any pooled liquids were periodically recovered via vacuum truck and hydro-vacuuming. A total of six underflow dams (Dams 1, 2, 3A, 3B, 4, and 5) were constructed with native fill material and reinforced with sandbags and impermeable plastic lining. The dams were inspected daily for signs of weakness or failure points. Construction contractors were on hand to repair dams immediately if necessary. Hydrocarbon absorbent booms were placed across the wash in numerous areas and absorbent pads were placed in areas with standing liquids. Absorbent booms and pads were inspected daily and replaced once saturated. Underflow dam and absorbent boom locations are depicted on Figure 2. In the area where sheet flow occurred, Enduring excavated soil and removed any free-standing liquids.

After initial emergency response remediation activities were completed, Enduring proposed flushing the affected wash with freshwater to displace oil from areas in the wash that were still frozen or covered in snow from recent precipitation. The resulting flushed liquids would accumulate at the underflow dams where vacuum trucks would recovery impacted liquids. The proposed flushing plan was approved by the NMOCD, BLM, and FIMO. On February 26, 2019, approximately 240 bbls of freshwater were released into an area above the channelized release footprint. The initial freshwater flush was intended to serve as a trial to evaluate the appropriate volume of freshwater needed to travel an observable distance and accumulate oil at the first underflow dam. However, the flushing activities were soon aborted due to increasing temperatures resulting in accelerated snowmelt and natural running wash conditions.

During runoff throughout the wash, dams were inspected and repaired/reinforced if necessary. Fluids that accumulated upgradient of each dam were recovered with vacuum trucks and hydro-vacuuming. Absorbent booms were replaced, and water samples were collected below the last underflow dam (Dam 5) when water was present. Dam 5 failed once and runoff was rerouted around it another time to avoid failure, but only after booms had been installed downgradient. There were six sections of oil-absorbent booms extending across the entire width of the first-order tributary installed downgradient of Dam 5; the furthest section was approximately 2,100 feet downstream of Dam 5. Additionally, a SwiftWater® oil containment boom was installed approximately 450 feet downstream of Dam 5 to divert any hydrocarbons to a central collection point comprised of oil-absorbent booms. The locations of downgradient booms are presented on Figure 2.

Every morning during runoff, LTE inspected the entire length of the affected washes, including 4.75 miles downgradient of Dam 5 as far as the County Road 7900 bridge crossing. As part of those inspections, the most downgradient observable evidence of impacted soil, vegetation, and/or sheen was mapped. Results of those investigations are presented on Figure 3. Visual observations consisted of globules of crude oil on vegetation or soil and discolored soil. Impacted soil was mapped and scheduled for removal. The most downgradient observed evidence of soil impact was approximately 0.5 miles from Dam 5. Downgradient of that location, the only evidence observed in the wash had accumulated on vegetation during periods of high runoff. The last observable impact to vegetation was identified on

March 18, 2019 and was approximately 0.5 miles upgradient of the CR 7900 bridge. All affected vegetation and soil was removed by hand shoveling during the afternoon following identification during the morning.

Water samples were collected anytime flowing water was present downgradient of Dam 5 and were submitted to Pace Analytical Services, LLC (Pace Analytical) of Mount Juliet, Tennessee, for analysis of BTEX by EPA Method 8015 and chloride by EPA Method 300.0. Laboratory analytical results of water samples collected below the last dam are summarized in Table 1. Complete laboratory analytical reports are included in Appendix B.

Once melt runoff subsided and sufficient drying occurred, the washes were inspected and areas with visibly observable surficial impacts were marked for removal. Crews were dispatched into the washes to remove visibly petroleum hydrocarbon impacted soil and vegetation via hand digging and excavation using skid steers. Following removal of visibly impacted materials, LTE geologists continued field screening the excavated areas for volatile organic compounds (VOCs) using visual and olfactory observations and a photo-ionization detector (PID) equipped with a 10.6 electron volt lamp to identify areas requiring additional remediation. Inspections included the area downgradient from the last containment (Dam 5), where impacts were reduced to minimal staining on vegetation. Impacted vegetation was removed upon identification. Routine inspections are still being conducted to monitor any potential migration of impacts downgradient.

Between March 6 and 26, 2019, a total of 2,200 cubic yards of soil were removed via excavation, and a total of 1,342 bbls of sludge (runoff containing impacted soil) was removed from the washes and underflow dam areas. Impacted soil, vegetation, and sludge were loaded and transported for disposal at the Envirotech Landfarm south of Bloomfield in San Juan County, New Mexico. To date, a total of 3,900 bbls of liquids have been recovered from the wash and underflow dam areas by vacuum truck or hydrovacuum. Recovered liquids were transported to a nearby Enduring wastewater recycling facility where solids and liquids were separated via settling, and the remaining impacted liquids were hauled for disposal to Agua Moss in Bloomfield, New Mexico. The final area of impact is estimated to be approximately 175,000 square feet and permeated the soil to depths ranging from 0 to 2 feet below ground surface (bgs).

2.4 GEOGRAPHIC LOCATION

The site is located on the Nacimiento Formation outcrop east-southeast of Escavada Wash in the northwest quarter of the southwest quarter (Unit L) of Section 10, Township 22 North, Range 7 West, Sandoval County, New Mexico, approximately 7.5 miles southwest of Counselor, New Mexico.

2.5 HYDROGEOLOGIC SETTING

Cretaceous and Tertiary sandstones, as well as Quaternary alluvial deposits, serve as the primary aquifers in the San Juan Basin. The Nacimiento Formation outcrops at the surface in this portion of the southern basin, flanked by the more resistant sandstones of the San Jose Formation to the east and the Ojo Alamo and more extensive Kirtland Formation to the east. Thickness of the Nacimiento Formation ranges from 418 feet to 2,232 feet and aquifers within the coarser and continuous sandstone bodies are between 0 feet and 1,000 feet deep in this section of the San Juan Basin (Stone et al., 1983). Groundwater within these aquifers flows toward the nearby San Juan River and its tributaries.

Depth to groundwater is estimated to be less than 50 feet bgs in the most downgradient portions of the release footprint. This estimation is based on groundwater data from Stone and others (1983), the United States Geological Survey (USGS) *Groundwater Atlas of the United States* and depth to groundwater data published on the New Mexico State Engineer's iWaters database website. Additionally, local topography and proximity to surface hydrologic features are taken into consideration. Although there are nearby water wells drilled into Nacimiento aquifers that report groundwater as deep as 790 feet (SJ 00949-EXPL) to 1,106 feet bgs (SJ 00949-S), the nearest permitted domestic water well to the release extent, as defined by the most downgradient extent of observed soil staining (SJ-02508, owned by Cash A. Carruth) is approximately 3.4 miles to the southwest and has a total depth of 20 feet bgs recorded in drilling logs. Impacted vegetation was observed closer to the well and removed; however, no pooling of release fluids or staining that might indicate saturation into the bed or banks of the wash were ever observed. Enduring has been in direct contact with Mr. Carruth during the release response and sampled the holding tank associated with the shallow groundwater well for analysis of BTEX. Laboratory analytical results did not detect any concentrations of BTEX. The water well itself is not accessible, and Mr. Carruth was satisfied with the results of the water sampling conducted.

The nearest spring is located approximately 3.7 miles southwest of the release extent. The nearest continuously flowing water is the San Juan River, approximately 40 miles to the north. Other than water resources, the nearest potential receptor is a permanent residence approximately 2,550 feet south of the release extent.

2.6 REGULATORY STANDARDS AND CRITERIA

Based on presumed depth to groundwater and in accordance with 19.15.29.12 NMAC, Table 1, *Closure Criteria for Soils Impacted by a Release,* the following apply.

- 10 milligrams per kilogram (mg/kg) benzene;
- 50 mg/kg total benzene, BTEX;
- 100 mg/kg TPH (the total sum of gasoline range organics, diesel range organics, and motor oil range organics); and
- 600 mg/kg chloride.

3.0 PROJECT DESCRIPTION

3.1 SCOPE OF WORK

Enduring has completed initial response activities according to 19.15.29.8.B NMAC (source elimination and site security, containment, site stabilization, and remediation). This SAP has been developed to:

- Assess the remediation activities implemented so far and determine if any areas meet the applicable standards for closure criteria;
- Define the vertical and horizontal extent of residual soil impact; and
- Develop sufficient information to identify and evaluate remedial alternatives and possible requirements for further action, if necessary.

Given the complexities of the release footprint (size and extent, as well as being a wash with defined beds and banks) and the amount of work completed to date, LTE has developed a plan to achieve these goals and in accordance with both the site characterization and closure requirements defined by the NMOCD in 19.15.29 NMAC. The total impacted surface area within the release area is approximately 175,000 square feet and has been segmented into 2,000-square foot areas (Figure 4). This apportionment was designed not only with regularly implemented NMOCD practices in mind, but additionally based on previous sampling experience of similar releases and situations and is intended to be representative of a surface area of this magnitude.

A grid system sampling design has been selected to provide information on residual contamination per 2,000-square foot area to assess response activities conducted to date, achieve lateral delineation, and facilitate remediation efforts in the event closure criteria are exceeded. A composite sampling design has been proposed, modeled on closure sampling requirements in 19.15.29.12.D NMAC and in prior consultation with NMOCD. Prior to sample collection, the release area will be segmented into approximate 2,000-square foot areas using a handheld Global Positioning System (GPS) and identified with survey lath stakes for future reference. The sampling design includes collection of 10-point composite surface soil samples from the top 6 inches within each 2,000-square foot area using a hand trowel. Soil samples will be field screened using visual and olfactory observations and a PID to identify VOCs, in accordance with a QAPP, which supplements this SAP. Each 10-point composite sample will be submitted for laboratory analysis. In addition to the composite sampling plan, discrete grab samples of any wet or discolored areas may be collected at the discretion of the NMOCD, a representative of which will be present to observe all sampling.

To achieve vertical delineation, LTE proposes a discrete sampling program more consistent with the site characterization sampling requirements required by NMOCD and defined in 19.15.29.11 NMAC. Discrete subsurface soil will be collected using a hand auger in accordance with the QAPP at a depth of at least 1-foot bgs from the center of the wash or release path footprint of every other 2,000-square foot area. Based on visual observations and field screening results, the release impacted soil along 7,400 linear feet of the wash. Discrete subsurface soil sampling locations collected approximately every other 2,000-square foot area equates to one borehole every 165 linear feet in the washes and will define any existing vertical impacts. Soil samples will be field screened by an LTE geologist using visual and olfactory observations and a PID to identify VOCs. Each soil boring will be advanced deeper should field screening

indicate PID results exceed 100 parts per million (ppm). In boreholes exceeding 1 foot bgs in depth, two samples from the borehole will be submitted for laboratory analysis: one sample from the interval with the highest field screening result and one sample from total depth of the borehole.

An estimated 90 composite surface soil samples and 45 discrete subsurface soil samples will be collected from the impacted surface area upgradient of the last containment (Dam 5). At the request of the NMOCD, an additional two 2,000-square foot areas will be composite sampled downgradient of Dam 5 and one subsurface soil sample location will be collected downgradient of Dam 5. During the proposed soil sampling event, field personnel will walk the wash downgradient from the last containment (Dam 5) with the NMOCD and collect any additional discrete surface samples using a hand trowel based on visual observations of staining. The project location is depicted on Figures 1 through 3. Proposed soil boring locations are depicted on Figure 4.

A field duplicate sample will be collected every 20 samples. Trip, field, and rinsate blank samples will be collected and submitted as detailed in the QAPP. An estimated total of seven field duplicate samples will be collected, or approximately five percent of the total number of samples collected.

Soil samples will be submitted to Hall Environmental Analysis Laboratory of Albuquerque, New Mexico, for analysis of BTEX by EPA Method 8021, TPH by EPA Method 8015, and chloride by EPA Method 300.0. Samples will be submitted under standard chain-of-custody procedure and analyzed within a standard turnaround time. Prior to any soil sampling, 48-hour notification will be provided to the NMOCD.

Groundwater impact is not anticipated as soil contamination is expected be confined to the top 2 feet of soil. However, should groundwater be encountered in a borehole, or contamination exceed 10 feet bgs, this SAP may be modified to include groundwater sampling following discussions with regulators.

3.2 SCHEDULE

The proposed characterization and confirmation soil sampling event will take place within two weeks of the approval of this SAP, weather dependent. A sampling results summary report and additional remediation work plan, if necessary, will be submitted to the NMOCD within four weeks after receipt of laboratory analytical results. When analytical results from sampling activities indicate soil has been remediated, Enduring will provide the NMOCD with a final closure request.

3.3 PROJECT CONSTRAINTS

Adequate levels of personnel, equipment, and subcontractors have been assigned to this project to ensure that the schedule milestones are met. It is anticipated that assessment activities and work tasks described in this SAP will be completed in accordance with the project schedule.

4.0 DATA QUALITY OBJECTIVE PROCESS

4.1 DATA QUALITY OBJECTIVES

As discussed in the QAPP, DQOs have been developed for sampling and analysis activities. DQOs are qualitative and quantitative statements which define data quality requirements based on the identified end-use of the data. These objectives may be re-evaluated as additional information is collected and data needs are further defined. Data acceptance criteria such as precision, accuracy, representativeness, comparability, and completeness are addressed in the QAPP.

Specific DQOs have been developed for the various sampling activities proposed for this project. DQOs are indicated in Table 1 for soil samples collected during the assessment. Analytical methods have been selected to have the sensitivity needed to achieve detection limits at or below action levels. Samples have been selected to be representative of contamination that might be present based on the composition of wellbore fluids and the requirements of NMOCD.

TABLE 2: DATA QUALITY OBJECTIVES – SOIL ASSESSMENT

Data Quality Objective	Project-Specific Action
State the Problem	On February 17, 2019, during flowback operations, a cam lock on an aboveground pipeline at the production site failed, resulting in liquids flowing off site and under an access road through culverts to an area of level topography where the fluids ran as sheet flow until channeling into a nearby drainage. This unnamed drainage is a second-order tributary to Escavada Wash, located approximately 1.25 miles to the east-northeast. Approximately 1,400 bbls of flowback fluids were released, of which 300 bbls were estimated to be crude oil. Between March 6 and 26, 2019, a total of 2,200 cubic yards of soil were removed via excavation, a total of 1,342 bbls of sludge was removed from the wash and underflow dam areas, and a total of 3,900 bbls of liquids have been recovered from the wash. However, the extent of residual soil contamination is unknown. The intent of this SAP is to determine the lateral and vertical extent of residual soil contamination, assess effectiveness of remediation activities conducted to day, and to provide information for additional remediation should it be necessary.
Identify the Decision	Composite soil sampling locations have been selected as depicted on Figure 4 and discrete subsurface samples will be collected within every other 2,000 square foot composite sampling location for chemicals of concern (COCs) in accordance with NMOCD regulations for both site characterization and closure evaluation for the release of fluids from the wellbore. Soil samples will be obtained from surface and subsurface soil, analyzed for the COCs, and compared to *Closure Criteria for Soils Impacted by a Release* (NMAC 10.15.29 Table 1).

Data Quality Objective	Project-Specific Action
Identify Inputs to the Decision	Soil samples selected for analysis will be analyzed for the following. • BTEX by EPA Method 8021B or 8260B; • TPH by EPA Method 8015M; and • Chloride by EPA Method 300.0. If groundwater is encountered in shallow borings, grab samples will be collected for analysis of the following. • BTEX by EPA Method 8021B or 8260B and • Chloride by EPA Method 300.0. Hall Environmental Analysis Laboratory will be used to perform these analyses.
Identify Inputs to the Decision	Soil laboratory analytical data will be compared to NMAC 19.15.29 Table 1 *Closure Criteria for Soils Impacted by a Release* for groundwater at less than or equal to 50 feet. Any groundwater laboratory analytical data will be compared to water quality standards for interstate and intrastate surface waters in New Mexico in 20.6.4 NMAC.
Define the Study Boundaries	The locations of the soil sample locations have been selected based on knowledge of the location of the release and observed visual observations and remediation activities as determined during emergency response actions.
Develop a Decision Rule	Surface soil samples will be collected from a depth of 0 to 6 inches based on a grid sampling design and composited for analysis. Subsurface soil samples will be collected from the center of each grid at a depth of 1-foot bgs. For subsurface soil, if visual or field screening indicates impacts exist at the 1 foot bgs depth, then the boring will be continued until visual and PID readings indicate no impact, and an additional sample will be collected. In boreholes exceeding 1 foot bgs in depth, two samples from the borehole will be submitted for laboratory analysis: one sample from the interval with the highest field screening result and one sample from total depth of the borehole. Additional soil samples may be collected based on field screening by visual and olfactory means, screening with a PID, or under direction of the NMOCD representative on site.
Specify Limits on Uncertainty	To reduce the limits of uncertainty and maintain a high level of accurate data, all equipment used during this project will be calibrated and operated in accordance with the proper SOPs included in the QAPP. In addition, dedicated sampling equipment will be used where feasible to limit introduction of contamination. Limitations of laboratory uncertainty are addressed in the Quality Assurance

Data Quality Objective	Project-Specific Action
	Manual for Hall Environmental Analysis Laboratory, which is kept on file at the laboratory.
Optimize the Design for Obtaining Data	Sampling locations and analyses have been selected to better understand the vertical and horizontal extent of potential contaminants in soil so closure can be achieved or additional remediation can be proposed. Sample locations may be modified based on field observations. Impacts to groundwater are not anticipated. If soil sampling indicates that contamination has infiltrated to the extent that groundwater may be impacted (i.e., greater than 10 feet bgs), then this SAP may be modified to address impacts to groundwater.

4.2 ACTION LEVELS AND DETECTION LIMITS

Analytical methods are specified in 19.15.29 NMAC, Oil and Gas Releases, as are action levels. Contaminant concentrations that exceed the applicable criterion will be evaluated to determine if additional investigation or remediation is needed.

The laboratory will report "J" values if Method Detection Limits (MDL) are exceeded. Non-detects will be reported at the MDL.

4.3 RANGE OF ANTICIPATED CONCENTRATIONS

Emergency response actions have removed visible contamination, therefore the range of concentrations is expected to be within the laboratory instrument capability. If concentrations are identified in the project samples which exceed instrument calibration ranges, the samples will be diluted and analyzed within the calibrated range of the instrument.

4.4 SPECIALIZED TRAINING

All LTE field personnel have Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) certification and have training on appropriate methods for sample collection based on SOPs. The LTE PM is responsible for ensuring field personnel have the appropriate training.

4.5 DOCUMENTATION AND RECORDS

In the final reports, all data generated for the project will be reconciled with the DQOs presented in this SAP to determine whether the DQOs were attained. The final reports will describe how issues were resolved and limitations on the use of the data. The reports will also summarize procedures used to define data usability and the results of these procedures.

4.5.1 Reports

LTE will prepare a detailed report summarizing the field activities and results of the work completed. The report will include an introduction, background, methodology, results, discussion, and conclusions. LTE will provide documentation in hard copy or electronic format. All laboratory reports will follow the standard laboratory reporting format as discussed in the Laboratory Quality Manual for Hall Environmental Analysis Laboratory. In addition to the laboratory's standard reports, the following information will be provided by the laboratory:

- Analytical results for method blanks and trip blanks, as appropriate to the method;
- Surrogate recoveries and QC acceptance limits;
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) amounts spiked, recoveries, relative percent differences (RPDs), and QC acceptance limits; and
- Matrix spike/matrix spike duplicate (MS/MSD) amounts spiked, recoveries, RPDs, and QC acceptance limits, and, although, the QAPP does not indicate dry weight or wet weight, the results will be reported on a dry weight basis.

4.5.2 File Maintenance

The LTE PM will be responsible for file maintenance and data management on this project. Microsoft Office® software will be used to manage data and produce deliverables to the client. After each day of field data collection, the LTE PM will review the collected data to ensure field activities are being conducted in accordance with project objectives and the SAP/QAPP. Field data is collected and recorded in a field logbook and on standardized forms (i.e., asbestos sampling form). Field logbook entrees will be made in accordance with SOPs.

LTE will scan and archive field notes, laboratory reports, QA/QC procedures and checklists, reports, and other relevant information electronically for a duration of at least three years. Files will be stored electronically on a company server. Files are backed up daily on a separate server in the event of a company server disruption or crash. Files will be available upon request. LTE's stores electronic files in an organized manner, relative to the client, project, task, and subtask, as applicable.

4.5.3 Report Delivery

The Enduring PM will ensure each officer, leader, and the LTE PM has the most current copy of the approved QAPP and SAP. The LTE PM will ensure each LTE team member, including subcontractors, has received all updated and revised QAPPs and SAPs during the duration of the project.

