

Title 10 – DEPARTMENT OF NATURAL RESOURCES
Division 26 – Petroleum and Hazardous Substance Storage Tanks
Chapter 2 – Underground Storage Tanks – Technical Regulations

PROPOSED RULE

10 CSR 26-2.076 Site Characterization and Data Requirements

PURPOSE: This rule presents requirements for conducting site investigations to characterize contamination resulting from releases from storage tank systems.

(1) Owners and operators shall perform site characterization to obtain data and information for a storage tank release site to be used to facilitate an assessment of the risk the release poses to receptors and to plan corrective action. Prior to initiating site characterization, owners and operators shall develop a site characterization work plan for review and approval by the department.

(2) To adequately characterize a release and all properties affected by the release, owners and operators shall collect data and information for the following categories. This information shall be included in the site characterization report. If any categories of data are not included, the site characterization report shall document the reason(s) for the omission.

(A) Chronology of site events;

(B) General site information and physical setting, including:

1. Vadose zone soil characteristics;
2. Characteristics of saturated zone(s); and
3. Surface water body characteristics.

(C) The nature and magnitude of the release on and off-site, including:

1. Distribution and characteristics of light non-aqueous phase liquid, including free product, if any;
2. Identification of chemicals of concern;
3. Distribution of chemicals of concern in soil and bedrock; and
4. Distribution of chemicals of concern in groundwater;

(D) Exposure considerations for the site and all affected and potentially affected off-site properties, including:

1. Current and reasonably anticipated future land use;
2. Current and reasonably anticipated future groundwater use;
3. Receptors;
4. Exposure pathways; and
5. Existing activity and use limitations, if any.

(E) Information about corrective action measures that have been conducted or are planned, including data pertinent to remedial system design, as appropriate; and

(F) Additional data and information necessary to complete a risk assessment, develop a corrective action plan, or design a remediation system might be needed based on site-specific considerations.

(3) Chemicals of concern. Potential chemicals of concern shall be identified based on the nature of the petroleum product or products or other regulated substances known or suspected to have been released. Specific types of petroleum and their associated chemicals of concern are listed in Table 1 of this rule.

(A) Owners and operators shall determine the specific chemicals of concern based on laboratory analyses of samples collected at the site. Soil and groundwater samples shall be managed and analyzed in accordance with the requirements of section (22) of this rule. For releases of a regulated substance(s) other than petroleum, soil and groundwater samples shall be analyzed for chemicals of concern and by analytical methods determined in consultation with and as approved by the department.

(B) At sites where the petroleum release(s) occurred prior to 1980 or when the date of the release is not known with certainty, owners and operators shall assume leaded gasoline was or might have been released and, in addition to lead, 1,2-dibromoethane and 1,2-dichloroethane shall be evaluated as potential chemicals of concern.

(C) For petroleum releases other than gasoline or where the type of petroleum is not known, samples with detectable levels of total petroleum hydrocarbon-diesel range or oil range organics shall also be analyzed for the polycyclic aromatic hydrocarbons listed in Table 1 of this rule.

(D) Where waste oil or used oil was or might have been released, arsenic, barium, cadmium, chromium, lead, and selenium shall be evaluated as potential chemicals of concern.

(E) If the release can be definitively identified as one or more specific types of petroleum or other regulated substance based on release reports, sample analysis, location of contamination, or other information, only the chemicals of concern for that type of petroleum or substance need be included in the initial laboratory analyses. If the type of petroleum or other regulated substance cannot be conclusively identified, chemicals of concern corresponding to all types of petroleum or substance known or suspected to have been stored at the release site shall be included in the initial analyses. The chemicals of concern for the site may be identified based on the initial laboratory results and the list of analytes modified accordingly in subsequent sampling rounds, with approval of the department.

