



Guidelines for Investigations of Contaminant Release Sites

The objective of an investigation at a contaminant release site is to determine the extent and environmental impact of the release contaminant. This includes:

- < Delineating the horizontal and vertical extent of Contaminants of Concern (COC) in the soil and groundwater;
- < Identifying and evaluating receptors;
- < Characterizing the nature of the COC present; and
- < Adequately defining the site geology and hydrogeology.

The investigation, in conjunction with a site characterization, should determine the source or sources of the release. The investigation must provide adequate and reliable information that can be used to determine if further action is required.

As an agent of the responsible party or potential buyer, the consultant is responsible for adequately investigating the site and recommending additional investigation or corrective action as appropriate. The consultant should be familiar with all local, state, and federal regulations, as well as the North Dakota Department of Environmental Quality (Department) guidance documents which address technical and reporting requirements. The consultant should also be versed in industry accepted remediation technologies and be aware of appropriate emerging technologies.

This document is designed to provide guidance for performing a site investigation of a petroleum release in North Dakota. However, these guidelines also apply generally to other contaminants, with variations possibly needed to address the physical and chemical characteristics of the COC or other site considerations.

A. Receptors Survey

1. A comprehensive initial site survey shall be conducted if not already completed. This survey shall include the locations and relative elevations of, at a minimum, potential receptors, existing or former underground or aboveground storage tanks, lines, dispensers, monitoring wells, and above and below ground structures.
2. All water wells (drinking and nondrinking) within a 1000-foot radius and other potential receptors (i.e., surface waters, wetlands, basements, public and private utilities) within a 250-foot radius of the facility shall be depicted on an appropriately scaled base map. The relevant portion of the appropriate United States Geological Survey 7.5 minute topographic map,

with the area of interest and release extent shown, shall be prepared for submission.

- a. Note and record on a site vicinity map the current use of the site and adjacent land (agricultural, residential, commercial, industrial). The local city or county administrative authorities shall be contacted for information pertaining to any applicable zoning and land use ordinances. Zoning ordinances set broad scale restrictions on property development such as residential, commercial, or industrial. Land use ordinances may establish smaller scale restrictions such as disallowing the installation of drinking water or irrigation wells. A photocopy of the applicable sections or summary of the ordinances shall be provided. If a copy cannot be obtained, name, phone number, and business address of the appropriate authorities should be documented along with a summary of the relevant information.
- b. Construct a map that depicts the location of the facility, all impacted properties, all properties located adjacent to the impacted properties, and any property on which a permanent monitoring well was installed as part of the investigation. The names and addresses of the owners or authorized contact person of each of these properties shall be included either in the map or in an associated table.
- c. Depict on a scaled site map to the nearest one foot, all aboveground and underground structures, underground utilities (electrical, water, storm sewer, sanitary sewer, natural gas, telephone, cable TV, vaults, manways, etc.) within a 250-foot radius of the facility. The depth (± 2 feet) shall be identified.
- d. Screen all potentially impacted receptors (residences, utility vaults, sewers, etc.), using appropriate, properly calibrated field instrumentation, and any receptor that may be potentially impacted within 250 feet of the last known area or suspected area of contamination. Any water supply well within 500 feet must be sampled for laboratory analysis. Provide the name, address, and a contact telephone number for the owner of any impacted receptors to the Department contact. This information shall be included in the report of findings.

B. Soil Boring Installation, Sampling, and Analysis

1. All soil borings and screening points shall be completed and properly abandoned pursuant to North Dakota Groundwater Monitoring Well Construction Requirements, Chapter 33.1-18-02.
2. If not previously defined and quantified, the horizontal and vertical extent of impacted vadose zone soil contamination shall be fully delineated. The actual number of soil borings will be determined in the field but shall, at a minimum, be five.