5.0 DATA GENERATION AND ACQUISITION

The scope of this SAP is to present the procedures which will ensure all data generated are scientifically valid, defensible, and of known precision and accuracy. The SAP describes procedures and specifications that will be followed to support the collection of data which are of satisfactory quality. Adherence to these procedures will ensure the integrity of the samples collected is maintained, no sampling-related cross-contamination occurs, and laboratory results will be representative of the actual site conditions.

The FL will keep the LTE PM informed of all on-site activities during the site assessment. Corrective action will be initiated by the LTE PM when problems occur, and all incidents will be documented by the FL in the field logbook.

5.1 SAMPLING DESIGN

5.1.1 Soil Assessment

Figure 4 depicts the expected locations of the proposed soil sampling locations. Table 2 presents the rationale for each soil sampling location.

Borehole sampling may result in variability due to heterogeneous contaminant distribution. However, judgmental sample design has been selected to increase the potential for determining the prevailing concentrations of COC within the impacted area.

TABLE 3: PROPOSED SOIL SAMPLING LOCATION RATIONALE

Type of Sample	Location	Rationale
Surface soil sample	Tributary Channel and Sheet Flow Area	To assess the residual impact following initial release response activities conducted after the flow of the release liquids in the tributary channel. Due to the size of the affected area and to comport with the closure requirements and practices of the NMOCD, the channel was segmented into 2,000-square foot grids. Sample collection is based on a 10-point aliquot within each grid. Grid sampling will provide adequate coverage of the area of concern and detect both areas that have been remediated and can be closed as well as areas requiring more work. Composite sampling across those grid spacings will produce Composite sampling is an acceptable method in this instance to identify areas of the tributaries that exhibit concentrations exceeding NMOCD Table 1 Standards (rare trait). The bed of the wash is largely homogenous in lithology.
Subsurface soil samples	Tributary channels and Sheet Flow Area	To assess the vertical impact from the flow of the release in the tributary channel. The channel was segmented into 2,000-square foot grids. Every other grid area along the tributary will be

Type of Sample	Location	Rationale
		investigated with a borehole. Sample collection is based on a 1-foot boring in the center of the wash and/or liquid release path. The samples will be collected at regularly spaced intervals. The grid spacing is designed to analyze for the presence of residual contamination at depth and the coverage of the area of concern will detect areas that contain soil exceeding NMOCD Table 1 Standards.
Surface soil samples	Tributary Channels and Sheet Flow Area	To assess the impact of the release downgradient from the last containment (Dam 5), additional discrete samples (using a hand auger and/or hand trowel) will be collected based on visual observations of staining and judgmental sampling criteria by NMOCD and LTE.

5.1.2 Sampling and Analytical Methods

As referenced in the QAPP, approved analytical methods from the most recent version of EPA publication SW-846, entitled *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, will be used for analysis of soil and water samples.

5.1.3 Soil Sampling

As referenced in the QAPP, SOPs for collection of soil samples using a hand trowel or a hand auger will be followed.

Duplicate samples collected at a frequency of five percent (one duplicate sample per 20 samples) will be analyzed for BTEX, TPH, and chloride. In addition to duplicate samples, field blanks, trip blanks, and equipment rinsate blanks will be collected in accordance with the QAPP.

5.2 SAMPLE CONTAINERS AND PRESERVATIVES

Sample preservation will be used to prevent or retard the degradation or modification of chemical compounds during transit and storage prior to laboratory extraction and analysis. Necessary preservatives will be selected by the laboratory based on the type of sample and required analyses. Preservatives will be added to containers by the laboratory prior to sampling. Laboratory tests will be performed within the maximum holding times established by the laboratory method and sample preservation procedure.

Samples will be packaged and preserved for analysis in accordance with Table 3. Turn-around time for sample analysis and reporting is 10 business days.

TABLE 4: SAMPLE VOLUMES, CONTAINER TYPES, AND PRESERVATION

Parameter	Analytical Method/Sample Medium	Number – Sample Volume and Container Type*	Preservation	Holding Time**
BTEX	8021A or 8021B/Soil	One 4-ounce glass jar	≤6˚C	14 days
TPH	8015M/Soil	One 4-ounce glass jar	≤6°C	14 days
Chloride	EPA 300.0	One 4-ounce glass or plastic jar	None	28 days

Notes:

** - Sample volume and container type determined by laboratory standards.*

*** - Holding times begin from the time of sample collection in the field.*

L – Liter

mL – Milliliter

BTEX – benzene, toluene, ethylbenzene, xylenes

TPH - Total Petroleum Hydrocarbons

≤ – Less than or equal to

°C – degrees Celsius

5.3 SAMPLE NUMBERING

Each sample will be assigned a unique identification code based on the sample location. Depending upon field conditions, the exact order and numbering of samples may vary slightly. Deviations will be noted in the field records and in subsequent field sampling reports.

The following numbering scheme will be used.

- Soil Sample:
  - SB-(Boring Number)-Sample depth in feet OR SA (Sample Aliquot) – Grid number
  - Sample number SB-01-1 would be for a soil sample from soil boring number one from a depth of 1 foot bgs; SA-12 would be for a 10-point surface aliquot sample collected from grid 12.

- Field Duplicate:
    - SB-A(B,C, etc.) or SA-A(B,C, etc.) and the unique letter identifier will be recorded by sample collector in the field book so as to withhold the corresponding field duplicate sample name from the laboratory.
- Field Blank:
    - FB-date
- Rinsate Blank:
    - RB-date
- Trip Blank:
    - TB-date

5.4 CHAIN-OF-CUSTODY FORMS

Chain-of-custody procedures are intended to document sample possession from collection to disposal in accordance with federal guidelines. For the purpose of these procedures, a sample is considered in custody if it meets any of the following criteria:

- In one's actual possession;
- In view, after being in physical possession;
- In a locked vehicle or room so that no one can tamper with the samples, after having been in physical custody; or
- In a secured area with restricted entrance.

A chain-of-custody record, supplied by the contracted laboratory, will be used to document and track possession of the samples. The chain-of-custody record will be sent with each sample shipment from the field to the laboratory and will serve as a record for the receipt of samples by the laboratory.

Within 24 hours of sample receipt, the laboratory will send the LTE FL a sample acknowledgement electronic mail with a copy of the executed chain-of-custody form. The FL will review the completed chain-of-custody form to ensure that the appropriate samples, types, methods, and quantities are consistent with the SAP.

5.5 SAMPLE LABELING, CUSTODY SEALS, PACKING AND SHIPPING

Sample container labeling will be performed as outlined in the QAPP. Custody seals are required to be affixed to all shipping containers. Sample packing and shipping will be performed as outlined in the QAPP.

5.6 SAMPLE LOCATION SURVEY

A handheld Trimble GPS unit with submeter accuracy will be used to mark the latitude and longitude of each sample aliquot and soil boring location.

5.7 FIELD NOTES

Written field records will be the primary source for sample information. Information concerning the sampling event will be recorded and kept in a field notebook. The person responsible for the entries will sign and date each entry. Field records will contain sufficient information to reconstruct the sampling event, if necessary. Field records will be kept in a field team member's possession or in a secure place during the period of the investigation. The PL or an approved designee is responsible for checking work performance and verifying that the applicable tasks required by this procedure have been performed. At the conclusion of the investigation, field records will become part of the file for the project. Additional details regarding field records can be found in the QAPP.

5.7.1 Field Logbook

Field logbook information is outlined in the QAPP.

5.7.2 Photographs

Key field activities will be photographed and conducted as outlined the QAPP.

5.8 DECONTAMINATION PROCEDURES

Reusable sampling equipment (e.g., scoops, spoons, bowls, etc.) will be stainless steel or a material that is compatible with the specified analysis. Sampling equipment will be decontaminated before the start of sampling and after each discrete sample is collected. Decontamination procedures as outlined in the QAPP will be followed.

IDW will be characterized, profiled, and managed for disposal as described in the QAPP.

6.0 ANALYTICAL REQUIREMENTS

Analyses of soil will be in accordance with the QAPP and the laboratory's internal QA plan. Laboratory analyses will achieve detection limits that are appropriate for the sample medium and that are at or below the applicable closure criteria.

If the analytical data are determined to be unreliable or incomplete, the laboratory is responsible for correcting the errors. If the laboratory cannot provide data of adequate accuracy and precision, the samples may need to be recollected.

A sample analysis matrix is included in Table 5.

TABLE 5: SAMPLE ANALYSIS MATRIX

Sample Medium	Field Methodologies	Number of Environ-mental Samples	Sample Turn-around Times (days)	Total Number of Samples						
				Lab QA/QC		Field QA/QC				
				MS/MSD	Other (MB, LCS, LCS/LCSD)	Field Duplicate	Field Blanks	Trip Blanks[1]	Equipment Rinsate Blanks[2]	Total Number of Samples
Soil Assessment										
Surface Soil	Hand trowel	90	10-14	5	5	5	1	3	1	108
Soil	Hand auger	45	10-14	3	3	3	1	3	1	59
Groundwater										
Water	IDW	1	5-10	0	1	0	0	0	0	1

***Notes**:*
1 –Trip blank required for VOCs only and GRO if TPH is added
2 – Dedicated equipment will be used for sampling
GW – Groundwater
MS – Matrix Spike
MSD – Matrix Spike Duplicate
MB – Method Blanks
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
QA/QC – Quality Assurance/Quality Control

Samples will be sent to the same analytical laboratory, thereby improving comparability of analytical results and including consistent reporting units, standardized analytical methods, and a standard data format.

Soil sample results will be reported on a dry unit weight basis. Therefore, the moisture content of each sample will be determined by the laboratory. The laboratory will provide a sample analytical report detailing individual sample and associated laboratory QA/QC data. This data will include all sample analytical datum, as well as method-specific and internal precision and accuracy values for blanks, duplicates, spikes, and laboratory reference materials. LTE's subcontracted laboratories are certified and accredited for the analytical methods included in this SAP.

Field data evaluation will be conducted in accordance with the QAPP. Data verification will be conducted on laboratory analysis reports to ensure that the laboratory QC requirements have been fulfilled and that the data are acceptable for use. Data evaluation will be conducted by QAM. As part of report preparation, consistency reviews will be conducted to ensure that data on laboratory reports are consistent with data summary tables and data presented in the narrative sections of the report. Laboratory analysis turn-around times will be 14 business days.

7.0 INSTRUMENT TESTING, CALIBRATION AND MAINTENANCE

Field equipment to be used on this project may include the following:

- Hand trowel
- Hand auger
- Resealable plastic bags
- Decontamination supplies (deionized water, Alconox®, brushes, paper towels, etc.)
- PID Unit;
- GPS Unit

The LTE FL is responsible for preventative maintenance of field instruments used on this project. Field instruments will be transported and stored in protective cases or boxes during sampling activities. Field equipment will be cleaned, calibrated, and maintained before and after each use in accordance with the manufacturer's operation and maintenance requirements. Necessary repairs will be performed by qualified individuals or by factory-trained technicians immediately after any defects are observed and before the equipment is used again. Equipment parts with a limited life (for example, batteries, lamps, calibration solutions, etc.) will be periodically checked and replaced or recharged as necessary in accordance with the manufacturer's specifications. Calibration and preventative maintenance will be conducted as specified in the QAPP.

8.0 DISPOSAL OF INVESTIGATION DERIVED WASTES

IDW generated during the assessment activities will likely include the following:

- Sampling equipment (i.e., personal protective equipment [PP]E); and
- Decontamination water.

The IDW will be managed in accordance with the QAPP. LTE's subcontracted laboratories will dispose of the remainder of the samples after the analytical hold time has expired.

9.0 QUALITY CONTROL PROCEDURES

QC procedures are in place to verify the DQOs are effectively implemented.

9.1 FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Field QC samples will be collected, analyzed, and evaluated as described in this SAP and the QAPP. The QC samples will be collected and sent to Hall Environmental Analysis Laboratory for analysis.

9.1.1 Field Replicates

Field replicates will be collected at a frequency of five percent to evaluate analytical accuracy. Replicate samples will be collected, sealed, handled, stored, shipped, and analyzed in the same manner as the primary sample. Precision of replicate results will be calculated using the RPD method in the QAPP. For this project, acceptable RPDs are less than (<) 50% for soil samples.

9.1.2 Trip Blanks

Trip blanks are used to assess contamination introduced into the sample by VOCs during transport of samples. Three trip blanks will be prepared by the laboratory and taken to the field in a sealed sampling container. The trip blank will remain each sealed container with the soil samples to be analyzed for VOCs until the blank is analyzed along with the samples at the laboratory.

9.1.3 Equipment Rinsate Blanks

Equipment rinsate blanks provide evidence that sampling equipment has been adequately decontaminated and will be collected at a frequency of five percent of the total samples collected for sampling equipment that is reused.

9.2 LABORATORY CONTROL SAMPLES

The analytical laboratory assumes responsibility for sample integrity and providing quality data in accordance with its internal QA plan. The analytical reports from Pace Analytical will provide a summary of the performed QA/QC tests.

9.3 QC REVIEW

Project deliverables will be reviewed by the LTE QAM. The LTE QAM has the requisite knowledge, experience, and credentials to review deliverables that contain data, evaluations, conclusions, and recommendations.

10.0 DATA MANAGEMENT

The LTE FL will be responsible for data management on this project. Microsoft Office software will be used to manage data and produce deliverables to the client. After each day of field data collection, the LTE PM will review the collected data to ensure that field activities are being conducted in accordance with project objectives and the SAP.

Field data is collected and recorded in a field logbook and on standardized forms. On a daily basis, all field-generated data (e.g., field logbook entries and completed forms) will be scanned into the LTE project folder on the LTE network drive. LTE uses a standardized folder system to store electronic files in an organized manner. On a daily basis, information stored on LTE's local network drive is automatically backed up.

Hall Environmental Analysis Laboratory will submit final laboratory reports to LTE in Adobe Acrobat electronic file format with an electronic data deliverable (EDD) file in Adobe® PDF format. Both files are uploaded by the PM, or designee, into the respective data folders on the LTE network file system. Upon receipt from the laboratory, the LTE PL, or designee, will review the laboratory analysis report to ensure that the correct analyses are performed and that all results, including appropriate QC documentation, are received. In addition, QC documentation will be reviewed and checked for usability. Corrective action will be initiated for any data deemed unusable and may include re-sampling or re-analysis.

11.0 ASSESSMENT AND OVERSIGHT

11.1 ASSESSMENTS AND RESPONSE ACTIONS

The LTE PM will monitor the performance of project activities to ensure that information is reliable, collected as outlined in the SAP and QAPP, and maintained and documented with integrity. Should an unsatisfactory condition be determined during the project monitoring, then the LTE PM will notify the PL and with concurrence, will order a stop-work until the problem is reconciled.

11.2 REPORTS TO MANAGEMENT

Unsatisfactory conditions and their corrective measures will be recorded and issued to the PL and maintained in the project file. Any nonconformance with the established QC procedures will be identified and corrected. Each nonconformance condition will be summarized in the final report submitted to the PL.

12.0 DATA EVALUATION AND USABILITY

12.1 DATA REVIEW, VERIFICATION AND EVALUATION

The QAM will conduct a review of the field and laboratory data to determine conformance with the project-specific DQOs, sampling design and quality procedures. Field QA samples will be evaluated to ensure that sample results conform to the quality parameters defined in the SAP. QAM will evaluate the following QC items.

- Samples collected and analyses completed (completeness)
- Holding times (accuracy)
- Method and field blanks (accuracy)
- Surrogate recoveries (accuracy)
- LCS recoveries (accuracy)
- MS/MSD recoveries (accuracy)
- LCS/LCSD RPDs (precision)
- MS/MSD RPDs (precision)
- Field duplicated RPDs (precision)
- Laboratory duplicate RPDs (precision)
- Rejected analytical data points, if any (completeness)

12.2 VERIFICATION AND USABILITY METHODS

Data collected during this project will be collected according with this SAP. Any apparent data collection errors will be identified by evaluation of adherence to sampling procedures and evaluation of the data compared to expected results based on historical activities.

12.3 RECONCILIATION WITH USE REQUIREMENTS

DQOs for this project are to determine the presence or absence of contamination that may have resulted from historical activities on or off the project. Data will be reviewed to resolve any potential issues. Based on the data review, the data may be accepted, qualified, or rejected by the QAM, with concurrence of the LTE PM and the PL.

13.0 FIELD SAFETY AND HEALTH PROCEDURES

A HASP has been developed for work completed under this SAP. The HASP has been prepared in accordance with the OSHA 29 CFR 1910.120, entitled *Hazardous Waste Operations and Emergency Response*. In addition, a Job Safety Analysis (JSA) will be completed at the start of field activities and will be updated at any time there is a change in conditions. The HASP and JSA are available from the LTE PM.

14.0 REFERENCES

Stone, W.J., Lyford, F. P., Frenzel, P.F., Mizell, N.H. and Padgett, E.T., 1983, *Hydrogeology and Water Resources of the San Juan Basin*, New Mexico: HR-6 New Mexico Bureau of Geology and Mineral Resources Hydrology Report 6.

USGS, Groundwater Atlas of the United States: Arizona, Colorado, New Mexico, Utah, HA 730-C: (http://www.pubs.usgs.gov).