(F) Ethanol and methanol. Groundwater samples need only be analyzed for ethanol and methanol when the domestic groundwater use pathway is complete under current or reasonably anticipated future site conditions and there is a reasonable probability that petroleum or another regulated substance containing ethanol or methanol was released. Soil samples need not be analyzed for ethanol and methanol.

(G) If laboratory analytical data from previously collected samples do not include all suspected chemicals of concern associated with a release, the department may require additional sampling to evaluate the chemicals of concern that were not included.

(4) Land use. Owners and operators shall identify the current and reasonably anticipated future land use of the site and all affected off-site properties in accordance with 10 CSR 26-2.075(6).

(5) Receptors. Actual and potential human and ecological receptors shall be identified at the site and all affected and potentially affected off-site properties in accordance with 10 CSR 26-2.075(10)(B).

(6) Site maps. Owners and operators shall prepare at least a site area map and a detailed site map. The maps shall be to scale with a north arrow.

(A) The site area map shall be prepared using United States Geological Survey seven and one-half (7.5) minute topographic maps as a base. Contour lines and all other features on the topographic map shall be legible upon delivery to the department.

(B) A detailed map of the site shall depict site features and property boundaries of the site and all off-site properties affected or potentially affected by the release. The site map shall show the layout of past and current site features including, but not necessarily limited to, underground storage tanks, above ground storage tanks, piping, dispenser islands, sumps, paved and unpaved areas, utilities (above and below ground), canopies, and buildings. At a minimum, the map shall show the locations of the following both on and off-site:

1. Monitoring wells (including any that have been abandoned, lost or destroyed);
2. Public and private water wells on and near the site;
3. Above and below ground utilities;
4. Soil borings;
5. Remediation system components and features;
6. Areas where remediation occurred via soil excavation; and
7. The point and area of release.

(7) Location and identification of utilities. Owners and operators shall locate and identify all underground utility lines and conduits that are within or very near a known or suspected area of contamination resulting from a storage tank release or are likely to be within such an area in the future due to the migration of chemicals of concern associated with the release. Owners and operators shall prepare a thorough assessment of the potential for preferential flow of free product or contaminated groundwater or vapors through any utility trenches or conduits.

(A) If water lines are present and found to be in contact with contaminated soil or groundwater or are likely to be in contact with contaminated soil and groundwater in the future, owners and operators shall determine the materials of construction of the main lines and service lines and the joints and gaskets of both within the area of contamination.

(B) If the water line, joint, or gasket material(s) are pervious to or degrade in the presence of chemicals of concern associated with the release, owners and operators shall contact the department, evaluate the integrity of the water lines, or alert the utility company regarding the contamination.

(8) Regional hydrogeology and aquifer characteristics. Owners and operators shall review available information and compile new information to determine regional hydrogeology, soil types and aquifer characteristics. This information shall be used to determine the type and depth of aquifers in the area, whether the aquifers are confined, semi-confined, or unconfined, and to obtain general aquifer characteristics, including yield and total dissolved solids.

(9) Seeps, springs, surface water and karst features. Owners and operators shall identify seeps, springs, karst features and all surface water bodies within at least five hundred feet (500') of the outer edge of the area of release, unless a different distance is required by the department based on site conditions. In karst areas, the department may require that the minimum search area radius be increased. Seeps, springs, karst features, and all surface water bodies identified on a site and all affected and potentially affected off-site properties shall be identified on the site area map and, if appropriate, included on the detailed site map. If a surface water body is identified and investigations determine that it may be or is affected by contamination arising at the site, owners and operators shall collect information regarding the type, flow rate, flow direction, depth, width, classification, and use of the surface water body.

(10) Water well survey. As part of the efforts to evaluate groundwater use in accordance with 10 CSR 26-2.075(7), owners and operators shall conduct a water well survey to locate all wells within the area of release, public water supply wells within an approximately one (1) mile radius of the outer edge of the area of release, and all private water wells within an approximately one quarter (0.25) mile radius of the outer edge of the area of release, unless a different distance is required by the department based on site conditions. In areas where private wells are likely to be present, the department may require that owners and operators conduct a door-to-door survey of businesses and residences.