3. Install the soil borings to a depth at which point field screening no longer shows the presence of the COC. Soil samples shall be collected at 2-foot intervals to the boring terminus for field analysis.
4. At least one soil boring shall be placed in an area where the highest COC concentration is expected to be found.
5. Soil Sample Descriptions:
 - a. Describe the lithology at each boring installation and screen each interval for COCs utilizing properly calibrated instruments.
 - b. On separate logs for each boring, record the soil type, color of soil using standard methods, split-spoon sample intervals, and any organic vapor and field screening measurements. Additionally, a qualitative indication of soil conditions (dry, moist, wet, saturated) shall be noted on the logs. The boring logs shall note the depth of each sample submitted for analysis.
6. A soil sample from each boring shall be submitted to a laboratory for analysis as follows:
 - a. For petroleum, oil, lubricant or solvent investigations, the soil sample from each boring with the highest organic vapor measurement shall be submitted to the laboratory for analysis. If the organic vapor measurements for all samples in a boring are within 10 percent of each other, the deepest sample above the water table shall be submitted for analysis. All industry standard quality assurance and quality control methods shall be followed for shipping (sample label, sealed sample containers, chain of custody prepared, stored on ice). The soil samples (one from each soil boring) shall be analyzed for the appropriate analyses as listed in Table 1.

Table 1.

Product	Soil Samples			Water Samples		
	Analyte	EPA Method	Reporting Limit	Analyte	EPA Method	Reporting Limit
Gasoline, Diesel, Fuel Oil	BTEX	5035/8020A	5 µa/ka	BTEX	5035A/8020A	5 µa/l
	TPH (DRO)	8015B	10 mg/kg	MtBE	5030B/8020A	40 µg/l
	TPH (GRO)	8015B	10 mg/kg	TPH (DRO)	8015B	10 µg/l
	Total Naphthalenes	5035/8260B	5 µg/kg	TPH (GRO)	8015B	10 µg/l
	PAH	3550B/8270C	660 µg/kg	Total Naphthalenes	5035/8260B	5 µg/l
				PAH 3550B/8270C Dissolved Oxygen and CO ₂		660 µg/l
				Ferrous Iron	SM3500-Fe D	30 µg/l
				Methane	Kerr Method	1 mg/l
				Nitrates	9056 or 9210	100 µg/l
				Sulfates	9056 or 9038	1 mg/l
Used Oil	BTEX	5035/8020A	5 µg/kg	BTEX	5035/8020A	5 µg/l
	TPH (DRO)	8015B	10 mg/kg	TPH (DRO)	8015B	10 mg/l
	Lead	7421	250 µg/kg	Dissolved Oxygen and CO ₂		
	Mercury	7471A	10 µg/kg	Ferrous Iron	SM3500-Fe D	30 µg/l
	Arsenic	7060A	250 µg/kg	Methane	Kerr Method	1 mg/l
	Barium	6010B	2,500 µg/kg	Nitrates	9056 or 9210	100 µg/l
	Cadmium	7191A	500 µg/kg	Sulfates	9056 or 9038	1 mg/l
	Chromium	7191	250 µg/kg	Lead	7421	15 µg/l
	Selenium	7740	250 µg/kg	Mercury	7471A	2 µg/l
	Silver	7761	250 µg/kg	Arsenic	7060A	10 µg/l
				Barium	6010B	2,000 µg/l
				Cadmium	7191A	5 µg/l
				Chromium	7191	100 µg/l
				Selenium	7740	50 µg/l
			Silver	7761	100 µg/l	

If the COC is not a petroleum hydrocarbon product, the analyte list and lab methodology should be approved by the Department prior to the investigation. Field screening, sampling triggers and techniques will be determined and approved based on the properties of the COC.

7. Soil Boring Abandonment - All soil borings and screening points shall be properly abandoned pursuant to the North Dakota Groundwater Monitoring Well Construction Requirements, Chapter 33.1-18-02.

C. Install permanent monitoring wells

1. The number and location of the permanent monitoring wells shall be based on available field data with the Department's preapproval. The wells shall be installed such that the horizontal and vertical extent of the groundwater COC are delineated for monitoring both on and off-site. The contractor is expected to define the extent of the COC to the maximum extent possible.

2. The installation, construction and decommissioning of boreholes and groundwater monitoring wells must be supervised on-site by a certified and licensed contractor in accordance with the North Dakota Groundwater Monitoring Well Construction Requirements, Chapter 33.1-18-02.

When installing monitoring wells for light, non-aqueous phase liquid (LNAPL) hydrocarbons, a two inch inside diameter (ID) PVC casing and screen shall be used, unless a variance is granted by the Department project manager prior to installation. The well screen length should be 10 feet for shallow wells. However, if the contractor is aware of significant groundwater level fluctuations, a longer screen length may be necessary and shall be specified in the plan. Well screens must bracket the water table and approximately one-half of the well screen should be positioned below the water table. Monitoring wells for other COC's must be constructed based on the properties of that COC.