FIGURES

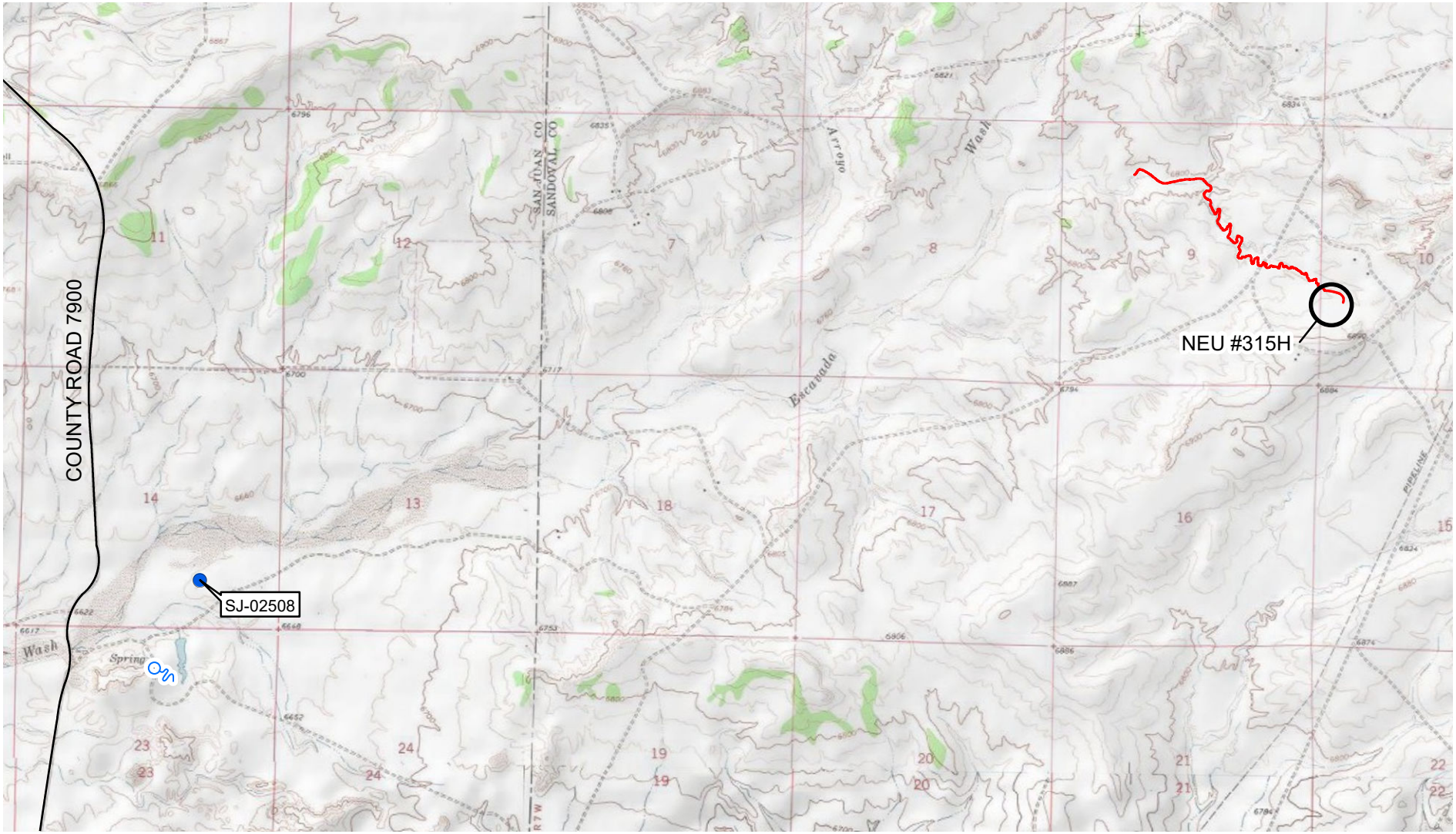

IMAGE COURTESY OF ESRI

LEGEND

- SITE LOCATION
- SPRING
- WATER WELL
- RELEASE PATH

0 5,000 10,000 Feet

N

NEW MEXICO

FIGURE 1
SITE LOCATION MAP
NEU #315H
SEC 9 & 10 T22N R7W
SANDOVAL COUNTY, NEW MEXICO
ENDURING RESOURCES, LLC

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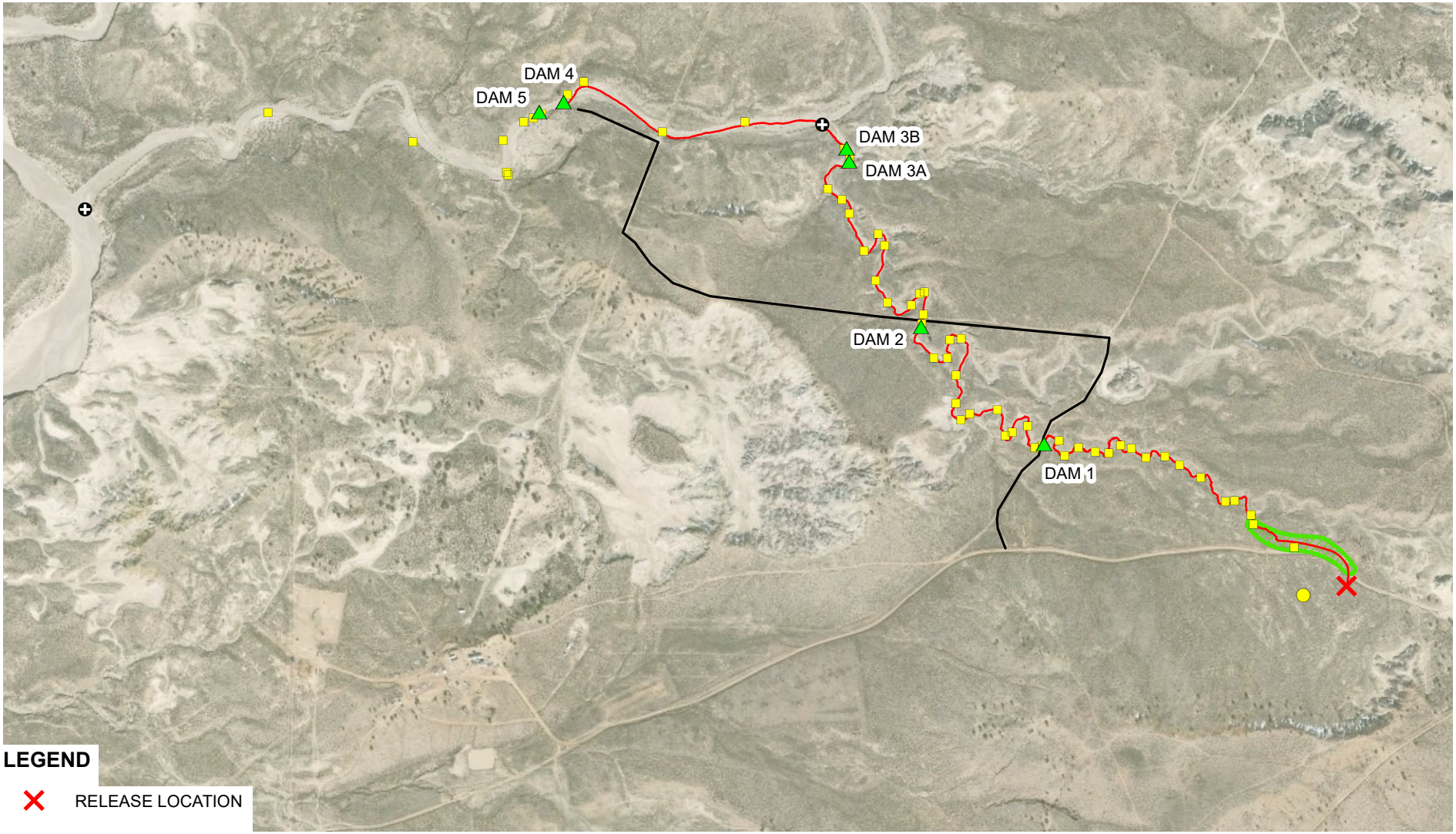


IMAGE COURTESY OF ESRI

LEGEND

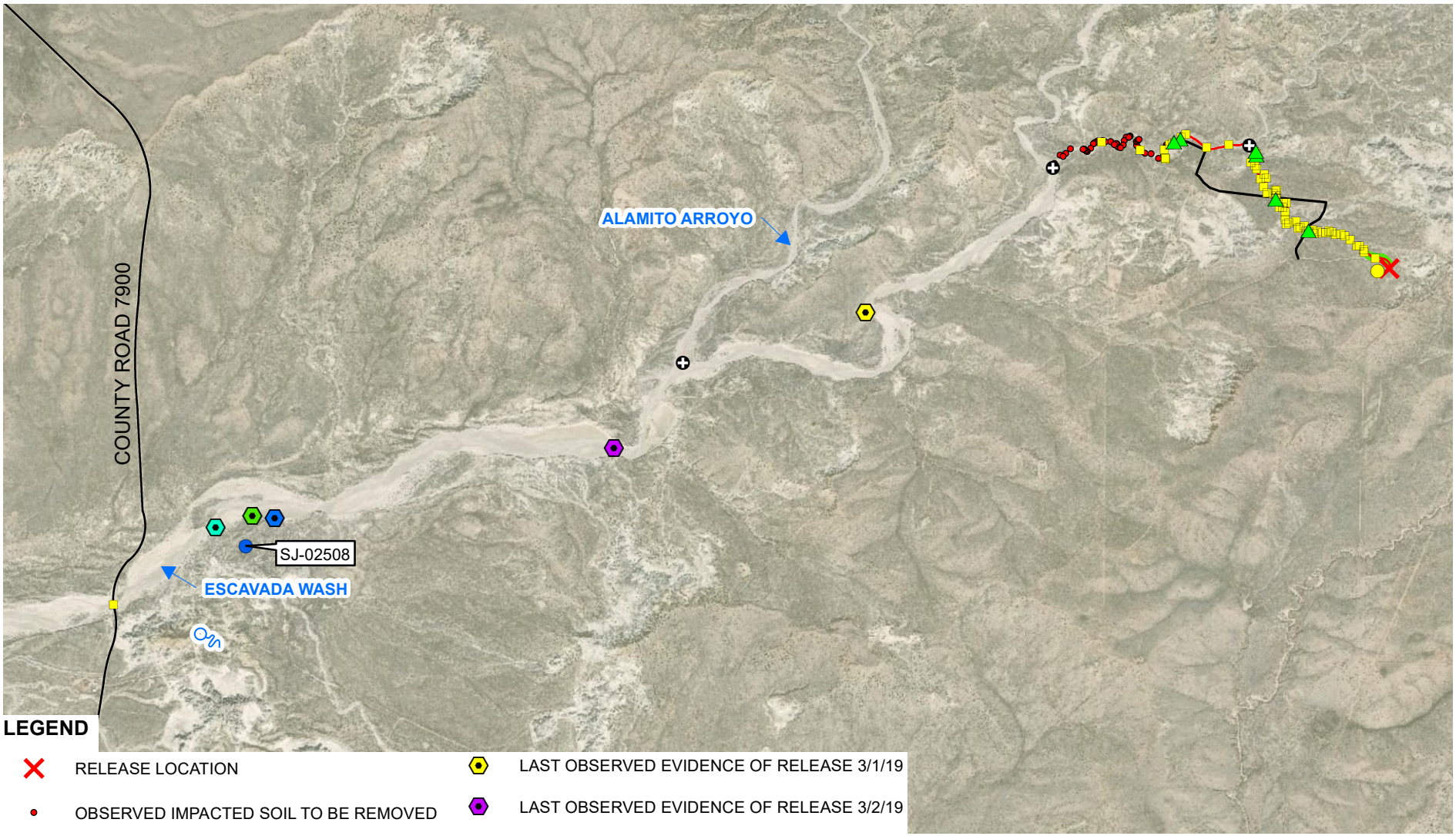
- RELEASE LOCATION
- OIL ABSORBENT BOOM
- CONFLUENCE
- DAM
- NEU #315H WELLHEAD
- RELEASE PATH
- IMPROVED 2-TRACK ROAD
- SHEET FLOW AREA

0 800 1,600
Feet

N

FIGURE 2
SITE MAP
NEU #315H
SEC 9 & 10 T22N R7W
SANDOVAL COUNTY, NEW MEXICO
ENDURING RESOURCES, LLC

P:\Enduring Resources\GIS\MXD\077919003_NEU 315H\077919003_FIG02_SITE_ZOOM_190326.mxd



LEGEND

- RELEASE LOCATION
- OBSERVED IMPACTED SOIL TO BE REMOVED
- BOOM
- CONFLUENCE
- DAM
- NEU 315H WELLHEAD
- SPRING
- WATER WELL
- LAST OBSERVED EVIDENCE OF RELEASE 3/1/19
- LAST OBSERVED EVIDENCE OF RELEASE 3/2/19
- LAST OBSERVED EVIDENCE OF RELEASE 3/3/19
- LAST OBSERVED EVIDENCE OF RELEASE 3/7/19
- LAST OBSERVED EVIDENCE OF RELEASE 3/18/19
- RELEASE PATH
- IMPROVED 2-TRACK ROAD
- SHEET FLOW AREA

NOTE: LAST OBSERVED EVIDENCE OF RELEASE 3/1/19 DEFINED BY OIL GLOBULES ACCUMULATED ON VEGETATION.

IMAGE COURTESY OF ESRI

0 3,000 6,000
Feet

N

FIGURE 3
SITE MAP - EXPANDED VIEW
NEU #315H
SEC 9 & 10 T22N R7W
SANDOVAL COUNTY, NEW MEXICO
ENDURING RESOURCES, LLC

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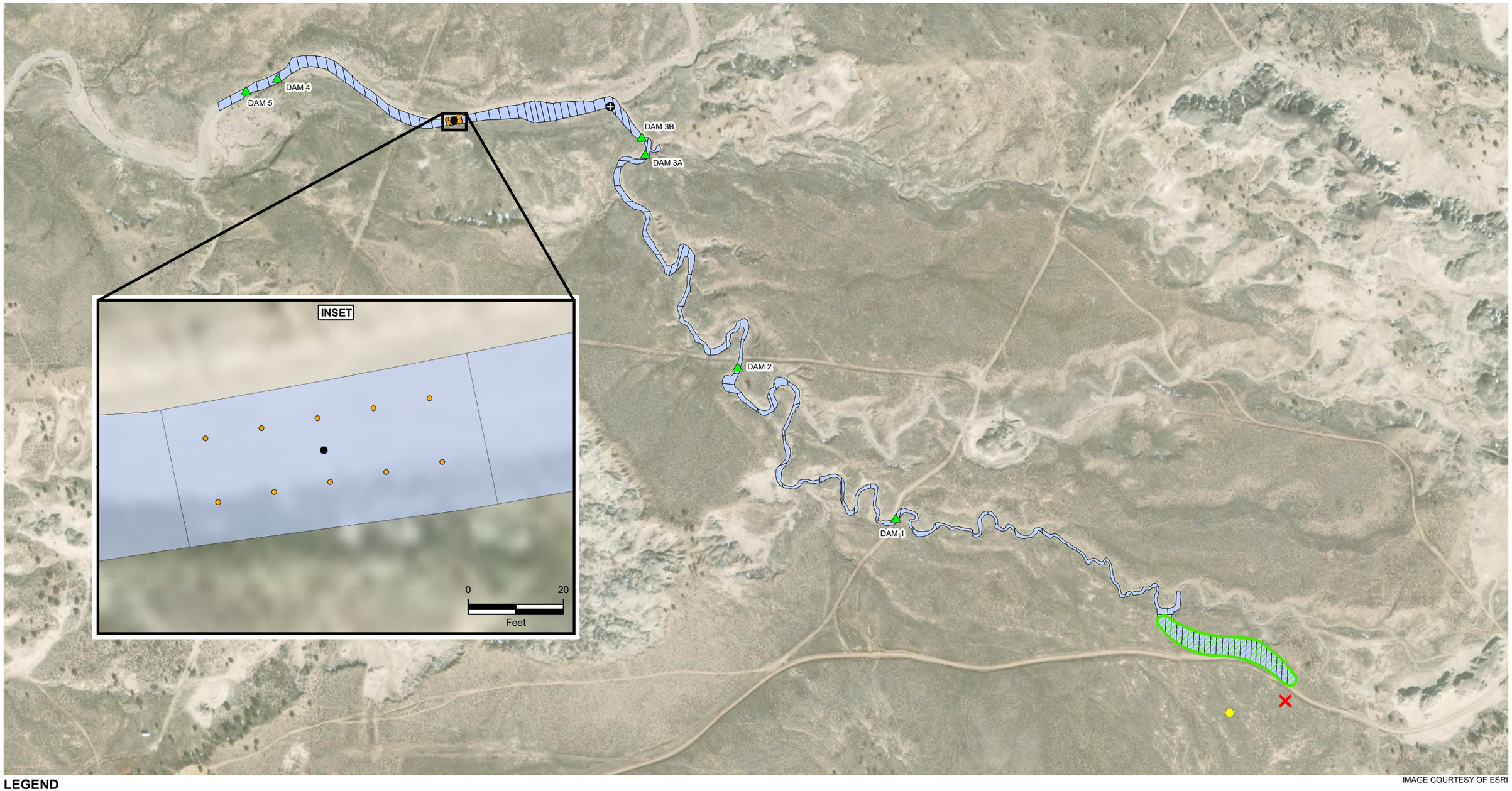

IMAGE COURTESY OF ESRI

LEGEND

- RELEASE LOCATION
- COMPOSITE SOIL SAMPLE ALIQUOT
- DISCRETE SOIL BORING
- DAM
- NEU #315H WELLHEAD
- CONFLUENCE
- SAMPLING AREA (APPROXIMATELY 2,000 SQUARE FEET)
- SHEET FLOW AREA

0 400 800
Feet

N

FIGURE 4
PROPOSED SOIL SAMPLING MAP
NEU #315H
SEC 9 & 10 T22N R7W
SANDOVAL COUNTY, NEW MEXICO
ENDURING RESOURCES, LLC

P:\Enduring Resources\GIS\MXD\077919003_NEU 315H\077919003_FIG04_SAMPLE_LOC_11X17.mxd

District I
1625 N. French Dr., Hobbs, NM 88240
District II
811 S. First St., Artesia, NM 88210
District III
1000 Rio Brazos Road, Aztec, NM 87410
District IV
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico
Energy Minerals and Natural Resources Department

Oil Conservation Division
1220 South St. Francis Dr.
Santa Fe, NM 87505

Form C-141
Revised August 24, 2018
Submit to appropriate OCD District office

Incident ID	
District RP	
Facility ID	
Application ID	

Release Notification

Responsible Party

Responsible Party: **Enduring Resources**	OGRID: **372286**
Contact Name: **James McDaniel**	Contact Telephone: **505-444-3004**
Contact email: **jmcdaniel@enduringresources.com**	Incident # *(assigned by OCD)* **NCS-1905249442**
Contact mailing address: **200 Energy Court**	**Farmington, New Mexico 87401**

Location of Release Source

Latitude **36.151204** Longitude **-107. 570666**
(NAD 83 in decimal degrees to 5 decimal places)

Site Name: **N Escavada Unit 315H**	Site Type: **Wellsite**
Date Release Discovered: **2/17/2019**	API# *(if applicable)* **30-043-21888**

Unit Letter	Section	Township	Range	County
L	**10**	**22N**	**7W**	**Sandoval**

Surface Owner: ☐ State ☒ Federal ☐ Tribal ☐ Private (*Name:* _____)

Nature and Volume of Release

Material(s) Released (Select all that apply and attach calculations or specific justification for the volumes provided below)

☒ Crude Oil	Volume Released (bbls) **300 BBLS**	Volume Recovered (bbls): **100 BBLS**
☒ Produced Water	Volume Released (bbls): **1,100 BBLS**	Volume Recovered (bbls): **0 BBLS**
	Is the concentration of dissolved chloride in the produced water >10,000 mg/l?	☐ Yes ☒ No
☐ Condensate	Volume Released (bbls)	Volume Recovered (bbls)
☐ Natural Gas	Volume Released (Mcf)	Volume Recovered (Mcf)
☐ Other (describe)	Volume/Weight Released (provide units)	Volume/Weight Recovered (provide units)

Cause of Release
On 2/17/19, a contractor noticed a release coming from a damaged 6" transfer line that was transferring flowback liquids to the WEU 300H Recycling Facility. The line had an integrity failure, releasing approximately 1,400 bbls of flowback liquids into the bar ditch along the road. Approximately 300 bbls of the liquid was oil, and the rest of the liquid was produced water, based on percentages that were being seen in the flowback tanks. The flowback fluid then traveled along the bar ditch and into a small drainage feature, heading away from the location. The fluids flowed in the drainage feature for approximately 1.4 miles, before entering a larger, unnamed tributary of Escavada Wash. The total distance was 1.66 miles. A dam was built at the end of the spill area, stopping the downstream migration. Cleanup activities re underway.

State of New Mexico
Oil Conservation Division

Incident ID	
District RP	
Facility ID	
Application ID	

Was this a major release as defined by 19.15.29.7(A) NMAC? ☒ Yes ☐ No	If YES, for what reason(s) does the responsible party consider this a major release? **The volume of fluids released is 1,400 bbls, and the volume was released into a small, unnamed wash. For these reasons, the release is considered to be a major release.**

If YES, was immediate notice given to the OCD? By whom? To whom? When and by what means (phone, email, etc)?
Notice was provided to Cory Smith, NMOCD, at 8:30 PM on 2/17/2019 via phone call. A follow-up email was sent on 2/17/2019 at 11:48 PM, see attached email.

Initial Response

The responsible party must undertake the following actions immediately unless they could create a safety hazard that would result in injury

☒ The source of the release has been stopped.
☒ The impacted area has been secured to protect human health and the environment.
☒ Released materials have been contained via the use of berms or dikes, absorbent pads, or other containment devices.
☐ All free liquids and recoverable materials have been removed and managed appropriately.

If all the actions described above have not been undertaken, explain why:
Due to access issues in the drainage and wash areas, recovery of free liquids is still on-going. A freshwater flush has been scheduled to begin on 2/26/2019 to capture as much free liquid as possible.

Per 19.15.29.8 B. (4) NMAC the responsible party may commence remediation immediately after discovery of a release. If remediation has begun, please attach a narrative of actions to date. If remedial efforts have been successfully completed or if the release occurred within a lined containment area (see 19.15.29.11(A)(5)(a) NMAC), please attach all information needed for closure evaluation.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Printed Name: **James McDaniel** Title: **HSE Supervisor**

Signature: Date: **2/25/2019**

email: **jmcdaniel@enduringresources.com** Telephone: **505-444-3004**

OCD Only

Received by: Date:

State of New Mexico
Oil Conservation Division

Incident ID	
District RP	
Facility ID	
Application ID	

Site Assessment/Characterization

This information must be provided to the appropriate district office no later than 90 days after the release discovery date.

What is the shallowest depth to groundwater beneath the area affected by the release?	_____ (ft bgs)
Did this release impact groundwater or surface water?	☐ Yes ☐ No
Are the lateral extents of the release within 300 feet of a continuously flowing watercourse or any other significant watercourse?	☐ Yes ☐ No
Are the lateral extents of the release within 200 feet of any lakebed, sinkhole, or playa lake (measured from the ordinary high-water mark)?	☐ Yes ☐ No
Are the lateral extents of the release within 300 feet of an occupied permanent residence, school, hospital, institution, or church?	☐ Yes ☐ No
Are the lateral extents of the release within 500 horizontal feet of a spring or a private domestic fresh water well used by less than five households for domestic or stock watering purposes?	☐ Yes ☐ No
Are the lateral extents of the release within 1000 feet of any other fresh water well or spring?	☐ Yes ☐ No
Are the lateral extents of the release within incorporated municipal boundaries or within a defined municipal fresh water well field?	☐ Yes ☐ No
Are the lateral extents of the release within 300 feet of a wetland?	☐ Yes ☐ No
Are the lateral extents of the release overlying a subsurface mine?	☐ Yes ☐ No
Are the lateral extents of the release overlying an unstable area such as karst geology?	☐ Yes ☐ No
Are the lateral extents of the release within a 100-year floodplain?	☐ Yes ☐ No
Did the release impact areas **not** on an exploration, development, production, or storage site?	☐ Yes ☐ No

Attach a comprehensive report (electronic submittals in .pdf format are preferred) demonstrating the lateral and vertical extents of soil contamination associated with the release have been determined. Refer to 19.15.29.11 NMAC for specifics.