(A) For each water well identified, owners and operators shall obtain well construction details to the extent such are available. At a minimum, owners and operators shall determine the total depth of the well, casing and screen intervals, materials of construction, and past and current use.

(B) Any identified well that is not currently used or likely to be used shall be abandoned by the party responsible for the well in accordance with 10 CSR 23-3.110, unless it is to be used as part of site characterization or corrective action activities for the release.

(11) Ecological receptors and habitats. Owners and operators shall collect data necessary to facilitate the screening process in 10 CSR 26-2.075(11) to evaluate the presence of ecological receptors or habitats at and near the site. If the screening process indicates the presence of one or more ecological receptors or habitats, owners and operators shall proceed in accordance with 10 CSR 26-2.077(8).

(12) Vadose zone characterization. Owners and operators shall characterize the vadose zone to determine its thickness, depth to groundwater, the nature and distribution of soil types and soil horizons, and other relevant characteristics of soils and other geological media affecting or potentially affecting contaminant fate and transport.

(A) Soil borings and probes shall be advanced to the water table, bedrock, or a depth of at least twenty feet (20') below ground surface, whichever is encountered first, unless one or more chemicals of concern are detected at twenty feet (20'), in which case the boring or probe shall be advanced until field screening indicates chemicals of concern are not present in two consecutive sampling intervals or groundwater or bedrock is encountered.

1. Unless a permanent monitoring well is installed, all boreholes and probes greater than ten feet (10') in depth shall be abandoned in accordance with 10 CSR 23-4.080(6). Boreholes and probes less than ten feet (10') in depth shall be plugged by returning uncontaminated native material into the hole from which it was removed or by grouting.

2. Soil borings and probes shall be continuously sampled and logged.

(B) Vadose zone soil characteristics. Owners and operators may determine site-specific values for soil properties including, but not limited to, dry bulk density, porosity, volumetric water content, and fractional organic carbon content, and use these values in developing tier two or tier three site-specific target levels.

1. Owners and operators shall determine site-specific values for soil properties based on data collected at the site using field procedures, sampling protocols and laboratory methods specified by the department in the *Missouri Risk-Based Corrective Action (MRBCA) Process for Petroleum Storage Tanks* guidance document dated XXXXXX, 2012, published by and available from the Department of Natural Resources, P.O. Box 176, Jefferson City, Missouri 65102-0176, and hereby incorporated by reference without later amendments or additions, or alternative procedures, protocols or methods approved by the department.

2. Owners and operators shall collect samples from the site in a manner that adequately accounts for soil heterogeneity. Sample locations shall be distributed to account for both vertical and horizontal variations in soil properties.

3. Owners and operators shall collect samples from the site over time for analysis of volumetric water content in order to adequately and accurately represent temporal variations in volumetric water content. All soil samples analyzed for chemicals of concern shall also be analyzed for volumetric water content.

4. In the event that site-specific soil property values cannot be determined because of sampling or other limitations, owners and operators shall use either the default values established by the department in the *Missouri Risk-Based Corrective Action (MRBCA) Process for Petroleum Storage Tanks* guidance document dated XXXXXX, 2012, or appropriate literature values that can be justified as representative of site conditions.

(13) Saturated zone characteristics. As appropriate in consideration of site conditions and release characteristics, owners and operators shall characterize the saturated zone to

gather information to define the extent to which chemicals of concern are being transported through the saturated zone and their ultimate fate.

(A) Saturated zone characteristics shall be determined based on field procedures, sampling and testing protocols, and lab methods specified by the department in the *Missouri Risk-Based Corrective Action (MRBCA) Process for Petroleum Storage Tanks* guidance document dated XXXXXX, 2012, or alternative procedures, protocols, or methods approved by the department. Literature values may be used to quantify saturated zone properties and characteristics.