Unnecessary permanent monitoring wells shall not be installed (e.g., wells installed a significant distance beyond existing temporary or permanent well that exhibits no appreciable concentration of COC).

If monitoring wells are needed, at least five monitoring wells shall be installed to define the groundwater flow direction. At least one of the wells shall be placed in the area with the highest concentrations of COC and one well shall be placed in the area with lesser concentrations. The remaining wells should be installed on the outside edges of the plume that exhibits no appreciable concentration of COC to fully define the extent of contamination and to provide monitoring for remedial progress. In some cases fewer monitoring wells may be used with permission of the Department.

3. For some COC's, vertical migration of the contaminant may occur. Nested wells completed at different depths may be appropriate.
4. All soil cuttings and groundwater generated during boring construction and monitoring well development/purging shall be handled in accordance to the North Dakota Groundwater Monitoring Well Construction Requirements, Chapter 33.1-18-02.
5. The development method, chosen by the contractor, shall be capable of removing formation cuttings, drilling fluids, and additives to provide relatively sediment-free water samples that are typical of the aquifer.
6. The purge waters shall be measured for pH, specific conductance, and temperature. Purging is considered complete once the groundwater temperature and pH measurement have equilibrated. All measurements shall be submitted to the Department in the site investigation report.

D. Groundwater Sampling

1. Prior to collecting a groundwater sample, check the static water level from each well. Sample collection for laboratory analyses shall not be performed less than 24 hours after well development. The sampling logs shall note the location and type of each sample submitted for analysis. Each groundwater sample shall be properly prepared for shipping (sample label, sealed sample container, no air in the sample, chain of custody prepared, stored on ice, etc.) and shipped to a laboratory.

E. Groundwater Analysis

1. For fuel/LNAPL investigations, the groundwater sample from each well shall be shipped for appropriate analysis as listed in Table 1. Laboratory data for each sample (field sampling logs, chain of custody forms, etc.) shall be added to the appendix of the report.
2. Analytical parameters for COC's other than petroleum hydrocarbons should be discussed with, and approved by, the Department before the investigation begins.

F. Free Product Recovery Test

1. If free product is encountered in a permanent monitoring well, then a recovery test or bail down test shall be conducted to determine free product recovery rates.

G. Final Survey

1. A final survey to tie-in field screening points and permanent monitoring well locations and elevations shall be performed. This subsequent survey may be performed by the contractor; however, a licensed land surveyor is preferred. Horizontal locations must have an accuracy of 3 feet. Vertical elevation of the top of the riser of all monitoring wells must have an accuracy of .01 feet. Survey coordinates should be in latitude-longitude or other established coordinate system, with reference to datum, location, and elevation of a nearest permanent benchmark.

H. Aquifer Characteristics

1. Follow-up investigations may require the following when it appears that remediation may be necessary:
 - a. Determine the aquifer characteristics - The completion of a pumping test is preferred whenever possible. In cases where a pumping test cannot be conducted because of technical (e.g., well yields are too low) or financial (e.g., wastewater disposal is cost-prohibitive) reasons, aquifer slug tests shall be acceptable. At least three separate slug tests shall be conducted in different on-site wells to determine aquifer characteristics unless otherwise specified by the Department. All wastewater generated during aquifer tests shall be properly disposed.

- b. Slug Tests - Data shall be analyzed in accordance with industry standards (Horslev, Bower and Rice, etc.).
- c. Pumping Test - To ensure that the pumping test data is representative, the test shall be conducted using a sufficient pumping rate and duration to stress the aquifer. Therefore, the pumping test shall have a duration of at least six hours to a maximum of 24 hours based on site-specific data. Data shall be analyzed in accordance with industry standards.

I. Waste Disposal

- 1. Sample, analyze, transport, and dispose of any soil or wastewater generated in accordance with Department guidelines. Sampling and disposal shall be the responsibility of the contractor. It is the responsibility of the contractor to acquire signatures for the disposal manifests. Categories of waste disposal include:
 - a. Wastewater -
 - i. Water generated from well development, purging and/or sampling.
 - ii. Water generated from a pumping test.
 - b. Free Product - Any product recovered from the subsurface.
 - c. Soil - Soil that requires treatment in accordance with Department guidelines.

Regulatory Agency

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