Characterization Report Checklist: ***Each of the following items must be included in the report.***

- ☐ Scaled site map showing impacted area, surface features, subsurface features, delineation points, and monitoring wells.
- ☐ Field data
- ☐ Data table of soil contaminant concentration data
- ☐ Depth to water determination
- ☐ Determination of water sources and significant watercourses within ½-mile of the lateral extents of the release
- ☐ Boring or excavation logs
- ☐ Photographs including date and GIS information
- ☐ Topographic/Aerial maps
- ☐ Laboratory data including chain of custody

If the site characterization report does not include completed efforts at remediation of the release, the report must include a proposed remediation plan. That plan must include the estimated volume of material to be remediated, the proposed remediation technique, proposed sampling plan and methods, anticipated timelines for beginning and completing the remediation. The closure criteria for a release are contained in Table 1 of 19.15.29.12 NMAC, however, use of the table is modified by site- and release-specific parameters.

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I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Printed Name: _____ Title: _____

Signature: _____ Date: _____

email: _____ Telephone: _____

OCD Only

Received by: _____ Date: _____

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Remediation Plan

Remediation Plan Checklist: ***Each of the following items must be included in the plan.***

- ☐ Detailed description of proposed remediation technique
- ☐ Scaled sitemap with GPS coordinates showing delineation points
- ☐ Estimated volume of material to be remediated
- ☐ Closure criteria is to Table 1 specifications subject to 19.15.29.12(C)(4) NMAC
- ☐ Proposed schedule for remediation (note if remediation plan timeline is more than 90 days OCD approval is required)

Deferral Requests Only: ***Each of the following items must be confirmed as part of any request for deferral of remediation.***

- ☐ Contamination must be in areas immediately under or around production equipment where remediation could cause a major facility deconstruction.
- ☐ Extents of contamination must be fully delineated.
- ☐ Contamination does not cause an imminent risk to human health, the environment, or groundwater.

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations.

Printed Name: _____ Title: _____

Signature: _____ Date: _____

email: _____ Telephone: _____

OCD Only

Received by: _____ Date: _____

☐ Approved ☐ Approved with Attached Conditions of Approval ☐ Denied ☐ Deferral Approved

Signature: _____ Date: _____

State of New Mexico
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Closure

The responsible party must attach information demonstrating they have complied with all applicable closure requirements and any conditions or directives of the OCD. This demonstration should be in the form of a comprehensive report (electronic submittals in .pdf format are preferred) including a scaled site map, sampling diagrams, relevant field notes, photographs of any excavation prior to backfilling, laboratory data including chain of custody documents of final sampling, and a narrative of the remedial activities. Refer to 19.15.29.12 NMAC.

Closure Report Attachment Checklist: ***Each of the following items must be included in the closure report.***

☐ A scaled site and sampling diagram as described in 19.15.29.11 NMAC

☐ Photographs of the remediated site prior to backfill or photos of the liner integrity if applicable (Note: appropriate OCD District office must be notified 2 days prior to liner inspection)

☐ Laboratory analyses of final sampling (Note: appropriate ODC District office must be notified 2 days prior to final sampling)

☐ Description of remediation activities

I hereby certify that the information given above is true and complete to the best of my knowledge and understand that pursuant to OCD rules and regulations all operators are required to report and/or file certain release notifications and perform corrective actions for releases which may endanger public health or the environment. The acceptance of a C-141 report by the OCD does not relieve the operator of liability should their operations have failed to adequately investigate and remediate contamination that pose a threat to groundwater, surface water, human health or the environment. In addition, OCD acceptance of a C-141 report does not relieve the operator of responsibility for compliance with any other federal, state, or local laws and/or regulations. The responsible party acknowledges they must substantially restore, reclaim, and re-vegetate the impacted surface area to the conditions that existed prior to the release or their final land use in accordance with 19.15.29.13 NMAC including notification to the OCD when reclamation and re-vegetation are complete.

Printed Name: _____ Title: _____

Signature: _____ Date: _____

email: _____ Telephone: _____

OCD Only

Received by: _____ Date: _____

Closure approval by the OCD does not relieve the responsible party of liability should their operations have failed to adequately investigate and remediate contamination that poses a threat to groundwater, surface water, human health, or the environment nor does not relieve the responsible party of compliance with any other federal, state, or local laws and/or regulations.

Closure Approved by: _____ Date: _____

Printed Name: _____ Title: _____

James McDaniel

From: James McDaniel
Sent: Sunday, February 17, 2019 11:48 PM
To: 'Smith, Cory, EMNRD'; Fields, Vanessa, EMNRD; Powell, Brandon, EMNRD
Cc: John Conley; Andrea Felix; Ashley Ager; Chad Snell
Subject: N Escavada Unit 315H Release

Cory,

As discussed on the phone, we had a release at the NEU 315H well location, API 30-043-21888. At approximately 3 PM, I was notified of a release at the NEU 315H wellsite. During flowback operations, flowback fluids were being transferred through a 6" flowline leaving the 315H location to the WEU 300H. During transfer, the line came apart at a camlock attachment, and released over 100 bbls of oil and flowback water into the bar ditch outside the 315H location. The oil and water crossed under the main road that runs past the 315H location through a culvert, ran along the bar ditch along the road, and entered a small drainage. The oil and water flowed along the drainage, entering a wash, where it flowed a total of 1.64 miles. On-site personnel hand dug a small dam to slow the oil down in the wash, and Adobe and Envirotech were called out for emergency response. A temporary dam was built in the wash to prevent the flow of oil and water any further. Adobe has been tasked with building a larger, more stable dam in the wash to allow for prevention of additional downstream migration of the oil and water, which will occur first thing in the AM. Enduring has made the appropriate notifications to BLM. A map of the release is below. Additional data will be collected tomorrow. Cold temperatures have helped slow down the flow of water in the wash, and the temporary dam will keep the materials from traveling further overnight. Don't hesitate to contact me with any questions or comments.

GPS of Release Starting Point: 36.151319, -107.569738

GPS of Release End Point: 36.157230, -107.585374

James McDaniel
HSE Supervisor
Enduring Resources
CSP #30009
CHMM #15676
Office: 505-636-9731
Cell: 505-444-3004
jmcdaniel@enduringresources.com

LT Environmental, Inc.
Advancing Opportunity

QUALITY ASSURANCE PROJECT PLAN

NEU #315H Release Response
API 30-043-21888
NMOCD Incident # NCS1905249442

APRIL 18, 2019

Prepared for:

ENDURING RESOURCES, LLC
Sandoval County, New Mexico

Prepared by:

LT ENVIRONMENTAL, INC.
848 East Second Avenue
Durango, Colorado 81301
970.385.1096

QUALITY ASSURANCE PROJECT PLAN

NEU #315H Release Response
API 30-043-21888
NMOCD Incident # NCS1905249442
Geophysical Survey, Phase II Environmental Site Assessment, Asbestos-Containing Materials Survey, and Lead-Based Paint Survey

April 15, 2019
Revision 0

Approved: _____ Date: _____
Enduring Resources, LLC

Approved: _____ Date: _____
New Mexico Oil Conservation Division

Approved: _____ Date: _____
United States Environmental Protection Agency Region IX

Approved: _____ Date: _____
Danny Burns, Project Manager, LT Environmental, Inc.

Approved: _____ Date: _____
Ashley Ager, Senior Geologist, LT Environmental, Inc.

DISTRIBUTION LIST

New Mexico Oil Conservation Division

Bureau of Indian Affairs, Federal Indian Minerals Office

Navajo Nation Environmental Protection Agency

United States Environmental Protection Agency Region IX

Bureau of Land Management

United States Army Corps of Engineers

Enduring Resources, LLC

LT Environmental, Inc.

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APPENDICES

LIST OF ACRONYMS

BTEX	Benzene, toluene, ethylbenzene, and total xylenes
COC	Chemical(s) of concern
DQOs	Data quality objectives
GC/MS	Gas chromatography/mass spectroscopy
IDW	Investigation derived waste
mg/kg	Milligrams per kilogram
NMAC	New Mexico Administrative Code
NMOCD	New Mexico Oil Conservation District
PC	Percent completeness
PR	Percent recovery
QA	Quality Assurance
QC	Quality Control
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
RPD	Relative percent difference
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TPH	Total petroleum hydrocarbons
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared as part of the Sampling and Analysis Plan (SAP) for confirmation and soil characterization to address soil impacted by petroleum hydrocarbons and produced water-associated with emergency response activities following a release during flowback operations at the NEU #315H production well. This QAPP has been prepared at the direction of the United States Environmental Protection Agency (USEPA) Region IX.

1.1 PURPOSE AND SCOPE

Quality Assurance (QA) is defined as the integrated program designed for assuring reliability of monitoring procedures and measurement data. Quality Control (QC) is defined as the routine application of procedures for obtaining prescribed standards of performance in the monitoring and measuring process.

This QAPP has been prepared to ensure that all data generated are scientifically valid, defensible, and of known precision and accuracy. The QAPP describes procedures and specifications that will be followed to support the collection of data that are of satisfactory quality. Adherence to these procedures will help ensure that the integrity of the samples collected is maintained, that no sampling-related contamination occurs and that laboratory results will be representative of the actual on-site conditions.

1.2 PROJECT ORGANIZATION AND RESPONSIBILITY

Primary responsibility for implementing the QA measures of this QAPP belongs to the Quality Assurance Manager (QAM).

It is the responsibility of the QAM to discover QA problems or non-conformances. All problems or non-conformances will be reported. As soon as practical, the QAM will propose corrective action(s), define significance of the deficiencies, and initiate the corrective action(s). Should the regulatory agency discover QA problems or non-conformances, the agency should contact and resolve these issues with the QAM.

2.0 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and quantitative statements which define data-quality requirements based on the identified end use of the database. These objectives must be re-evaluated as additional information is collected and data needs are further defined.

2.1 DATA QUALITY OBJECTIVES

The DQOs for this project are to:

- Assess the effectiveness of the response actions for potential closure;
- Define the vertical and horizontal extent of residual soil impact; and
- Develop sufficient information to identify and evaluate remedial alternatives and possible requirements for further action, if necessary.

2.2 DATA QUALITY SUMMARY

A data quality summary for the investigation follows:

- Overall Study Objectives - Assess the vertical and horizontal extent of petroleum hydrocarbon impact in soil resulting from the release following emergency response and initial release response activities.
- Appropriate Analytical Levels - Analyses will be Level III, except field screening, performed in an offsite analytical laboratory using standard, documented procedures.
- Data Needs – Soil data to establish the areal extent and depth of contamination.
- Chemicals of Concern (COC) -
    - Benzene, toluene, ethylbenzene, and total xylenes (BTEX);
    - Total petroleum hydrocarbons (TPH); and
    - Chloride.
- Levels of Concern - New Mexico Administrative Code (NMAC) Title 19, Chapter 15, Part 29, Section 12 (19.15.29.12), Table 1, *Closure Criteria for Soils Impacted by a Release*: 10 milligrams per kilogram (mg/kg) benzene; 50 mg/kg total BTEX; 100 mg/kg TPH; and 600 mg/kg chloride. These levels are based on shallow groundwater and an affected significant watercourse.
- Required Detection Limits -. Detection limits for soil per SW 846 Method protocols to meet Levels of Concern.
- Planned for Collection –Soil samples.

3.0 SAMPLING COLLECTION PROCEDURES

Field measurements and sampling will be conducted in accordance with State of New Mexico and USEPA procedures, as identified in:

- *Test Methods for Evaluating Solid Wastes* -Update IV (SW 846) (USEPA, 2008).
- NMAC Title 19, Chapter 15, Part 29, *Oil and Gas Releases*.
- *Methods for Chemical Analysis of Water and Wastes* (MCAWW) (USEPA, 1979).

3.1 SAMPLING DESIGN

Field activities that will be conducted, including the number of samples and their locations, are discussed in the SAP. A formal sample identification system will be used to designate each sample collected during the site characterization activities. The identification system and the date of sample collection will provide a tracking procedure to allow retrieval of information about a particular sample location and ensure that each sample is assigned a unique sample identification that describes where the sample was collected.

3.2 SAMPLING METHODS AND CHEMICAL ANALYSES

The quality of data collected in an environmental study depends on the quality and thoroughness of field sampling activities as well as the applicability of the task to the objectives. Due to the sensitivity of analytical methods, the sampling process becomes integral to the integrity of the data generated. As a result, general field operations and practices and specific sample collection and inventory must be well planned and carefully implemented.

Sampling methods and chemical analyses for the COCs were selected based on *Closure Criteria for Soils Impacted by a Release* in the NMAC 19.15.29.12, Table 1, as follows.

- BTEX by USEPA Method 8021B or 8260B;
- TPH by USEPA Method 8015M; and
- Chloride by USEPA Method 300.0.

3.3 STANDARD OPERATING PROCEDURES

Standard Operating Procedures (SOPs) have been developed for use on sampling and related data-gathering activities. The purpose of these SOPs is to obtain samples that represent the environment and contamination under investigation. These SOPs provide consistency in data collection activities and decrease the time needed for SAP preparation and review. Proposed project-specific modifications to the SOPs along with their justification are clearly documented in the project-specific SAP and in the project report.

For non-standard operations, unusual sample matrices, or unusual sampling conditions, validation of procedures may be required to confirm that project quality criteria can be met. These validations must be developed before project sampling begins and must be documented in the project report.

SOPs for sampling and related data-gathering activities are included in this QAPP and will be adhered to while conducting project-specific data collection activities.

3.4 SAMPLE COLLECTION, HANDLING, AND CUSTODY

Written documentation of sample custody from the time of sample collection through the generation of data by analysis of that sample is recognized as a vital aspect of an environmental study. The chain of custody of the physical sample and its corresponding documentation are maintained throughout the handling of the sample. All samples must be identified, labeled, logged onto a chain-of-custody form, and recorded in a sample tracking log or field logbook as a part of the procedure to ensure the integrity of the resulting data. The record of the physical sample (location and time of sampling) is joined with the analytical results through accurate accounting of the sample custody. Sample custody applies to both field and laboratory operations.

SOPs and data collection forms have been developed for sample custody, sample labeling, analysis requests, and shipping and tracking procedures. These SOPs are referenced in the project-specific SAP. Analytical laboratory sample custody procedures are included in the laboratory's QA plan.

3.5 SAMPLE VOLUMES, CONTAINER TYPES, AND PRESERVATION

Sample volumes will be at least the minimum amount required by the laboratory and analytical method to achieve the requested reporting limits. Sample containers will be compatible with the analyte of interest and the selected analytical method. Sample preservation will be used to prevent or retard the degradation or modification of chemical compounds during transit and storage prior to laboratory extraction and analysis. Necessary preservatives will be selected by the laboratory based on the type of sample and required analyses. As practicable, preservatives will be added to containers by the laboratory prior to sampling. Laboratory tests will be performed within the maximum holding times established by the laboratory method and sample preservation procedure. Turnaround time for sample analysis is 10 business days.

3.6 ANALYTICAL METHODS AND PARAMETERS

To ensure that the DQOs established in the project-specific SAP can be achieved, the analytical criteria that are to be used for data generation by laboratory analysis must be clearly identified. Analytical methods for sample analyses are selected based on the requirements of the State of New Mexico for oil and gas releases. Approved analytical methods from the most recent version of USEPA's publication SW-846, entitled *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, will be used for analysis of soil and water samples.

Prior to sample analysis, the laboratory is provided with the following directions.

- Number and matrices of the samples to be analyzed;
- Required analysis turnaround time;
- Identification of analytical methods and equipment;
- Description of sample preparation procedures;

- Identification of digestion/extraction methods;
- Frequency and type of QC analyses;
- Precision and accuracy criteria;
- Data reporting limits and units; and
- Laboratory documentation and reporting requirements.

If the analytical data are found to be unreliable or incomplete, the laboratory is responsible for correcting the errors. If the laboratory cannot provide data of adequate accuracy and precision, the samples may need to be recollected.

3.7 SAMPLING EQUIPMENT, DECONTAMINATION, AND CONTROL OF CONTAMINATED MATERIALS

3.7.1 Sampling Equipment

The sampling equipment will be appropriate for the media being sampled, contaminant characteristics, and sampling protocol described in the SOPs.

3.7.2 Calibration Procedures

All equipment used on the project will be calibrated and adjusted to operate within manufacturers' specifications. Equipment and instrumentation calibrations ensure that accurate and reliable measurements are obtained. All calibration standards are traceable to the National Institute of Standards and Technology or other primary standards. Methods and intervals of calibration are based on the type of equipment, stability characteristics, required accuracy, intended use, and environmental conditions.

3.7.3 Preventative Maintenance

Preventive maintenance is implemented on a scheduled basis to minimize downtime and to ensure accurate measurements from both field and laboratory equipment. This program is designed to achieve results commensurate with the specified capabilities of equipment operation, thus generating data of known quality. Maintenance is conducted by trained technicians using service manuals or through service agreements with qualified maintenance contractors. In addition, backup equipment and critical spare parts are maintained to quickly correct equipment malfunction.

3.7.4 Calibration and Maintenance Records

Calibration and maintenance records are maintained for equipment in project-specific logbooks.

3.7.5 Decontamination Procedures

All sampling equipment will be decontaminated prior to initial use. All non-disposable and nondedicated sampling equipment will be decontaminated after collecting each sample in accordance with the SOP in Appendix A.

3.7.6 Control of Contaminated Materials

Investigation derived waste (IDW) generated during the investigation will be handled in accordance with the respective SOP.

3.8 RECORD KEEPING AND DOCUMENT CONTROL

Project activities are documented in the project plans and project reports and are supported by field activity records and laboratory data reports. This QAPP will be maintained by Enduring Resources, LLC who will retain all updated versions of the QAPP and be responsible for distribution of the current version of the QAPP. Copies of all management reports, memoranda, and correspondence between project personnel identified on the Distribution List will be maintained by Enduring Resources, LLC.

4.0 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

4.1 FIELD QUALITY CONTROL

As a check on field sampling, QA/QC samples such as trip blanks, field blanks, equipment rinsate samples, field duplicates, and ambient condition blanks will be sent to the laboratory at specified frequencies. These samples, and the frequency with which collection will occur, are discussed in this section.

4.1.1 Trip Blanks

A trip blank is defined as a sample bottle filled by a laboratory with analyte-free laboratory reagent-grade Type II water, transported to the site, handled like a sample but not opened, and returned to the laboratory for analysis. One trip blank per day of sampling will be submitted for analysis of volatile organic compounds, e.g., BTEX, if samples from that day are to be analyzed for BTEX.

4.1.2 Field Blanks

A field blank is designed to check the purity of water used for equipment decontamination. One field blank will be collected for each water source used. Field blanks will be analyzed for the same parameters as the environmental samples.

4.1.3 Equipment Rinsate Blanks

Equipment rinsate blanks are generated by pouring deionized water over field equipment that has been decontaminated. This rinsate water is then collected and transferred to a sample bottle and analyzed for the same parameters as the environmental sample. The results of these sample analyses indicate how well the sampling equipment was decontaminated.

One equipment rinsate sample will be collected for each sampling event. The equipment rinsate samples will be analyzed for the same analytes as the environmental samples collected during the event.

4.1.4 Duplicate Samples

A field duplicate is defined as two or more samples collected independently at a sampling location during a single act of sampling. The total number of field duplicates required for each analysis is equal to 5 percent of the samples collected. An estimated 1 duplicate for every 20 samples collected will be required.

Field duplicates will be indistinguishable by the laboratory from other samples. Therefore, one completed sample set will be identified with a coded or false identifier, which will be in the same format as other identifiers used with this sample matrix. Both the false and true identifiers will be recorded in the field notebook. The coded identifier will be used on the chain-of-custody forms.

4.2 FORMULAS

4.2.1 Accuracy

The degree of accuracy of a measurement is a comparison of the measured value with an accepted reference or known true value. Accuracy of an analytical procedure is best determined by analysis of a known or "spiked" sample quantity. Accuracy is expressed as percent recovery (PR) and is calculated as follows.

$PR = [(A-B)/C] \times 100$

Where:

A = spiked sample concentration

B = measured sample concentration (without spike)

C = concentration of spike added

The degree of accuracy and the recovery of the analyte to be expected for the analysis of QC samples and spiked samples are dependent upon the matrix, method of analysis, and compound or element being measured. The concentration of the analyte relative to the detection limit is also a factor in determining the accuracy of the measurement. Laboratory control charts will be used to determine acceptance criteria in the absence of established data.