(B) Depth to groundwater shall be determined from boring logs and water levels measured in monitoring wells at the site. The vertical range of water table fluctuations shall be determined and water level data shall be evaluated to determine whether the water level variations are seasonal or represent a consistent upward or downward regional trend.

(14) Delineation criteria. Owners and operators shall delineate chemicals of concern associated with a tank release as follows:

(A) Groundwater. In every case and without regard to the soil delineation criteria applicable to the site, and notwithstanding subsection (14)(C) of this rule, delineation criteria for groundwater shall be based on complete current and reasonably anticipated future groundwater exposure pathways for residential land use. The groundwater domestic use exposure pathway shall be evaluated independent of land use. Where more than one groundwater exposure pathway is complete, the delineation criteria for groundwater shall correspond to the lowest residential groundwater target level in Table 2 of 10 CSR 26-2.078.

(B) Soil. Chemicals of concern in soil shall be delineated to the default target levels in 10 CSR 26-2.078 Table 1, except as provided for at subsections (14)(B)1 and 2 of this rule.

1. If an evaluation of the groundwater domestic use exposure pathway completed in accordance with 10 CSR 26-2.075(7) finds the pathway to be incomplete, owners and operators shall delineate chemicals of concern in soil to the lowest of the residential target levels for soil in 10 CSR 26-2.078 Tables 2 and 6, except as provided for in subsection (14)(B)2 of this rule.

2. If owners or operators demonstrate that the reasonably anticipated future use of the site is non-residential, and the department agrees, and that chemicals of concern in soil associated with the release(s) have not migrated off the site, as documented by site investigation findings agreed to by the department, owners and operators may delineate chemicals of concern in soil to the lowest of the tier one non-residential risk-based target levels for soil in Table 3 of 10 CSR 26-2.078, unless the domestic use of groundwater pathway is complete, in which case chemicals of concern in soil shall be delineated to the lower of the tier one non-residential risk-based target levels for soil in Table 3 of 10 CSR 26-2.078 and the tier one risk-based target levels in Table 5 of 10 CSR 26-2.078.

(C) In accordance with subsection (22)(B) of this rule, if the delineation criterion for a chemical of concern is less than the required reporting limit for that chemical found in Table 2 of this rule, the reporting limit shall be used as the delineation criterion.

(15) Degree and extent of contamination. Owners and operators shall collect soil and groundwater data to determine:

(A) Potential exposure pathways to human and ecological receptors under current and reasonably anticipated future conditions;

(B) The extent of chemicals of concern at concentrations equal to or greater than those specified in section (14) of this rule; and

(C) Exposure domains for each complete exposure pathway and associated maximum or representative concentrations for chemicals of concern.

(16) Distribution of chemicals of concern in soil. Owners and operators shall collect an adequate number of soil samples from surface and subsurface soils, including fill material and non-soil geological materials, to meet the objectives listed in section (15) of this rule.

(A) All soil samples shall be managed and analyzed in accordance with section (22) of this rule.

(B) Soil borings or probes shall be located so as to define and characterize concentrations of chemicals of concern in surface and subsurface soil. Each soil boring or probe shall be continuously field screened and advanced in accordance with subsection (12)(A) of this rule.

1. At least one soil boring or probe shall be located at the point of release or, if the point of release is unknown, near the center of the release area.

2. For each boring or probe, at least one surface soil sample shall be collected for laboratory analysis of chemicals of concern from the location having the highest level of surface soil contamination, unless the release is documented as having occurred below a depth of three feet (3') below ground surface, in which case a surface soil sample need not be collected.

3. Soil samples for laboratory analysis shall be collected from each soil boring or probe to clearly define the lateral and vertical extent and quantify the degree of chemicals of concern present in the soil.

(C) In soil borings or probes where bedrock is encountered before the water table, a soil sample shall be collected at the soil/bedrock interface.

(17) Distribution of chemicals of concern in groundwater. Owners and operators shall collect an adequate number of groundwater samples to meet the objectives listed in section (15) of this rule. Monitoring wells shall be installed to delineate the horizontal and vertical extent of the groundwater solute plume and determine the direction of groundwater flow at and near the site. The number and placement of permanent monitoring wells may be based on data collected via temporary sampling points or other types of subsurface investigations.

(A) Groundwater samples shall be managed and analyzed in accordance with section (22) of this rule.

(B) Monitoring wells shall be properly developed and gauged after installation.

(C) A survey shall be conducted to establish monitoring well locations and elevations.

(D) Solute plume behavior. Owners and operators shall conduct groundwater monitoring for a sufficient period of time and with adequate frequency to:

1. Demonstrate that the areal extent of and concentrations of chemicals of concern in the groundwater solute plume are not increasing; and
2. Allow for the determination of accurate representative concentrations of chemicals of concern in groundwater in consideration of potential or actual seasonal or other temporal variability in concentrations of chemicals of concern.

(18) Free product/light non-aqueous phase liquid (LNAPL).

(A) When free product or LNAPL is encountered in soil or groundwater at or near a site, owners and operators shall:

1. Conduct vapor monitoring of utilities, subsurface and surface structures, and any other enclosed spaces in the area immediately above and within twenty feet (20') of the known extent of the free product or LNAPL unless owners or operators or others provide information to the department that clearly demonstrates such monitoring is not warranted.

2. Conduct investigations to determine the following:

- A. The full vertical and horizontal extent of the free product and LNAPL;

- (I) A sufficient number of investigation points, including, but not limited to, probes, soil borings, monitoring wells, and soil gas sampling points, shall be installed to ensure full characterization of free product and LNAPL and associated dissolved and vapor-phase concentrations of chemicals of concern;

- (II) Layers or seams of relatively high permeability materials that may act as pathways for free product migration shall be identified;

- B. Whether and to what extent the free product is migrating;

- (I) Free product shall be monitored on a frequency and for a period of time sufficient to document that the areal extent of the free product is not increasing using appropriate methodologies approved by the department;

- C. The extent to which free product removal is practicable;

- D. The most appropriate free product removal method in consideration of site-specific soil and geological conditions; and

- E. The potential for free product or LNAPL to pose unacceptable risk to human and ecological receptors.

- (I) Owners and operators may determine free product physical properties and composition to allow site-specific determination of effective solubility and vapor pressure for chemicals of concern using analytical methods approved by the department. Concentrations of chemicals of concern associated with the free product shall be determined in accordance with 10 CSR 26-2.077(9).

(19) Location of chemicals of concern relative to current and future structures. Owners and operators shall determine if volatile chemicals of concern at concentrations above the delineation criteria exist in soil, soil gas, or groundwater within five feet (5')

laterally or vertically of a current or future structure that humans will or could occupy for either a residential or non-residential purpose.

(A) The determination must include an evaluation of the presence or possible presence of a basement; if activity and use limitations are not in place to prevent the installation of a building with a basement in the future, owners and operators must assume a basement extending at least eight feet (8') below the ground surface will be present when evaluating whether volatile chemicals of concern in any media will be within five feet laterally or vertically of a future building. For current buildings with basements, the actual depth of the basement shall be used in the determination.

(B) Unless physical site constraints or durable and reliable activity and use limitations are in place that limit where and what type of building may be constructed, for the purposes of this determination owners and operators must assume a building could be constructed anywhere on the site or an affected off-site property.

(20) Surface water and sediment characterization and sampling.