4.2.2 Precision

Precision of laboratory analytical methods will be evaluated by recording and comparing multiple measurements of the same parameter on the same exact sample under the same conditions.

Relative percent difference (RPD) is calculated as follows.

$RPD = [(x^1 - x^2)/X][100]$

Where:

x^1 = analyte concentration of first duplicate

x^2 = analyte concentration of second duplicate

X = average analyte concentration of duplicates 1 and 2

Accepted levels of precision vary according to the sample matrix, the specific analytical method, and the analytical concentration relative to the method detection limit. Laboratory control charts will be used to determine acceptance criteria in the absence of established data.

Precision of field sampling methods will be assessed in a similar manner. Duplicate field samples will be collected, when possible, in separate containers, but under identical conditions. The samples will be

analyzed and RPD will be calculated, as above. RPD should be less than 50 percent for groundwater field duplicates.

4.2.3 Completeness

Completeness of sample analyses will be defined by comparing the number of tests initially requested with the number of tests successfully completed and reported by the testing laboratory, and which meet validation criteria. The QA objective for completeness is 90 percent. Valid analytical data must be reported by the laboratory for a least 90 percent of the samples collected.

Percent Completeness (PC) is calculated as follows:

$PC = [N_A/N_I] \times 100$

Where:

N_A = Actual number of valid analytical results obtained

N_I = Theoretical number of results obtainable under ideal conditions

4.2.4 Comparability

Consistency in acquisition, handling, and analysis of samples is necessary so that the results may be compared with previous studies. Concentrations will be reported in a manner consistent with general practice.

To support the comparability of analytical results with those obtained in previous or future testing, all samples will be analyzed by USEPA-approved methods, where available. The USEPA-recommended maximum permissible holding times for organic and inorganic parameters will not be exceeded. All standards will be traceable to National Institute of Standards and Technology or USEPA standards. Calibrations will be performed in accordance with USEPA or the manufacturer's specifications and will be checked at the frequency specified in the methods.

4.2.5 Representativeness

The sample representativeness will be preserved by using correct field sample collection and handling procedures, properly decontaminating sampling equipment, and using field QC samples, where appropriate. Sample collection and equipment decontamination procedures will be followed to collect samples that are representative of on-site environmental conditions. QC samples will be collected to check and document that the procedures are providing representative samples.

4.3 LABORATORY OPERATIONS

The field coordinator will notify the laboratory project coordinator of anticipated field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

To facilitate sample preparation and analysis within the specified holding times, the laboratory will track the progress of sample preparation, analysis, and report preparation. The laboratory project coordinator (or designee) will provide the QAM with a sample tracking report. This report will include the laboratory sample identification, time received, condition of samples, and anticipated extraction and/or analysis.

The laboratory chosen to conduct the analysis of samples will, at a minimum, check all arriving samples for integrity and note any specific observations on the original chain-of-custody record. Each sample will be logged into the laboratory system by assigning it a unique sample number. This number and the field sample identification number will be recorded on the laboratory report. Samples will be stored and analyzed according to specified methods. The original chain-of-custody record will be returned to the Project Manager upon its completion for permanent storage.

Raw data from field measurements and sample collection activities will be appropriately recorded in the field logbook. As the data are used in project reports, they will be reduced and summarized, and the method of reduction will be documented in the report.

The analytical laboratory will perform in-house analytical data reduction and validation under the direction of the laboratory QAM. The laboratory QAM is responsible for assessing data quality and advising of any data which were rated “preliminary” or “unacceptable” or other qualitative ratings that would caution the data user of possible unreliability. Laboratory data reduction, validation, and reporting will be conducted under standard SW 846 protocols.

The laboratory will report the data in the same chronological order in which it is analyzed along with QC data. The laboratory will provide the following information in each analytical data package submitted.

- Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis;
- Tabulated results of inorganic and organic compounds identified and quantified;
- Analytical results for QC sample spikes, sample duplicates, initial and continuous calibration verifications of standards and blanks, standard procedural blanks, and laboratory control samples (LCSs);
- Tabulation of instrument detection limits determined in blanks; and
- Raw data system printouts (or legible photocopies) identifying data of analyses, analyst, parameters determined, calibration curve, calibration verifications, method blanks, sample and any dilutions, sample duplicates, spikes and control samples.

For organic analyses, the data packages must include matrix spikes, matrix spike duplicates, surrogate spike recoveries, chromatogram, gas chromatography/mass spectroscopy (GC/MS) spectra (if used), and computer printouts.

A systematic review of the data for compliance will be conducted with the established QC criteria based on the spike, duplicate, and blank results provided by the laboratory. An evaluation of data accuracy, precision, comparability, and completeness will be performed and presented in the analytical data report.

All data generated will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include data flags from the laboratory.

5.0 REPORTS TO MANAGMENT

5.1 ASSESSMENTS

Approaches used for the assessments vary with the objectives of the assessment and the status of the project but are of two basic types.

- Management and technical self-assessment: the qualitative assessment of a management or technical system by those immediately responsible for overseeing and/or performing the work.
- Management and technical independent assessment: the qualitative assessment of management or technical system by someone other than the group performing the work.

Assessments will be conducted by personnel who have sufficient authority, access to work areas, and organizational freedom to:

- Identify quality problems;
- Identify and cite practices that can be shared with others to improve the quality of their operations and products;
- Propose recommendations for resolving quality problems;
- Confirm implementation and effectiveness of solutions;
- Provide documented assurance to management that, when problems are identified, further work performed is monitored carefully until the problems are suitably resolved;
- Suspend or stop work with the concurrence of the QAM, upon detection; and
- Identify an immediate adverse condition affecting the quality of results.

Assessment findings, recommendations, and corrective actions are documented in reports that contain some or all of the following.

- Names of the parties responsible for the assessment;
- A copy of guidelines developed for the assessment;
- Brief description of the activity assessed;
- Description of any quality problems;
- Recommendations for resolving any quality problems; and
- Suggestions for sharing noteworthy practices.

5.2 MECHANISMS FOR ASSESSMENT

The tools for assessment include:

- Management system reviews;
- Audits and surveillances;

- Independent technical reviews and peer reviews;
- Readiness reviews;
- Data reduction assessment; and
- Data quality assessments.

5.3 RESPONSE TO OUT-OF-CONTROL EVENTS

All project personnel have the responsibility, as a part of normal work duties, to promptly identify, report, and solicit approved correction of conditions adverse to quality. Corrective actions may be initiated if any of the following conditions apply.

- Sample holding times are not attained;
- Predetermined acceptance standards are not attained (objectives for precision, accuracy, and completeness);
- Reports or data compiled are determined to be inconsistent or faulty;
- Equipment or instrumentation is found to be faulty;
- Samples and test results are not readily traceable;
- QA requirements have been violated; or
- Designated approvals have been circumvented.

Project management and staff, such as field investigation teams and the QAM monitor ongoing work performance in the normal course of daily responsibilities. Work is monitored at the site by the field coordinator.

5.4 RE-ESTABLISHMENT OF CONTROL

When a significant condition adverse to data quality is noted at the site, laboratory, or by the subcontractor, the cause of the condition will be determined and corrective action taken, up to and including subcontractor or laboratory replacement, to preclude repetition. Condition identification, cause, reference documents, and corrective action planned will be documented and reported to the Project Manager. Implementation of corrective actions will be verified by follow-up action.

5.5 DOCUMENTATION

Out-of-control events and corrective actions will be documented in writing. Any non-conformance with the established QC procedures will be identified and corrected. A non-conformance report will summarize each non-conformance condition.

6.0 DATA REDUCTION, VALIDATION, AND REPORTING

Data collected during this program must be collected according to this QAPP and the SAP. Any apparent data collection errors will be identified by evaluation of adherence to sampling procedures and evaluation of the data compared to historical concentrations or trends. Questionable data will be reviewed and analyzed to resolve these problems. Depending on the conclusions of these evaluations, the data may be accepted, qualified, or rejected.

6.1 CHEMICAL DATA

On receipt of the laboratory data, the following reduction, validation, and reporting scheme will be conducted by the QAM.

- Laboratory data will be reviewed to identify if the correct QC information is included and that the prescribed frequency of analysis was conducted. The QC information, if not included in the analytical package, can be requested from the laboratory at this time. Should the QC information not be available, the data must be qualified or rejected; and
- QC information will be reviewed. Data outside of control limits, if discovered, will be evaluated appropriate to corrective action. The data can be qualified, rejected, or the laboratory requested to re-analyze the sample.

6.2 FIELD MEASUREMENT DATA

Validation of field measurement data will be performed by qualified personnel and will include:

- Verifying proper calibration and frequency of calibration for equipment;
- Evaluating duplicate sample analyses; and
- Comparing data to existing data to assess for anomalous points.

If variations occur that are greater than control limits, the data and potential causes will be reviewed. If the variations cannot be explained, the data will be qualified and assessed as usable, not usable, or limited use.

6.3 DATA MANAGEMENT

After the data have been validated, the data will be entered into the existing database management system. Data along with qualifiers will be entered into a computer database. Data entry will be checked by the QAM or QAM-assigned personnel.

6.4 REPORTING REQUIREMENTS

The analytical laboratory will provide, in a timely manner, all sample and laboratory QA/QC results and custody information. These data will be reviewed and validated by the QAM or designated personnel.

STANDARD OPERATING PROCEDURE

SOP TITLE: EQUIPMENT CALIBRATION

SOP NUMBER: TECH-004

Approval by:	Chris Shephard Chief Engineer		
Content Management Owner:	Technical Committee	John Brown	
Version:	Final	Version Date:	07-08-2015

1.0 PURPOSE

Calibration and proper maintenance of field and laboratory instruments are critical to obtaining acceptable data.

2.0 RELATED DOCUMENTS

- All SOPs related to water sampling, air monitoring, soil sampling, soil vapor sampling, and industrial hygiene.

3.0 PREREQUISITES

All users of the instruments will be trained in the proper calibration and operation of the instrument prior to initial use. At a minimum, operation, maintenance, and calibration will be performed in accordance with the instrument manufacturer's specifications. It is recommended that users of the instruments read the operations and maintenance manual for each instrument that is frequently used.

4.0 PROCEDURES

To ensure that field instruments will be properly calibrated and remain operable in the field, the following procedures will be used.

4.1 GENERAL INFORMATION

- The dates, times, and results of all calibrations and repairs to field instruments will be recorded on the appropriate field form and/or in the field logbook.
- Standards used to calibrate field instruments will meet the minimum requirements for source and purity recommended in the operation and maintenance manual.
- Users of the instrument will be trained in routine maintenance, including battery and lamp replacement, lamp and sensor cleaning, and battery charging.
- Inoperative or malfunctioning instruments will be immediately reported to the LTE equipment manager or the rental company (if the instrument is rented).
- In certain cases, such as when using health and safety monitoring equipment for monitoring life-critical operations or potentially hazardous conditions, work must cease if the instrument is malfunctioning or inoperative.
- Each instrument's operation and maintenance manual should be brought to the project site and stored in the equipment case for reference.
- Field instruments will be inspected to confirm they are fully operational prior to departure for the project site. Instrument battery charge will be inspected far enough ahead of time to bring the instrument up to full charge prior to departure. Ideally, all

instruments should be calibrated at the project site each day before work begins. If this is not feasible, instruments will be calibrated in the office or at the lodgings, in the case of out of town projects, prior to departure.

- A source of extra batteries and lamps (if applicable) will be readily available.

4.2 WATER QUALITY INSTRUMENTS

- Prior to each day of use, pH meters will be calibrated with standard pH solutions. The calibrated pH meter must read within plus or minus (+/-) 0.2 standard units (su) of the calibration solution.
- Specific conductance (SC) meters will be calibrated prior to each day of use. The meter must read within 5 percent (%) of the calibration solution after calibration.
- Dissolved oxygen (DO) meters will be field calibrated per the manufacturer's specifications. The DO meter will be calibrated in percent saturation and must read between 80% and 86% saturation at elevations between 4,000 feet and 6,000 feet above sea level. Please consult the chart at the end of this document for additional altitude corrections.
- Oxidation reduction potential (ORP) meters will be calibrated prior to each day of use. The meter must read within +/- 10 millivolts (mV) of the calibration solution after calibration has been completed.
- Water level and product interface meters will be checked daily to assess whether the instrument is functioning properly. Product interface probes can be checked using a jar with half water and half vegetable oil. The vegetable oil layer should trigger the product tone (usually a steady tone) and the water layer should trigger the water tone (usually an intermittent tone). Additionally, water level meters and product interface meters will be periodically (no less than once per year) checked to ensure that measurements are accurate and that the tapes are not damaged.

4.3 AIR QUALITY INSTRUMENTS

- Photo-ionization detectors (PIDs)/flame-ionization detectors (FIDs) will be calibrated before each testing/monitoring session. For volatile and unknown potential contaminants, these instruments will be calibrated to yield "total organic vapors" in parts per million (ppm) as referenced to the calibration gas. PIDs will be operated with a 10.6 electron volts (eV) lamp source, unless being used to detect the presence of compounds with high ionization potentials such as certain chlorinated solvents, which will require the use of an 11.7 eV lamp. A 9.6 eV lamp can be used for the detection of compounds with low ionization potentials such as benzene without picking up longer chain carbon compounds (diesel range organics).
- Four gas meters will be calibrated before each testing/monitoring session. Because four gas meters are most often used for critical health and safety monitoring activities, it is imperative that these function-to-design specifications and that the

installed sensors are not expired (the expiration date is generally displayed on the liquid-crystal display (LCD) screen during instrument startup).

- There are several other types of instruments that are available to measure air quality for health and safety purposes or for collecting semi-quantitative measurements of specific gases. These instruments should be calibrated according to the manufacturer's recommendations. In the event that LTE personnel are unfamiliar with the operation of these types of equipment, please consult with the LTE equipment manager and/or the equipment manufacturer's technical support staff well in advance of the date the field work is to be conducted.

CHANGES MADE / DATE OF REVISIONS

Author Name	Date	Description of Change	Version Number
J. Brown	6/03/2014	Create First Draft	Draft
R. Rebel	8/22/2014	Technical Edit	Draft
D. Rountree	8/22/2014	Editorial Review	Draft
K. Pollman	9/11/2014	Final Technical and Editorial Review	Final
D. Rountree	10/1/2017	Final Review	Final

Dissolved Oxygen Percent Saturation

The Percent Saturation of Dissolved Oxygen depends on the temperature of the water and elevation of the water testing site. Determine the altitude (elevation) or atmospheric pressure and use the table below to determine the correction factor. Multiply the Dissolved Oxygen level (in ppm) by the correction factor.

Atmospheric Pressure (mmHg)	Equivalent Altitude (ft.)	Correction Factor
775	540	1.02
760	0	1.00
745	542	.98
730	1094	.96
714	1688	.94
699	2274	.92
684	2864	.90
669	3466	.88
654	4082	.86
638	4756	.84
623	5403	.82
608	6065	.80
593	6744	.78
578	7440	.76
562	8204	.74
547	8939	.72
532	9694	.70
517	10,472	.68

*From the Field Manual for Water Quality Monitoring

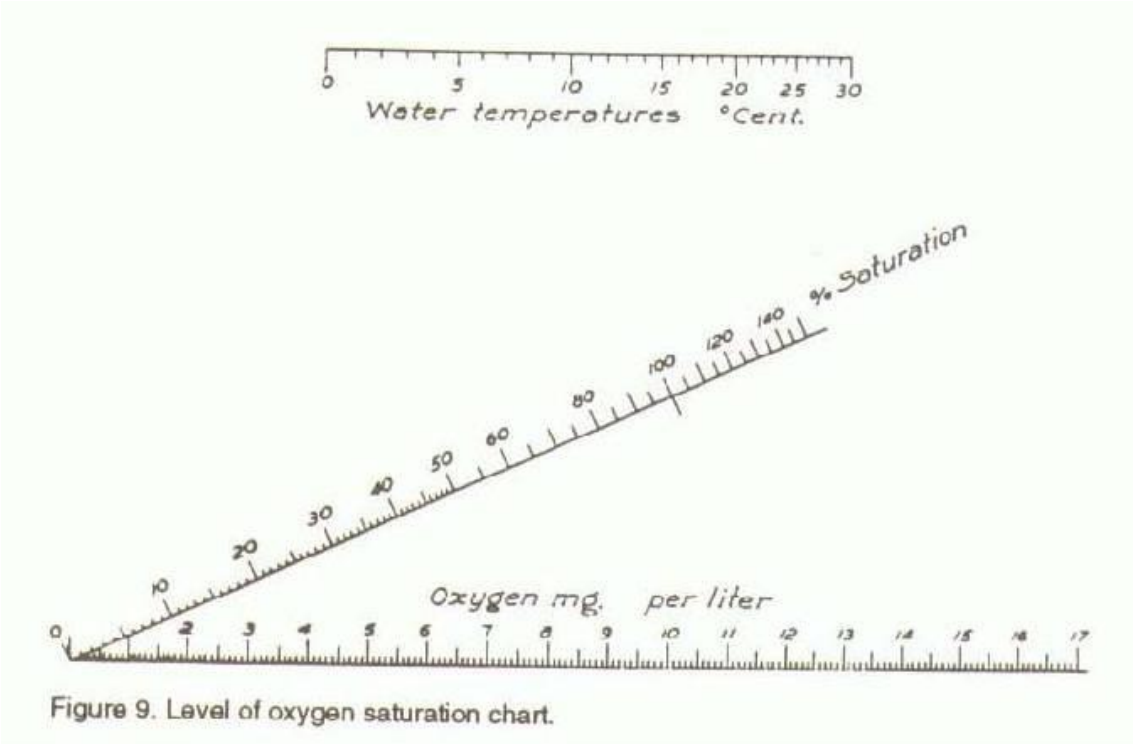


Figure 9. Level of oxygen saturation chart.

EQUIPMENT CALIBRATION CHECKLIST

GENERAL

- Review and understand job-specific work plan(s) and requirements.
- Ensure users are trained in the proper calibration, operation, and routine maintenance of equipment being used, including battery and lamp replacement, lamp and sensor cleaning, and battery charging.
- Read the operations manual prior to initial use; carry the manual in equipment case at all times. Perform calibrations, operations, and maintenance according to the manufacturer's recommendations.
- Ensure instrument functionality prior to departure for a project site.
- Calibrate equipment at the project site prior to beginning work, if feasible. Otherwise calibrate the equipment before departing for the project site.
- Report inoperative or malfunctioning equipment to the LTE equipment manager; if equipment is rented, contact the rental agency responsible for the equipment.
- Cease work if health and safety monitoring equipment that is used for monitoring life-critical operations is malfunctioning or inoperative.

Water Quality Instruments

- pH meters: calibrate prior to each daily use with pH solution to read +/- 0.2 SU of the reference solution value.
- Conductivity meters: calibrate prior to each daily use with calibration solution to read within 5% of the reference solution value.
- DO meters: per manufacturer specifications, field calibrate between 80 and 86% saturation at elevations between 4,000 and 6,000 feet above sea level. Use calibration chart to determine percent saturation values at elevations not within this range.
- ORP meters: calibrate prior to each daily use with calibration solution to read within +/- 10 millivolts of the reference solution value.
- Water level and product interface meters: check functionality using a jar with water (for water level meters) or with half water and half vegetable oil (for product interface meters). Verify that the tapes are not damaged.

Air Quality Instruments

- All Air Quality Meters: Calibrate prior to each testing/monitoring activity.
- PIDs and FIDs: Calibrate to yield total organic vapors in parts per million (ppm) as referenced to the calibration gas; contact the equipment manager if you are unsure of the calibration setup and/or reference gas.
- Four Gas Meters: Verify sensor expiration dates. Do not use if sensors are expired. Calibrate according to manufacturer specifications using the appropriate gas mixture for span calibration.
- Other Air Quality Meters: Use manufacturer's specifications from the operations manual.

Dissolved Oxygen Percent Saturation

The Percent Saturation of Dissolved Oxygen depends on the temperature of the water and elevation of the water testing site. Determine the altitude (elevation) or atmospheric pressure and use the table below to determine the correction factor. Multiply the Dissolved Oxygen level (in ppm) by the correction factor.

Atmospheric Pressure (mmHg)	Equivalent Altitude (ft.)	Correction Factor
775	540	1.02
760	0	1.00
745	542	.98
730	1094	.96
714	1688	.94
699	2274	.92
684	2864	.90
669	3466	.88
654	4082	.86
638	4756	.84
623	5403	.82
608	6065	.80
593	6744	.78
578	7440	.76
562	8204	.74
547	8939	.72
532	9694	.70
517	10,472	.68

*From the Field Manual for Water Quality Monitoring

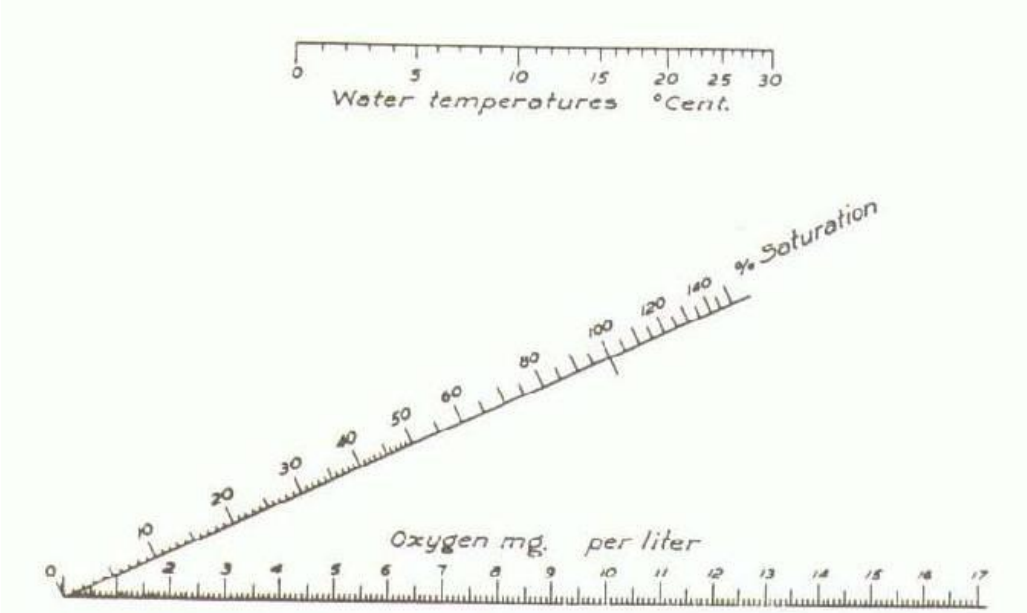


Figure 9. Level of oxygen saturation chart.

FORM RECORD: EQUIPMENT CALIBRATION RECORDS	
Meter ID:	**Responsibility:**
Approved By:	**Issue Date**:
Active Record Location: file on main computer: "calibration.doc"	
Record Protection:	
Retrieval:	
Completed Record Storage:	
Minimum Storage Retention Time: 5 years from last entry	
Related Documentation:	

Equipment:
Basis for Calibration*:
Calibration Interval:
Calibration Method: refer to user's manual

Date	Init.	Notes	Date	Init.	Notes	Date	Init.	Notes

** ISO 9001:2000 Clause 7.6a Equipment is calibrated… against measurement standards traceable to international or national measurement standards; where no such standards exist, the basis used for calibration or verification is recorded*

Equipment:
Basis for Calibration*:
Calibration Interval:
Calibration Method: refer to user's manual

Date	Init.	Notes	Date	Init.	Notes	Date	Init.	Notes

** ISO 9001:2000 Clause 7.6a Equipment is calibrated… against measurement standards traceable to international or national measurement standards; where no such standards exist, the basis used for calibration or verification is recorded*

Equipment:								
Basis for Calibration*:								
Calibration Interval:								
Calibration Method: refer to user's manual								
Date	**Init.**	**Notes**	**Date**	**Init.**	**Notes**	**Date**	**Init.**	**Notes**

** ISO 9001:2000 Clause 7.6a Equipment is calibrated… against measurement standards traceable to international or national measurement standards; where no such standards exist, the basis used for calibration or verification is recorded*

STANDARD OPERATING PROCEDURE

SOP TITLE: EQUIPMENT DECONTAMINATION

SOP NUMBER: TECH-005

Approval by:	Chris Shephard, Chief Engineer		
Content Management Owner:	Technical Committee	John P. Brown	
Version:	Final	Version Date:	11-4-2014

1.0 KEY STEPS

- Always have provisions ready to decontaminate equipment for any known or suspected site contaminants.
- Always decontaminate equipment with enough frequency to avoid cross-contamination between wells, soil borings, and discrete sampling intervals.
- Never return equipment to the equipment room or rental company without completing the proper decontamination procedures.

2.0 PURPOSE

Any equipment not intended for disposal and that comes into contact with potentially contaminated material must be thoroughly decontaminated prior to and after each use. Decontamination procedures are listed below for different types of equipment and for several common types of contaminants that are encountered while conducting field work. This SOP is not inclusive of all types of contaminants that might be encountered while conducting field work. Please consult with the LTE Health and Safety Manager in the event that any contaminants not covered by this SOP are known or suspected.

3.0 RELATED DOCUMENTS

- All SOPs related to field work where portable equipment will be used.

4.0 PREREQUISITES

All personnel conducting field work at contaminated sites must have US Occupational Safety and Health Administration (OSHA) 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and should be made aware of any known or suspected contamination (including types/chemistry and suspected volumes or concentrations) and the areas of the project site where contamination is most likely to exist. A site-specific Health and Safety Plan (HASP) will be available on site at all times to confirm the known site contaminants and the necessary level(s) of protection. Appropriate personal protective equipment (PPE), as outlined in the HASP, will be donned prior to completing decontamination of field and/or drilling equipment. Field personnel will capture any rinsate generated (in buckets or drums) while decontaminating field equipment known to contain gross contamination, and the rinsate will be disposed of in accordance with all applicable local, state, and federal laws.

5.0 PROCEDURES

The following sections describe the decontamination procedures appropriate for each type of commonly encountered contamination.

Approval by:	Chris Shephard, Chief Engineer		
Content Management Owner:	Technical Committee		John P. Brown
Version:	Final	Version Date:	11-4-2014

5.1 NON-NAPL-CONTAMINATED EQUIPMENT

Equipment showing no visible signs of, and is not thought to have come into contact with, non-aqueous phase liquid (NAPL) will be decontaminated according to the following procedures:

1. Thoroughly wash the equipment with a 1:100 mixture (2 tablespoons per gallon) of Alconox® or similar solution and de-ionized water. The equipment may need to be disassembled and scrubbed to be properly cleaned.

2. Triple rinse the equipment with de-ionized water.

3. Allow equipment to air-dry.

5.2 KNOWN OR SUSPECTED NAPL CONTAMINATION

Regardless of the type of equipment, equipment that is thought or known to have been in contact with NAPL can be decontaminated according to the following procedures:

1. Rinse the equipment thoroughly with de-ionized water to remove any loose debris or chemicals. The equipment may need to be disassembled, if possible, to be properly cleaned.

2. Evenly spray the equipment with an approved solvent (laboratory-grade methanol, hexane, or acetone) observing all applicable health and safety procedures (see applicable Safety Data Sheets [SDS]). The solvent will be chosen based upon the project-specific requirements and type of contamination that is known or suspected.

3. Rinse the equipment with clean potable water.

4. Thoroughly wash the equipment with a 1:100 mixture (2 tablespoons per gallon) of Alconox® or similar solution and de-ionized water. The equipment may need to be disassembled and scrubbed to be properly cleaned.

5. Triple rinse the equipment with de-ionized water.

6. Allow equipment to air-dry.

5.3 METALS-CONTAMINATED EQUIPMENT

Equipment that is thought or known to have come into contact with metals contamination will be decontaminated according to the following procedures:

1. Thoroughly wash the equipment with a 1:100 mixture (2 tablespoons per gallon) of Alconox® or similar solution and de-ionized water. The equipment may need to be disassembled and scrubbed to be properly cleaned.

2. Rinse the equipment with clean potable water.

3. Rinse the equipment with a 10 percent (%) solution of laboratory-grade nitric acid.

4. Rinse the equipment with clean potable water.

5. Triple rinse the equipment with de-ionized water.

6. Allow equipment to air-dry.

5.4 DRILLING/BORING EQUIPMENT

Any drilling/boring or subsurface investigation equipment will be decontaminated prior to and after each use. Decontamination procedures will be explained to subcontractors in advance so necessary supplies and equipment are brought to the project site. The following steps will be taken to ensure drilling equipment is properly decontaminated:

1. To ensure no outside contamination is introduced at the project site, drill rigs should arrive in clean, working order. Inspect the equipment for loose dirt, gas, oil, or hydraulic leaks, and proper safety equipment. Be sure to inspect augers, split spoons, and drill rods for cleanliness and defects.

2. Do not use petroleum-based lubricants on parts of the drill rig which come into contact with sampling or drilling equipment.

3. Between uses, split spoons and other down-hole sampling devices should be thoroughly decontaminated according to the procedures that are appropriate for any known or suspected site contaminants.

4. Thoroughly clean drilling equipment that becomes contaminated (augers, drill rods, etc.) between each borehole. This will be accomplished by either steam cleaning or using a high-pressure, hot water/detergent wash. The method to be used should be based on the expected contamination and outlined in the project-specific field plan. Wash water should be contained and disposed of according to the project-specific waste management plan.

6.0 VERIFICATION OF ADEQUATE DECONTAMINATION

In order to verify that decontamination is being performed properly, equipment blanks (also known as rinsate blanks) should be collected periodically and sent to the laboratory for analysis of each known or suspected site contaminant. Equipment blanks are typically made by running

Approval by:	Chris Shephard, Chief Engineer		
Content Management Owner:	Technical Committee	John P. Brown	
Version:	Final	Version Date:	11-4-2014

laboratory-supplied de-ionized water over or through the equipment and collecting the rinsate in sample containers. When equipment blanks are required, a project-specific program will be developed and approved.

7.0 REFERENCES

U.S. Environmental Protection Agency. *Sampling Equipment Decontamination.* August 1994.

U.S. Environmental Protection Agency. *Field Equipment Cleaning and Decontamination*. December 2011.

CHANGES MADE / DATE OF REVISIONS

Author Name	Date	Description of Change	Version Number
J. Brown	8/20/2014	Write First Draft	Draft
R. Rebel	8/20/201	Technical Review	Draft
D. Rountree	8/21/2014	Editorial Review	Draft
K. Pollman	9/11/2014	Final Technical and Editorial Review	Draft
D. Rountree	11/4/2014	Final Review and Publication	Final

EQUIPMENT DECONTAMINATION CHECKLIST

GENERAL

- Review and understand job-specific work plan(s) and requirements.
- Always have provisions ready to decontaminate equipment.
- Always decontaminate equipment while wearing the appropriate personal protective equipment (PPE) prescribed in the site-specific Health and Safety Plan (HASP).
- Always decontaminate equipment with enough frequency to avoid cross-contamination between wells, soil borings, and discrete sampling intervals.
- Analytical results are in parts per billion (ppb). Just because it looks clean does not mean it is clean.
- Equipment includes, but is not limited to drilling split spoons, water level indicators, water quality meters, shovels, and hand augers.

BASIC DECONTAMINATION PROCEDURES

Decontamination is critical to prevent cross-contamination between samples. If non-aqueous phase liquid (NAPL) or metals are present, review the standard operating procedures (SOP) document and implement alternative methods. The procedure below is for non-NAPL- and non-metal-contaminated equipment.

1. Thoroughly wash the equipment with a 1:100 mixture (2 tablespoons per gallon) of Alconox® or similar and de-ionized water. The equipment may need to be disassembled and scrubbed to be properly cleaned.
2. Triple rinse the equipment with de-ionized water.
3. Allow equipment to air-dry.
4. Decontaminate before, between (as necessary to prevent cross-contamination), and after sampling events.

STANDARD OPERATING PROCEDURE

SOP TITLE: FIELD NOTES & FIELD LOGBOOKS

SOP NUMBER: TECH-001

Approval by:	Chris Shephard Chief Engineer		
Content Management Owner:	Technical Committee	John P. Brown	
Version:	Final	Version Date:	11-4-2014

1.0 KEY STEPS

- Record field notes in a manner consistent with the SOP.
- Be clear and concise.
- Record facts and not opinions.
- Avoid contextual mistakes and confusing or ambiguous language.

2.0 PURPOSE

The purpose of this SOP is to provide the proper requirements for recording information in field logbooks.

Recording field observations and data are critical to ensuring that our field activities are adequately and accurately summarized in reports, that subcontractor invoices are correct, and that there is a written ledger of our field activities available for use during project review and management. Special care must be taken to record all pertinent observations and relevant data and to avoid subjective language. Field logbooks and other forms of written documentation generated in the field must be treated as both confidential and irreplaceable. It is our duty to protect this information and to supply the information to our clients and the regulatory agencies as appropriate or required.

3.0 RELATED DOCUMENTS

- All SOPs related to field work (sampling, inspection, project oversight, etc.).

4.0 PREREQUISITES

A complete understanding of the work to be conducted will dictate the content of your field notes and the media on which they will be recorded. There may also be client-specific requests for documentation that are the responsibility of the client manager and/or project manager to communicate to the respective field personnel prior to starting the job.

5.0 DEFINITIONS

- **Field Logbook** – Field logbooks are bound, company-supplied notebooks, which generally have a yellow or orange waterproof cover and are designed to be used on the project site. They are supplied by the administrative personnel upon request.
- **Standard Company Form** – Standard company forms are those forms that are available on the company server, are generally task specific, and have been approved for use by the client manager and/or project manager. Some examples

are monitoring well purging forms, Spill Prevention, Control, and Countermeasure (SPCC) inspection forms, and soil boring logs.

6.0 PROCEDURES

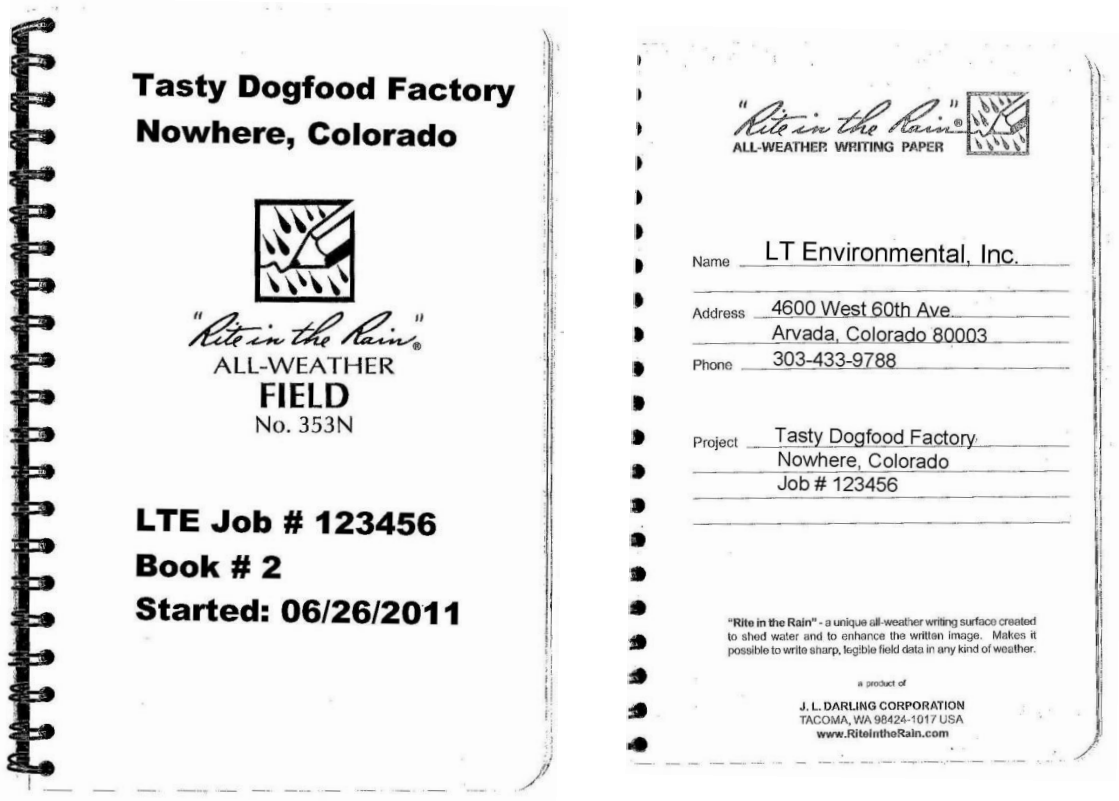
6.1 ACCEPTABLE MEDIA AND GENERAL REQUIREMENTS

A bound field logbook is the primary medium on which LTE observations are recorded. Field notes must be recorded in a bound field logbook, on an approved standard company form, or in an electronic format as approved by the client manager. Please check with the project manager or client manager prior to starting any project to determine the project-specific data recording and recordkeeping requirements. Certain projects require the completion of forms generated by the client, contractor, or vendor. LTE will retain copies of all completed forms in the project file until targeted for archiving or disposal by the client manager.

6.1.1 Field Logbooks

- LTE will supply blank field logbooks to employees.
- Field logbooks can be site-specific, job-specific, or client-specific depending upon the needs of our clients and client managers. In certain cases, the field logbook may be person-specific at the discretion of the client manager. Please check with the project manager or client manager to determine which field logbook to use.
- Field logbooks are company property and must be kept clean, the pages in good condition, and the information safeguarded.
- Mark the outside front cover of the book with the following information:
    - Project Name
    - Job Number
    - Date on which entries were started
    - Book number (i.e., if there is already a completed book for this job numbered Book #1, the new book would be numbered Book #2)
- Information on the outside front cover of field logbooks should be written using a permanent marker such as a Sharpie®.
- Complete the inside cover (ID page) of the book to identify that the book belongs to LTE. This is vital to recovering the field logbook in the event that it is lost or stolen. If the inside cover cannot be used, use the first blank page. Spell out LTE and other names as required on the ID page.

- All field notes within the field logbook should be recorded using blue or black waterproof ink. Do not use gel ink or pencil.
- Field notes should be written legibly.
- Scan the field book notes daily and store in the project file on the LTE server.
- Place completed field books in designated filing location.



6.1.2 Standard Company Forms

Standard company forms come in a variety of styles to suit task- and project-specific needs. Employees must either use a form that has already been approved for use or develop a project-specific form and have it reviewed by the client manager prior to use in the field.

- Company forms are an alternate medium on which data can be recorded, specifically when data are recorded in tabular format or when repetitive qualifiers and headings are necessary.

- These forms may be typed or scanned for direct use in reports or project summaries. It is required to treat company forms in the same manner that you would for field logbooks.
- Ensure that all data are recorded legibly.
- Ensure that all forms are completed with the appropriate data.
- Scan the field forms daily and store in the project file on the LTE server.

6.2 MINIMUM REQUIREMENTS FOR DOCUMENTATION

6.2.1 Daily Heading

The daily heading in a field logbook entry must include the arrival time on site, followed by a list of the LTE personnel on site, the purpose of the site visit, and the weather conditions. When working with client personnel, landowners, third parties, regulatory personnel, and/or contractors, there will be entries to document their arrival on site, the personnel present, the purpose of their visit, and the equipment being used.

- The date must be recorded at the top of each page in the field logbook.
- Dates must be provided in either an 8-digit format (MM-DD-YYYY) or standard full format (example: July 14, 2011).
- Time entries must be recorded in military (24-hour) format and are associated with all entries to the field logbook (example: 1 p.m. = 13:00).
- Each new day must start on a new page in order to minimize confusion during review of the field notes. This also helps to locate the notes for a specific day if there are any questions regarding the field activities for that day.
- Dates must be entered in sequential order. In the event that a blank page is left between entries, write “PAGE INTENTIONALLY LEFT BLANK” and draw a single line diagonally across the page.
- Draw a diagonal line from the last entry of the day to the end of the page to indicate that this was the last entry for the day and to prevent unauthorized data entry at a later time.
- The top of each page in the field logbook must be signed by the person completing the log.
- The bottom of the page must also be signed at the last entry of the day.

6.2.2 Health & Safety

Health & Safety meetings must be conducted at the start of field work (start-up meeting), each morning before starting work, and at any time that a significant change occurs that may affect the safety of yourself or your coworkers. These

meetings and subsequent discussions and findings will be documented in the field logbook.

6.2.3 Instrument Calibration

Many of the instruments that we use require daily or periodic calibrations to ensure that they are functioning within the specified ranges. Instrument calibrations must be recorded either in the field logbook or on an approved company form. Ensure that all of the appropriate parameters are recorded for the instrument that you are calibrating. Recording the ambient temperature during calibrations is necessary for nearly all instruments that we regularly use.

6.2.4 Sampling Activities

Detailed requirements for data collection during groundwater sampling and soil sampling activities are outlined in separate standard operating procedures (SOPs). Please refer to these SOPs, as appropriate, prior to completing any sampling activities. The following list summarizes the basic information recorded during any type of sampling activity:

- The sample name identification ("ID") and sample collection time.
- The depth interval sampled (for soil sampling).
- Where the sample was collected.
- How the sample was collected (i.e., grab sample, composite sample, bailer, at pump discharge, spigot, etc.).

6.2.5 Photographic Logging

All photographs taken must be recorded in the field logbook or on an approved company form. Photographs must be recorded in the order they were taken and the time and location details must be noted.