(A) When a surface water body is or is likely to be affected by a release from a storage tank or storage tank system, owners and operators shall collect information regarding or related to the surface water body, including, but not necessarily limited to, the following:

1. Distance from the release or the known extent of contamination resulting from the release to the surface water body. If chemicals of concern have reached the surface water body, the distance is zero (0); if chemicals of concern might migrate to the surface water body, the distance is measured from the leading edge of the groundwater plume or the down gradient edge of the area of release to the surface water body;

2. The location or likely location where chemicals of concern from the site would discharge into the surface water body;

3. Flow direction and depth of any groundwater contamination plume(s) in relation to the water body;

4. Lake or stream classification and determination of the beneficial uses of the lake or stream as found in 10 CSR 20-7.031, Tables G and H, respectively;

5. Lake or pond acreage or seven (7)-day, one (1)-in-ten (10)- year low flow (7Q10) stream low-flow rate; and

6. In accordance with 10 CSR 26-2.077(3)(C), applicable water quality criteria as found in 10 CSR 20-7.031, Table A.

(B) If necessary to evaluate the risks posed by chemicals of concern, the department may require that owners and operators collect water and sediment samples at and upstream and downstream of each point of discharge or entry into the surface water body.

(21) Soil vapor sampling. If owners and operators elect in accordance with 10 CSR 26-2.077(4)(C)1 or (5)(C) to perform soil vapor sampling, soil vapor sampling shall be performed using the department's *Soil Gas Sampling Protocol* dated _____, published by the Department of Natural Resources, P.O. Box 176, Jefferson City,

Missouri 65102-01756, and hereby incorporated by reference without later amendments or additions, or another appropriate methodology approved by the department.

(A) Owners and operators shall develop a work plan for soil vapor sampling. If the work plan is based on a methodology other than that referenced at section (21) of this rule, the work plan shall be submitted to the department and shall not be implemented until approved by the department. The work plan shall include either a copy of the other appropriate methodology on which the work plan is based or, if the method is commonly available, a clear, detailed reference for the methodology.

(B) When collecting soil vapor samples, owners and operators must:

1. Use a tracer compound to check for short circuiting or breaches of the sampling system when collecting soil gas samples;
2. Collect soil vapor samples at least one foot (1') or more below the slab or foundation of the building being evaluated, except that vapor samples may also be collected along basement walls;
3. Collect soil vapor samples from multiple sampling points representative of a single actual or hypothetical building during multiple sampling events representing significantly different climatic conditions;
4. Analyze samples for oxygen and carbon dioxide content in addition to chemicals of concern;
5. Manage and analyze samples in accordance with section (22) of this rule; and
6. Ensure that, in collecting data for a specific current or hypothetical building, the depths at which soil vapor samples are collected are consistent from sampling point to sampling point, or ensure that the evaluation of data from samples of different depths takes the different depths into account in comparing data, developing representative concentrations, and making decisions regarding the vapor intrusion pathway.

(22) Sample management and laboratory analysis of samples.

(A) Sample management. All soil, water, air, and soil vapor samples for laboratory analysis shall be collected and handled in accordance with the methods in the *Missouri Risk-Based Corrective Action (MRBCA) Process for Petroleum Storage Tanks* guidance document dated XXXXXX, 2012, and analyzed in accordance with the methods specified in Table 2 of this rule. Adequate quality assurance and quality control procedures shall be utilized to ensure sample quality and integrity. Samples shall be adequately and appropriately preserved according to the requirements of the laboratory analyses and extracted within the holding times of each particular analytical method.

1. A chain of custody form must be completed for and accompany all samples. A copy of a completed chain of custody must be submitted to the department with all laboratory analytical reports.

A. For samples requiring preservation by refrigeration, the chain of custody form for the samples shall indicate the temperature at which the samples were received by the laboratory. The department may reject data for samples received by the laboratory

at temperatures above 6°C (+/- 2°C) or for which the temperature upon receipt at the laboratory is not recorded on the chain of custody.