Example: 13:32, Photograph 1, Tank 332 Location, View Facing North

6.2.6 General Content

Facility information, site sketches, sampling information, diagrams, changes to the scope of work, and phone calls of substantive content are all good examples of information that should be recorded in the field logbook.

At a minimum, field logbooks must contain enough information to reconstruct the daily events, determine who was on site and for how long, and to determine the working conditions. Information regarding site conditions, incidents, personnel, etc., which may have positively or negatively affected the completion of the planned

scope of work, required a change in procedures, or which may have necessitated a change in the health and safety protocols must be recorded.

6.2.7 Correcting Mistakes

Common mistakes such as spelling or numerical errors must be corrected by placing a single horizontal line through the incorrect item and writing in the correct information, then initialing the changes. Do not completely cross out a mistake so it cannot be read and do not use correction fluid or tape.

7.0 AVOIDING CONTEXTUAL MISTAKES

7.1 BE ACCURATE

Accuracy is important even beyond the obvious areas like remediation and sampling procedures. Accurately reporting sequences of events and activities will protect you if your work is scrutinized after the fact. Accuracy includes:

- Defining all acronyms and abbreviations even if you think it is a common abbreviation or acronym.
- Using specific numbers rather than “a few” or “most” or other such unspecific descriptions.
- Avoiding double negatives as they cause confusion or misunderstanding.
- Not using words such as “broken” or “damaged” without details.

7.2 BE OBJECTIVE

Always try to remove personal emotions and opinions from your writing. Place yourself in a dispassionate mindset and record information, not feelings, hunches, or viewpoints. Remove subjective perspectives from your writing, such as “I think...” or “I feel...” and use actual observations.

CHANGES MADE / DATE OF REVISIONS

Author Name	Date	Description of Change	Version Number
J. Brown	2/26/2014	Draft – New Template	Draft
R. Rebel	8/21/2014	Technical Review	Draft
D. Rountree	8/21/2014	Editorial Review	Draft
K. Pollman	9/11/2014	Final Editorial and Technical Review	Draft
D. Rountree	11/4/2014	Final Review and Publication	Final

FIELD NOTES CHECKLIST

GENERAL

- All notes in blue or black waterproof ink – no pencil or gel ink.
- Write notes legibly.
- Project Name, Job Number, and Date Started on the outside front cover of field book.
- Complete LTE name, address, telephone number, and project information on the inside cover of each field book.
- Page number, job number, and date on each page.
- Signature at the top of each page and below last entry for the day.
- Draw a diagonal line from the end of the last entry to the bottom of the page.
- Cross out blank pages not used between days and write "PAGE INTENTIONALLY LEFT BLANK".
- Initial any strikeouts/corrections.
- Scan the notes daily and store in the project file on the LTE server and place book in designated filing location.

DAILY NOTES

A person should be able to read field notes and determine who was on site, the purpose of the field work, and what occurred during the day.

1. Record daily heading with names of all LTE personnel and contractors on site and arrival time(s).
2. Log minutes for initial project, daily, and other safety meetings and any accident details.
3. Log serial numbers and types of equipment used daily, and calibration notes and updates over the course of the day.
4. Take detailed notes! Avoid: "0800 – Arrive on site"; "1700 – Depart site" with nothing in-between.
5. Record company and personnel names, arrival time(s), and function of all contractors.
6. Record visitors' names, company, and purpose of visit.
7. Record current weather and forecast. Provide an update if weather conditions change.
8. Include a short description of fieldwork to be conducted that day.
9. Use military (24-hour) time and full numeric or text date formats.
10. Record times of samples collected, type of sample, and where/how the sample was collected.
11. Provide a site sketch or GPS coordinates for new sampling locations that have not yet been mapped.
12. Record any problems encountered and solutions/resolutions to problems.
13. Do not record personal/subjective observations that are not pertinent to the job.
14. Record any changes from a specified work plan and reason for change.
15. Take photographs and include a photographic log.
16. Sign and date beneath the last entry for the day and draw a diagonal line across any unused portion of the page below your signature.

STANDARD OPERATING PROCEDURE

SOP TITLE: SAMPLE HANDLING

SOP NUMBER: TECH-008

Approval by:	Chief Engineer		
Content Management Owner:	Technical Committee	Alexis Fricke	
Version:	Final	Version Date:	04-10-2019

1.0 KEY STEPS

- Chain of custody procedures
- Sample identification, labeling, and packaging procedures

2.0 PURPOSE

The purpose of this standard operating procedure is to describe the proper sample labeling, handling and chain-of-custody tracking methods to be followed for environmental projects. This procedure outlines the documentation necessary to track sample possession and shipment and provides standardized forms to be used in the field and to describe the standard method for sample identification to be used on environmental investigations.

3.0 RELATED DOCUMENTS AND SOPS

- U.S. Environmental Protection Agency (EPA). 1986. “RCRA Groundwater Monitoring Technical Enforcement Guidance Document.” (OSWER Directive 9950.1). September 1986.
- U.S. Environmental Protection Agency (EPA). 1987. “A Compendium of Superfund Field Operations Methods.” EPA/540/P-87/001. (OSWER Directive 9355.01-14). December 1987.

4.0 RESPONSIBILITIES

Field personnel (samplers) are responsible for performing the tasks in accordance with this procedure. These personnel are responsible for the care and custody of the collected samples until the samples are transferred or dispatched properly. All activities and data collected shall be recorded in the field log book.

The Project Manager or an approved designee is responsible for checking all work performance and verifying that the work satisfies the applicable tasks required in this procedure and ensuring that the work is conducted in a satisfactory manner. This will be accomplished by reviewing all documents and data produced.

5.0 CHAIN OF CUSTODY PROCEDURES

5.1 General

Samples are collected as described in a site-specific work plan or sampling plan.

The chain of custody of the physical sample and its corresponding documentation will be maintained throughout the handling of the sample. All samples will be identified, labeled, logged onto a Chain-of-Custody form, and recorded in the field log book and/or a sample

tracking log as a part of the procedure to ensure the integrity of the resulting data. The record of the physical sample, such as location and time of sampling, will be joined with the analytical results through accurate accounting of the sample custody. As described below, sample custody applies to both field and laboratory operations.

A sample or evidence file is under custody if it is in:

- The possession of the sampler/analyst;
- The view, after being in the possession of, the sampler/analyst;
- The possession of the sampler/analyst and then placed in a secured location; or
- A designated secure area.

5.2 Shipping

Waterproof ink should be used unless prohibited by weather conditions. A log book notation should explain if a pencil was used to fill out the sample tag because the ballpoint pen would not function in freezing weather.

5.3 Review

The Field Team Leader or an approved designee is responsible for verifying that all planned samples have been before relinquishing custody. If all samples have not been collected as planned, the Project Manager should be notified and appropriate actions taken.

5.4 Transfer of Custody and Sample Tracking

Samples should be accompanied to the laboratory by a properly completed Chain-of-Custody form. The sample numbers, locations, and requested analyses should be listed. When transferring the possession of samples, the individuals relinquishing and receiving should sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, or to the laboratory. Commercial carriers are not required to sign off on the Chain-of-Custody forms as long as the Chain-of-Custody forms are sealed inside the sample cooler and the Custody Seals remain intact.

Approval by:	Chief Engineer		
Content Management Owner:	Technical Committee	Alexis Fricke	
Version:	Final	Version Date:	04-10-2019

6.0 SAMPLE IDENTIFICATION

6.1 Method of Sample Identification

The sample taken during the sampling program. This coding system will provide a method for tracking each sample. Proper sample identification will allow information about a particular sample to be retrieved and will enable the analytical results to be assigned to a specific location. It is imperative that each sample be labeled clearly and concisely and that a consistent and standard identification system be used as described below.

The method for identification of a sample depends on the matrix of the sample, and the type of measurement or analysis performed. On-site measurements will be recorded in field log books. The measurements may also be recorded on a log sheet.

Each sample is identified by a unique code which may include, but is not limited to, the following: sample type, sample point, and sequence number.

6.1.1 Sample Type

A two-letter designation can be used to identify the specific type of sample or the area in which it was collected. Typical designations for sample types which may be collected during the site investigations are below.

SW - Surface water grab sample (streams, rivers, lakes, runoff)

SF - Surface water flow (continuous measurement)

MW - Monitor well sample

GW - Groundwater sampled from various types of wells; SS - Source sample

SB - Soil boring sample

SG - Soil gas

SE - Sediment samples collected from stream beds, etc.

TS - Tank samples including aboveground and below ground enclosures

DM - Drum samples

BI - Biological samples

6.1.2 Sample Point

A number may be used to identify a sample point location. This location can be a soil sample point, borehole, well, drum, tank, surface water sample point, lagoon point, air monitor station, or any other point where a source material, water, soil, core, or air sample will be taken.

The sample type and sample point together represent the unique sample station from which the sample will be taken (e.g., MW-01).

7.0 SAMPLE LABELING

7.1 Sample Label

All samples will be temporarily identified with the sample ID and analyses to be performed on the respective bottle. This will be conducted with the use of an indelible pen, crayon or paint marker. Sample labels can be affixed to the sample jar prior to sampling, but if the label gets wet, the writing on the label may run or the label may fall off. Each label must meet the following criteria:

- Waterproof;
- Will not disintegrate;
- Will retain indelible ink markings when wet; and
- Must be self-adhesive.

Complete all sample labels in legibly printed text with an indelible ink pen using the following suggested approach.

- Date - A six-digit number indicating the month, day and year of collection;
- Time - Time (24 hour clock) sample was collected;
- Project - Project name
    - Job No. -LTE job number;
- Location - Brief sample location description. This can also be the sample ID.
- Depth - Depth at which sample was collected (if applicable);
- Sample Number I.D. -
- Preservative - Indicate presence or absence and composition of preservative if present;
- Remarks - Pertinent remarks to help identify sample and analysis to be performed; and

- Signature - Signature of sampler who actually collected the sample.

As each sample is collected, make a record of this in the field log book and place the sample in a labeled container. Bring chests to the decontamination area where, if necessary, the samples can be separated for shipping to the analytical laboratories. Fill out the Chain-of- Custody form for all samples.

7.2 Custody Seal

Custody Seals are required on shipping containers.

Fill out Custody Seals and sign and date each. Affix the Custody Seals such that any opening of the shipping container or sample will be indicated by a broken seal.

8.0 SAMPLE PACKING AND SHIPPING

Pack all samples for shipment following the guidelines outlined below.

8.1 Steps in Packing a Cooler

- Clean the inside and outside of the cooler.
- Line one layer of bubble wrap, bottom side down, in bottom of cooler and line with shredded paper to absorb shock and water.
- Line cooler with one large garbage bag.

8.2 Prepare Samples

- Wrap all glass sample jars one time with bubble wrap. Take note to leave the sample tag out, while making sure that there is bubble wrap coverage on the top and bottom of the sample container.
- Affix bubble wrap in place and put sample in plastic bag of appropriate size as to prevent the bubble wrap from coming unwrapped. Take note to lay the sample tag flat on the outside so it can be read and eliminate air pockets in the ziplock bag.
- Volatile organic compound (VOC) vials are placed in the VOC vial sponge. This is then wrapped loosely in bubble wrap and bagged like other samples.
- Plastic sample bottles are not wrapped in bubble wrap. They are placed in a plastic ziplock baggie with careful attention paid to eliminate air pockets. Make sure that the sample tag is placed face out so it can be read during the final Quality Control (QC) check.
- Check all tags and labels to the corresponding chain of custody. This will complete the final QC check.

8.3 Pack Coolers

- Care must be taken to maximize the number of sample jars placed in the cooler while not overpacking it. Sample jars should fit snugly with little or no movement if shaken lightly prior to filling open spaces with available materials. Do not place sample jars on their sides or on top of one another. Above all, glass should never be touching or capable of touching glass.
- Use available materials to fill any potentially open space in the cooler. Tape jars together, if appropriate, to reduce movement of sample jars during shipment.
- Ice coolers with:
    - Two to three large ziplock bags with few or no air pockets, or several small bags. These bags then are double bagged to prevent any potential for leaking.
    - Put ice inside a trash bag below a layer of shredded paper. This will help keep the sample at 4 degrees (°) Celsius (C). Put paper on top of the ice so it closes very tightly. There should be no inside shifting if the cooler is packed correctly.
- Affix a piece of tape on the top of the cooler with the cooler sequence number, total numbers of coolers for that respective shipment, and the laboratory destination.
- Wrap each cooler a minimum of three times around at each end with strapping or shipping tape. Tape up the drain hole.

8.4 Completing Shipment

Use special hazardous waste (Dangerous Goods) Federal Express air bills.

STANDARD OPERATING PROCEDURE

SOP TITLE: SAMPLE HANDLING

SOP NUMBER: TECH-008

Approval by:	Chief Engineer		
Content Management Owner:	Technical Committee		Alexis Fricke
Version:	Final	Version Date:	04-10-2019

CHANGES MADE / DATE OF REVISIONS

Author Name	Date	Description of Change	Version Number
A. Fricke	4/10/2019	Create First Draft	Draft
D. Stewart	4/10/2019	Prepare draft	Draft

STANDARD OPERATING PROCEDURE

SOP TITLE: SOIL SAMPLING

SOP NUMBER: TECH-002

Approval by:	Chris Shephard – Chief Engineer		
Content Management Owner:	Technical Committee	Nick Talocco; John Brown	
Version:	Final	Version Date:	07/30/2015

1.0 KEY STEPS

- Decontaminate soil sampling equipment as needed.
- Collect soil samples using appropriate means and methods and in appropriate containers.
- Screen soil using a calibrated instrument appropriate for the contaminant encountered.

2.0 PURPOSE

Obtaining accurate and consistent soil analytical data is critical to successful delineation of soil impacts and to characterize excavated soil. The integrity of the sample results is dependent upon the ability of the field staff to implement consistent and reliable sampling procedures. This SOP outlines the standard procedures used to collect soil samples via discrete and composite sampling methods.

3.0 RELATED DOCUMENTS AND SOPS

- TECH-001 *Field Notes & Field Logbooks SOP*
- TECH-003 *Drilling and Soil Boring Logs SOP*
- TECH-004 *Equipment Calibration SOP*
- TECH-005 *Equipment Decontamination SOP*
- TECH-006 *Excavation SOP*
- TECH-007 *Management of Investigation Derived Waste SOP*
- TECH -008 *Sample Handling SOP*

Each client or project may have specific requirements as dictated by a specific sampling plan.

4.0 PREREQUISITES

- Review the sampling program and meet with the project manager prior to completing field activities to determine if there are any special considerations associated with the site (e.g., type of sampling, access issues, laboratory analysis, number and type of jars, holding times, turnaround times, and if preservatives are required). Whenever possible, inform the site manager or property owner of LTE's intention to sample the site prior to mobilizing and of LTE's presence once at the site.
- Prepare a site- and project-specific Health and Safety Plan (HASP) for the project prior to initiation of soil sampling or other field activities. The HASP outlines the potential hazards present, the personal protective equipment (PPE) requirements, the safety standards for the soil sampling procedures, and the procedures for

potential encounters with hazardous materials and other emergencies. Review a copy of the HASP and have it signed by all personnel on site. In addition, the HASP should accompany personnel to the site and be accessible at all times.

- A Job Safety Analysis (JSA) review is required prior to beginning work and when work conditions change.
- The sampling technician or Site Manager will verify that all utility locates and any additional client-specific clearance activities have been completed prior to conducting any subsurface sampling activity.
- Use a bound field logbook to document all field activities conducted during soil sampling. Record additional documentation as needed on soil sampling forms or soil boring logs.
- Calibrate field screening equipment prior to use.
- Collect samples in the appropriate containers and place the samples on ice, in a sealable plastic bag, and in a cooler.
- Complete a laboratory chain-of-custody (COC) form legibly. Verify that the COC indicates the correct company information, name of project manager, site information, sample IDs, dates and times, number of bottles, requested analyses, turnaround time, and signatures.
- Compare the COC to the number of samples collected to ensure that these match and that the laboratory receives the correct number of samples.
- Complete a custody seal and affix to each cooler when using a delivery service or commercial shipper to transfer the samples to the analytical laboratory.

5.0 DEFINITIONS

- Discrete Soil Sample – A soil sample collected at a specific interval or location.
- Composite Soil Sample – A technique that combines a number of discrete samples (aliquots) collected from a body of material into a single homogenized sample for the purpose of analysis. The objective of composite soil sampling is to represent the average conditions in the sample body of material.

6.0 OVERVIEW

The primary goal of soil sampling is to evaluate contaminant types and concentrations and soil characteristics throughout a source area, to identify the spatial (horizontal and vertical) extent of soil contamination, and to characterize soil for disposal purposes. Specific sample requirements and requirements for discrete or composite samples are project- or client-specific. Often a grid sampling pattern may be used.

Approval by:	Chris Shephard – Chief Engineer		
Content Management Owner:	Technical Committee	Nick Talocco; John Brown	
Version:	Final	Version Date:	07/30/2015

7.0 PROCEDURES

Soil sampling procedures are outlined in the following sections.

7.1 Surface Soil Sampling

Collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, hand augers, and scoops. The following procedures will be used to collect a surface soil sample.

1. Carefully remove the top layer of soil and debris to the desired sample depth with a pre-decontaminated tool.

2. For volatile organic analysis, a coring device or other sampling tool that allows for the sample to be collected in a manner that limits the loss of volatile compounds is used to collect the sample. Transfer the sample directly into the laboratory provided container, fill the jar to minimize headspace, and secure the cap tightly. For other analyses, collect the sample using a pre-decontaminated sampling device and then transfer to a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogeneous sample representative of the entire sampling interval. Place the sample into an appropriate, labeled, laboratory-provided container and tightly secure the cap; or, if composite samples are to be collected over a larger area, place sample(s) from other sampling intervals or locations into the homogenization container and mix thoroughly. When compositing is complete, transfer the final sample into an appropriate, labeled, laboratory-provided container and tightly secure the cap.

3. Decontaminate sample equipment per TECH-005 *Equipment Decontamination SOP*.

7.2 Sampling at Depth with Hand Auger or Thin Wall Tube Samplers

This sampling system consists of an auger or thin-walled tube sampler, a series of extension rods, and a “T” handle. The auger is used to bore a hole to a desired sampling depth and is then withdrawn. If a core sample is to be collected, the auger tip is then replaced with a thin-walled tube sampler. The sampler is then lowered into the borehole and driven into the undisturbed soil to the completion depth.

The following procedures are to be used for collecting soil samples with an auger:

1. Attach the auger bit to an extension rod and the “T” handle to the extension rod.

2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, and litter). It may be advisable to remove the first three to six inches of surface soil from the sample area to start the process.

3. Begin augering, periodically removing and depositing accumulated soil into jars for laboratory analysis or a sealable plastic bag for soil screening (if warranted) and/or onto a plastic sheet spread near the borehole. Document the soil types and characteristics in the field log or designated form as required.

4. Continue augering to evaluate subsurface soil conditions or to achieve the desired sampling depth(s). As needed, remove the auger and deposit the soil into sealable plastic bags for soil screening and the remainder onto the plastic sheeting. If conducting soil characterization activities, the auger bit should be decontaminated in between auger trips in accordance with TECH-005 *Equipment Decontamination SOP*.

5. If sampling a designated interval for laboratory analyses, decontaminate the auger bit using a wire brush and a 5-gallon bucket containing water and Alconox®, followed by a deionized water rinse prior to sample collection. Verify the bit is free of soil, prior to sampling.

If a thin-walled tube sampler will be used to collect a sample from a designated interval, the following procedures should be followed:

1. Remove the auger tip from the extension rods and replace with a pre-cleaned thin wall sampler. Install proper cutting tip.

2. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring wall to collapse.

3. Remove the tube sampler, and unscrew the extension rods.

4. Remove the cutting tip and the core from the device.

5. Discard the top of the core (approximately 1-inch), as this likely represents cuttings from shallower depths that collected at the bottom of the borehole above the undisturbed layer of interest. Place the remaining core directly into the appropriate labeled sample container and/or plastic bag for soil screening.

6. If collecting additional samples, decontaminate all sampling tools and repeat steps 4 or 5 as needed.

7.3 Sampling Using Direct-Push Technology

This system utilizes a direct-push drilling rig or portable hammer and sampling rods or core barrels fitted with polyethylene liners in which the soil samples are collected as undisturbed soil cores. A series of consecutive cores may be extracted to give a complete soil column profile or the direct-push unit may be used to drill to a desired depth for sampling a discrete location. The depth intervals sampled and the number of samples to be collected may be

specified by the project work plan or determined in the field based upon the conditions observed and project requirements. The following procedures are to be used when collecting soil samples using direct-push.

1. After extracting the polyethylene liner from the core barrel, place the liner on a flat surface and note the orientation (top and bottom). Record the amount of soil recovered and the soil type on the boring log.

2. Place the soil fraction retained for analysis in a laboratory-supplied container with the appropriate label indicating the sample name, depth, time, and date. Larger diameter sampling barrels and liners may be necessary to obtain the required sampling volume if multiple analytes will be evaluated.

3. Screen the soil material for visible indications of contamination and odors. Record these observations on a boring log.

4. Screen selected soil intervals for organic vapors with a PID or FID per the project-specific requirements.

5. Decontaminate all sampling tools and repeat steps 1 through 3 as needed to screen and sample additional depths as dictated by the project work plan or field observations.

7.4 Sampling Using Split-spoon Sampler

Split-spoon sampling is generally conducted with a drilling rig and is used to collect undisturbed soil cores that are 18 or 24 inches in length. A series of consecutive cores may be extracted with a split-spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth to collect a sample from a discrete depth interval. The following procedures are used for collecting soil samples with a split-spoon.

1. The split-spoon barrel and drive shoe are attached to the drill rod and then lowered through the hollow-stem auger or the open borehole to the sample collection top depth.

2. The drill rig will be used to push or hammer the split-spoon through the undisturbed soil. The driller will monitor the depth to which the split-spoon is advanced, making sure not to drive too deeply and compress the sample.

3. Record the length of the tube used to penetrate the sampled material (typically 18 or 24 inches) and the number of hammer blows required (if used) to attain the sample depth in the site logbook or on the soil boring log.

4. After withdrawing the split-spoon from the borehole and unscrewing it from the drill rod, open it by unscrewing the drive shoe and rod coupling and splitting the barrel. Record the amount of soil recovered and the soil types on the boring log.

5. Place the soil fraction retained for analysis in a laboratory-supplied container with the appropriate label indicating the sample name, depth, time, and date. Larger diameter split-spoons may be necessary to obtain the required sampling volume if multiple analytes will be evaluated.

6. Screen the soil material for visible indications of contamination and odors. Record these observations on a boring log.

7. Field screen samples with a PID or FID per the project-specific requirements.

8. Decontaminate all sampling tools and repeat steps 1 through 7 to screen and sample additional depths as dictated by the project work plan or field observations.

7.5 Soil Sampling from Test Pits or Excavations

A backhoe can be used to remove overburden soil when detailed examination of the soil profile and characteristics is required or when completing soil remediation activities. The following procedures are used for collecting soil samples from test pits or excavations.

1. Utilize a backhoe to excavate the test pit or to remove the vertical and areal extents of the observed contamination.

2. Depending on total depth of the test pit or excavation and if groundwater is encountered, soil samples can often be collected as outlined in Section 7.1. Additional information regarding the sampling procedures for test pits and excavations is provided below.

3. Avoid collecting a sample that has been in direct contact with the excavating equipment.

7.5.1 Shallow Excavation (less than 4 feet) – No Groundwater Present

- Enter only stable test pits or excavations, sample using a trowel, scoop, hand auger, or coring device at the desired intervals along the walls of the test pit or excavation. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above and to expose fresh soil for sampling.
- Using a trowel, scoop, hand auger, or coring device, collect samples from the bottom of the test pit or excavation as needed. All samples should be placed in laboratory-supplied containers with the appropriate label containing the sample name, depth, time, date, and requested analyses.
- Field screen samples with a PID or FID per the project-specific requirements.

7.5.2 Deep Excavation (greater than 4 feet) or Groundwater is Present

- Samples should be collected from the excavator bucket. Under no circumstance does LTE require its employees to enter an excavation for soil sampling.
- Direct the excavator operator to scrape the soil from the sampling location using the backhoe. Using a sampling device, collect a sample of the soil that was excavated as directed and place in laboratory-supplied containers with the appropriate labels indicating the sample name, depth, time, date, and requested analyses.
- Field screen samples with a PID or FID per the project-specific requirements.

7.6 Soil Field Screening

Select an appropriate screening device based on the ionization potential of the expected contaminant and the device specifications. Typically, a photo-ionization detector (PID) or flame ionization detector (FID) is used to evaluate volatile organic compounds. Calibrate the instrument and record calibration information in the field notes. The following Ambient Temperature Headspace Analysis (ATHA) field screening method will be utilized for the selection of subsurface soil samples; however, state and/or project specific requirements may be used in lieu of the following procedure.

1. When collecting samples where splits may be destined for laboratory analysis, collect laboratory supplied sample jars prior to collecting field screening samples to minimize the potential for loss of VOCs.

2. Place a consistent amount of soil into a sealable plastic bag and seal tightly or place the soil into a pre-cleaned glass jar, covering the top of the jar with aluminum foil. Label the outside of the bag or the jar with the sample name, depth, time, and date.

3. Allow the soil to equilibrate at approximately 70 degrees (º) Fahrenheit for approximately 10 minutes.

4. Place the container on a clean work surface upwind of other volatile organic sources.

5. Insert the tip of a PID or FID probe into the corner of the bag or through the foil jar cover to measure the meter reading of the headspace within the container. Allow the meter to equilibrate and then record the maximum measured concentration on the soil boring log, appropriate recording form, or field logbook.

7.7 Composite Sampling Procedures

In many cases a composite sample of a soil pile will be collected for waste characterization analysis or to evaluate potential for reuse at the site. Site-specific plans may provide specific procedures related to composite sampling. Always verify with the client manager or project

manager if specific sampling requirements exist. The following procedures are used for collecting composite soil samples.

1. Collect aliquot samples at 10 separate locations (points) to comprise each composite sample (project-specific requirements may vary for the number of aliquots per sample).

2. Collect each aliquot in an area free of debris and six inches below the surface of the soil stockpile.

3. Using a decontaminated, stainless steel scoop, plastic spoon, hand auger, or trowel, collect the aliquot sample and place it in a decontaminated stainless steel bowl or large sealable plastic bag.

4. Once all of the aliquots have been placed in the bowl or sealable plastic bag, mix the soil and then transfer the mixed sample into an appropriate, labeled container with a stainless steel spoon, or equivalent, and secure the cap tightly. Collect a sufficient volume of composited material to fill all of the required sample bottles.

5. Decontaminate and rinse sampling equipment after compositing the material and filling the sample bottles, and prior to collecting any additional samples.

6. Record the sample collection information in a field logbook.

8.0 Clean-up, Equipment Decontamination, and Borehole Abandonment

Always clean up trash and sampling supplies and dispose of all trash accordingly. All sampling equipment should be decontaminated in accordance with TECH-005 *Equipment Decontamination SOP.* All boreholes will be sealed and abandoned according to state and project-specific regulations/requirements. Many projects specify that the surface penetration must be patched to match the existing surface completion (i.e. – asphalt or concrete).

9.0 Quality Assurance and Quality Control

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, all data must be documented on field sheets and/or field logbooks and COCs. All instruments must be operated in accordance with operating instructions as supplied by the manufacturer. Refer to TECH-004 *Equipment Calibration SOP* for additional information.

10.0 Investigation-Derived Waste Handling

Soil cuttings generated during drilling should be placed in a labeled 55-gallon drum, or other designated container, per TECH-007 *Investigation Derived Waste SOP*.

Approval by:	Chris Shephard – Chief Engineer		
Content Management Owner:	Technical Committee	Nick Talocco; John Brown	
Version:	Final	Version Date:	07/30/2015

11.0 References

Mason, B.J., 1983: Preparation of Soil Sampling Protocol: Technique and Strategies. EPA-600/4-83-020.

Barth, D.S. and Mason, B.J., 1984: Soil Sampling Quality Assurance User Guide, EPA-600/4-84-043.

U.S. Environmental Protection Agency, 1984: Characterization of Hazardous Waste Sites – A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, E.R., B.P. Simmons, R.D. Stephen, and D.L. Storm. Storm 1980: Samplers and Sampling Procedures for Hazardous Waste Streams. EPA-600/2-80-018.

ASTM D 1586-11, ASTM Committee Standards, Philadelphia, PA.

EQUIPMENT AND TOOL CHECKLIST

	Stainless steel spoon, trowel, or scoop		HASP
	Screw drivers (flat and Phillips)		Site map
	Allen keys (metric and standard)		Logbook, soil boring logs
	Trowel		Pens
	Sample containers and coolers		Alconox®
	Ice		PPE
	COC forms		Nitrile gloves
	PID or FID		Bubble wrap
	5-gallon buckets		Trash bags
	55-gallon drum(s)		LTE safety signs and/or traffic cones or barricades
	Methanol (specific projects only – ask Project Manager)		Additional tools
	Hand Auger		

STANDARD OPERATING PROCEDURE

SOP TITLE: SOIL SAMPLING

SOP NUMBER: TECH-002

Approval by:		Chris Shephard – Chief Engineer	
Content Management Owner:		Technical Committee	Nick Talocco; John Brown
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CHANGES MADE / DATE OF REVISIONS

Author Name	Date	Description of Change	Version Number
N. Talocco	4/2/2015	Create First Draft	Draft
K. Pollman	6/1/2015	Technical edits / updates	Draft
D. Rountree	7/27/2015	Edit Review	Final
J. Brown	7/29/2015	Technical edits / updates	Final

SOIL SAMPLING CHECKLIST

GENERAL

Obtain consistent soil analytical data and ensure samples are representative of the soil and that samples are not contaminated by cross contamination and improper sample collection.

- Obtain project specific requirements for sampling including quality control needs.
- Review HASP and JSA and update when conditions change.

PROCEDURE

- Calibrate equipment prior to use.
- Decontaminate equipment appropriately before and between samples.
- Record sampling activities in the bound field logbook and soil boring logs.
- Use correct labeling, packing, and COC and delivery procedures.
- Confirm turnaround time, analyses requested, reporting limits, and reporting requirements.
- Manage waste properly.

Discrete Soil Samples

1. Transfer the sample directly into the laboratory provided container, fill the jar to minimize headspace, and secure the cap tightly.
2. Screen the soil for volatile organic compounds by:
   - Place a consistent amount of soil into a sealable plastic bag or jar with foil cover and seal tightly. Label the container.
   - Warm the bag to a consistent temperature prior to screening.
   - Use a PID or FID to measure the headspace within the bag.
   - Record the maximum measured concentration.
3. Record lithology, etc. on logs or in field book

Composite Soil Samples

1. Combine multi-point aliquot samples to create a composite sample.
2. Collect each aliquot in an area free of debris and 6 inches below the surface of a stock pile.
3. Using pre-decontaminated sampling device to collect the aliquot sample and place and pre-decontaminate stainless steel bowl or large sealable plastic bag.
4. Once all aliquots have been placed in the bowl or sealable plastic bag, mix soil and then transfer the mixed sample into an appropriate, labeled container and secure cap tightly.

STANDARD OPERATING PROCEDURE

SOP TITLE: INVESTIGATION DERIVED WASTES

SOP NUMBER: TECH-007

Approval by:		Chris Shephard – Chief Engineer	
		Technical Committee	Alexis Fricke
Version: 001	Final	Version Date:	11-15-2017

1.0 PURPOSE

This SOP outlines the management of waste generated during environmental field operations. Types of waste include Investigation Derived Waste (IDW) and management waste, such as used oil generated during operation and maintenance (O&M) activities. Management of remediation wastes is based on site-specific requirements as outlined in a scope of work, work plan, contract, or state, local, and federal regulations and is not a focus of this SOP.

2.0 KEY STEPS

To properly deal with IDW and used oil, the following steps are required:

- Identify the waste
- Characterize the waste
- Properly store and label the waste
- Determine management options
- Dispose of the waste

Remember that LTE never owns any of the waste that is generated at our client's jobsites. Therefore, LTE will never appear as the "generator" of the waste on waste profiles, manifests, and other documentation, and LTE personnel will not sign any waste disposal documents unless given prior written authorization to act as "Agent For" the client.

Issues or questions on dealing with IDW and management waste should be directed to LTE Regulatory Affairs.

3.0 RELATED DOCUMENTS AND SOPS

- TECH 002: *Soil Sampling*
- TECH 003: *Drilling and Soil Boring Logs*
- TECH 005: *Equipment Decontamination*
- TECH 009: *Monitoring Well Installation and Development*
- TECH 011: *Groundwater Sampling – Traditional Purge*
- TECH 012: *Groundwater Sampling – Low Flow*
- TECH 014: *Baseline Water Well Sampling*
- TECH 023: *Operation and Maintenance*
- TECH 031: *Surface Water Sampling*

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		Technical Committee	Alexis Fricke
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4.0 ACRONYMS

- IDW – Investigation Derived Waste
- E&P – Exploration and Production
- POTW – Publicly Owned Treatment Works
- PPE – Personal Protective Equipment
- RCRA – Resource Conservation and Recovery Act
- SOP – Standard Operating Procedure
- TCLP – Toxicity Characteristic Leaching Procedure
- UST – Underground Storage Tank

5.0 PROCEDURES for IDW

Management of IDW cannot contaminate clean areas or pose a risk to public health or the environment. Waste management must comply with governing regulations. These may include oil and gas commission rules, solid waste rules, hazardous waste rules, groundwater and soil quality standards, underground storage tank (UST) regulations, industrial pretreatment standards for publicly-owned treatment works (POTWs), and other applicable regulations. This SOP provides general guidelines for determining proper disposal of IDW but the user must be aware of any local, state, and federal regulations that may apply to specific site conditions as well as corporate policies and procedures of LTE and our clients.

5.1 TYPES OF IDW

IDW includes the following types of wastes:

- Soil cuttings and well development water from soil borings and the installation of monitoring wells.
- Purge water removed from wells before groundwater samples are collected.
- Water, solvents, or other fluids used to decontaminate field equipment and personal protective equipment (PPE).
- PPE and disposable equipment.

5.2 CLASSIFICATION OF IDW

To properly deal with IDW, the waste must be evaluated and classified to determine whether the waste is:

- A hazardous waste;

- An exploration and production (E&P) exempt waste;
- An industrial waste; or
- A solid waste, not otherwise specified.

5.2.1 RCRA Hazardous Waste

IDW is a hazardous waste if the IDW contains a listed hazardous waste as defined in 40 Code of Federal Regulations (CFR) Part 261, Subpart D or if the IDW is characteristically hazardous.

Listed wastes are identified based on process knowledge, which requires identifying the source of the waste and whether the IDW is derived from a listed waste. Listed hazardous wastes may be:

- Wastes from non-specific sources (F-wastes);
- Wastes from specific sources (K-wastes);
- Discarded commercial chemical products, off-specification products, or container and spill residues from acutely hazardous wastes (P-wastes); or
- Discarded commercial chemical products or off-specification products that are “toxic” (U-wastes).

IDW is a characteristically hazardous waste if it exhibits the characteristics of ignitability, corrosivity, reactivity, or toxicity.

5.2.2 E&P and Other Exempt Waste

IDW from an oil production site may be E&P exempt waste if it is derived from material that was down hole and is therefore also E&P exempt waste. Examples include soil and groundwater impacted with crude oil or other unrefined product. Fuel, used oil, or other chemicals used at an oil production site that were not downhole are not E&P exempt wastes.

Other Exempt wastes include wastes from Petroleum Contaminated Media & Debris from Underground Storage Tanks, Mining and Mineral Processing Wastes (Bevill), Household Hazardous Waste and Agricultural Waste. Disposal availability and restrictions should be researched and applied in accordance with the specific exemptions.

5.2.3 Non-Hazardous Industrial Waste

IDW that is determined not to be a hazardous waste or E&P exempt waste, but which is derived from commercial or industrial processes, is industrial waste. This includes soil and groundwater from sites that are neither hazardous waste sites nor oil

production sites and may include decontamination fluid and contaminated PPE and disposable sampling equipment.

5.2.4 Solid Waste Not Otherwise Specified

IDW that has not been characterized as a hazardous waste, E&P exempt waste, or industrial waste may be a municipal waste or other solid waste. Examples include PPE and disposable sampling equipment that has been decontaminated and is free of oil and soil. This category also includes IDW, such as soil and groundwater that has not been impacted (e.g., chemical concentrations are not detected or are below all regulatory standards and residential screening levels) and PPE or disposable equipment that has been decontaminated or that has contacted non-impacted media.

5.3 WASTE CHARACTERIZATION

Whenever possible, the nature of the wastes should be assessed by applying the best professional judgement and using readily available information about the site (i.e., observation and field screening of contamination, information from previous investigations, sampling data, and site characteristics). Extensive resources need not be used to characterize IDW, however IDW cannot be assumed to be non-hazardous or E&P exempt unless clear process knowledge is available.

When readily-available information cannot be used, or if required by the disposal facility, one or more samples will be collected and submitted to a laboratory for characterization. Check with the disposal facility regarding specific analyses that may be required for the characterization of the IDW.

6.0 MANAGEMENT OF IDW

When managing IDW, an option must be chosen to:

- Comply with local, state, and federal regulations;
- Be protective of public health and the environment;
- Follow LTE corporate policy; and
- Adhere to contract requirements.

When IDW is generated by the activities of a subcontractor (i.e., driller), it should be noted prior to contractual arrangements that the subcontractor will contain, stage, characterize, and dispose of all IDW generated by the activity.

When a subcontractor is not responsible for the generation of the IDW, details for the characterization and management process should be clarified prior to the generation of IDW.

Management options by waste type commonly encountered are presented in Table 1.

Approval by:		Chris Shephard – Chief Engineer	
		Technical Committee	Alexis Fricke
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Table 1

Management Options by Waste Type

Type of IDW	Generation Process	Management Options			
		Hazardous	E&P Exempt	Industrial	Municipal/ Other
Soil	Well Installation Borehole Sampling	Containerize Dispose at permitted facility within 90 days of generation	Return to area of impact; assumes that the returned soil will be remediated within the area of impact Store for future treatment or offsite disposal at a permitted facility	Return to area of impact; assumes that the returned soil will be remediated within the area of impact Containerize for treatment or offsite disposal at a permitted facility	If not impacted, spread around boring or pit in area of sample collection Soil may not be disposed in a municipal waste dumpster
Groundwater and surface water fluids	Well development Well purging Pumping test Sampling	Containerize Dispose at permitted facility within 90 days of generation	Combine with impacted waste water in onsite sump for disposal if approved by client Containerize for offsite disposal at a permitted facility (e.g., Class II disposal well)	Send to POTW if permitted Discharge to surface in accordance with discharge permit Containerize for treatment or offsite disposal at a permitted facility	If not impacted, return to the vicinity of sample collection If impacted, refer to other categories
Decontamination fluids	Decontamination of equipment and PPE	Containerize Dispose at permitted facility within 90 days of generation	Evaporate if very small amounts If not mixed with solvent, pour on ground in impacted area Containerize for offsite disposal May only be combined with E&P waste if impacted media are E&P exempt	Evaporate if very small amounts If not mixed with solvent, pour on ground in impacted area Containerize for offsite disposal at a permitted facility Send to POTW if permitted	If not impacted, pour on ground near sample location If impacted, refer to other categories

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		Technical Committee	Alexis Fricke
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Type of IDW	Generation Process	Management Options			
		Hazardous	E&P Exempt	Industrial	Municipal/ Other
Disposable PPE and sampling equipment	Sampling procedures or other onsite activities	Containerize and dispose at permitted facility within 90 days of generation	If decontaminated and free of oil and soil, dispose as municipal waste If non-hazardous but not free of oil and/or soil, dispose as industrial waste at a permitted facility	Bag or containerize and dispose as industrial waste at a permitted facility	If decontaminated and free of impacted soil and oil, bag and dispose as municipal waste If impacted, refer to other categories
Trash (e.g., empty packaging, unused well casing material)	Sampling procedures or other onsite activities	No	No	No	Bag and dispose as municipal waste
Unused materials (e.g., left over silica sand, bentonite, concrete mix, etc.)	Sampling procedures or other onsite activities	No	No	Reuse at another location Bag or containerize and dispose as industrial waste at a permitted facility	Not applicable
Used well casing and other well materials	Well abandonment	No	No	Bag or containerize and dispose as industrial waste at a permitted facility	If decontaminated and free of impacted soil and oil, bag and dispose as municipal waste If impacted, refer to other categories
Used oil	Engine maintenance	Recycled used oil is not a hazardous waste	No	Recycle at a permitted facility	Not applicable

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		Technical Committee	Alexis Fricke
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7.0 REFERENCES

U.S. Environmental Protection Agency. 1992. *Guide to Management of Investigation Derived Wastes*. OSWER Directive 9345.3-03FS. Office of Solid Waste and Emergency Response.

CHANGES MADE / DATE OF REVISIONS

Author Name	Date	Description of Change	Version Number
A. Fricke	12/2/2015	First Draft	Draft
D. Rountree	1/4/2016	Editorial Review	Draft
C. Shephard	11/15/2017	Finalized	Final