2. Adequate quality assurance and quality control procedures shall be utilized to ensure sample quality and integrity. At a minimum, quality assurance and quality control samples shall include surrogate and spike recovery and trip blanks. All sampling equipment must be decontaminated utilizing United States Environmental Protection Agency and standard industry protocols.

(B) Required reporting limits. All laboratory analytical data for chemicals of concern shall meet the minimum required reporting limits in Table 2 of this rule for soil and groundwater samples to the extent practicable, unless the applicable target level for a chemical of concern exceeds the required reporting limit for that chemical, in which case the reporting limits shall not exceed the applicable target levels when possible. Laboratory reporting limits for soil vapor samples shall not exceed the applicable target level for any chemical of concern. When practical, laboratories should achieve reporting limits lower than the required reporting limits. Laboratory analytical reports submitted to the department shall include both the reporting limit and method detection limit for the analytes, quality assurance and quality control sample results, and a copy of the completed chain of custody.

(C) Laboratory quality assurance and control. Laboratory analytical data shall be accompanied by quality assurance and quality control sample results. The following shall be considered in laboratory quality assurance and quality control planning and documentation, if applicable:

1. If the published analytical method used specifies quality assurance and quality control requirements within the method, those requirements shall be met and the quality assurance and quality control data reported with the sample results;

2. At a minimum, quality assurance and quality control samples shall consist of the following items, where applicable:

- A. Method/instrument blank;
- B. Extraction/digestion blank;
- C. Laboratory control samples;
- D. Duplicates;
- E. Matrix spikes/matrix spike duplicates; and

F. Documentation of appropriate instrument performance data such as internal standard and surrogate recovery.

(23) Access to Adjacent and Nearby Property. Owners and operators shall make reasonable attempts to investigate all properties on which one or more chemicals of concern in any media exceed or are likely to exceed delineation criteria, unless the department determines that such access is not required.

(A) If owners and operators are unable to gain access to an off-site property from the owner of the property or the owner's authorized representative, owners and operators shall notify the department and comply with the following provisions:

1. Owners and operators shall provide documentation to the department of all unsuccessful attempts to gain access to off-site property or properties and obtain concurrence from the department that the attempts to gain access were legitimate and reasonable and that further attempts by the owners and operators need not be made.

2. Owners and operators shall provide written notice of the contamination or potential contamination to the owner or the owner's authorized representative of the property to which access has been denied in accordance with 10 CSR 26-2.080(1).

(24) Reporting. Owners and operators shall submit the information collected in accordance with this rule to the department in a site characterization report as soon as practical or in accordance with a schedule established or approved by the department. The department will review and respond in writing to the report.

Table 1. Chemicals of concern associated with petroleum release types.

Chemical of Concern	Gasoline	Diesel/ Light Fuel Oils	Jet Fuel	Kerosene	Heavy Fuel Oils	Waste/ Used Oil
VOLATILES						
Benzene	X	X	X	X	NC	X
Toluene	X	X	X	X	NC	X
Ethylbenzene	X	X	X	X	NC	X
Xylenes (total)	X	X	X	X	NC	X
1,2-Dibromoethane / Ethylene dibromide (EDB)	X ¹	NC	NC	NC	NC	NC
1,2-Dichloroethane / Ethylene dichloride (EDC)	X ¹	NC	NC	NC	NC	NC
OXYGENATES						
Methyl- <i>tert</i> -butyl-ether (MTBE)	X	NC	NC	NC	NC	NC
Tertiary amyl methyl ether (TAME)	X	NC	NC	NC	NC	NC
Tertiary butyl alcohol (TBA)	X	NC	NC	NC	NC	NC
Ethyl- <i>tert</i> -butyl-ether (ETBE)	X	NC	NC	NC	NC	NC
Diisopropyl ether (DIPE)	X	NC	NC	NC	NC	NC
Ethanol	X	NC	NC	NC	NC	NC
Methanol	X	NC	NC	NC	NC	NC
TPH						
TPH-GRO	X	NC	NC	NC	NC	X
TPH-DRO	NC	X	X	X	X	X
TPH-ORO	NC	NC	X	X	X	X

PAHs²						
Acenaphthene	NC	X	X	X	X	X
Anthracene	NC	X	X	X	X	X
Benz(<i>a</i>)anthracene	NC	X	X	X	X	X
Benzo(<i>a</i>)pyrene	NC	X	X	X	X	X
Benzo(<i>b</i>)fluoranthene	NC	X	X	X	X	X
Benzo(<i>k</i>)fluoranthene	NC	X	X	X	X	X
Chrysene	NC	X	X	X	X	X
Dibenz(<i>a,h</i>)anthracene	NC	X	X	X	X	X
Fluoranthene	NC	X	X	X	X	X
Fluorene	NC	X	X	X	X	X
Naphthalene	X	X	X	X	X	X
Pyrene	NC	X	X	X	X	X
METALS						
Arsenic	NC	NC	NC	NC	NC	X
Barium	NC	NC	NC	NC	NC	X
Cadmium	NC	NC	NC	NC	NC	X
Chromium	NC	NC	NC	NC	NC	X
Lead	X ¹	NC	NC	NC	NC	X
Selenium	NC	NC	NC	NC	NC	X

Notes:

X = Chemical of concern

NC = Not a chemical of concern

TPH = Total petroleum hydrocarbons

GRO = Gasoline range organics

DRO = Diesel range organics

ORO = Oil range organics

PAHs = Polycyclic aromatic hydrocarbons

¹ Chemical of concern for leaded gasoline

² Chemicals of concern when TPH-DRO or TPH-ORO are detected in soil or groundwater at a concentration at or above the required reporting limits in 10 CSR 26-2.076 Table 1

Table 2 – Analytical Methods and Required Reporting Limits

Contaminants of Concern	Analytical Methods and Required Reporting Limits			
VOLATILES	Groundwater		Soil	
Benzene	8260B	5 µg/L	8260B	25 µg/kg
Toluene	8260B	5 µg/L	8260B	25 µg/kg
Ethylbenzene	8260B	5 µg/L	8260B	25 µg/kg
Xylenes (total)	8260B	10 µg/L	8260B	50 µg/kg
1,2-Dibromoethane / Ethylene dibromide (EDB)	8260B/8011	5 µg/L	8260B	25 µg/kg
1,2-Dichloroethane / Ethylene dichloride (EDC)	8260B	5 µg/L	8260B	25 µg/kg
OXYGENATES				
Methy-tert-butyl-ether (MTBE)	8260B	5 µg/L	8260B	25 µg/kg
Ethanol	Direct injection GC	1 mg/L	NA	NA
Methanol	Direct injection GC	1 mg/L	NA	NA
Tertiary amyl methyl ether (TAME)	8260B	50 µg/L	8260B	250 µg/kg
Tertiary butyl alcohol (TBA)	8260B	50 µg/L	8260B	250 µg/kg
Ethyl tert butyl ether (ETBE)	8260B	5 µg/L	8260B	25 µg/kg
Diisopropyl ether (DIPE)	8260B	50 µg/L	8260B	250 µg/kg
TPH				
TPH-GRO	8260B	1 mg/L	8260B	20 mg/kg
TPH-DRO	8270C	1 mg/L	8270C	20 mg/kg
TPH-ORO	8270C	1 mg/L	8270C	20 mg/kg
PAHs				
Acenaphthene	8270C ²	10 µg/L	8270C ²	660 µg/kg
Anthracene	8270C ²	10 µg/L	8270C ²	660 µg/kg
Benzo(a)anthracene	8270C ²	10 µg/L	8270C ²	660 µg/kg
Benzo(a)pyrene	8270C ²	10 µg/L	8270C ²	660 µg/kg
Benzo(b)fluoranthene	8270C ²	10 µg/L	8270C ²	660 µg/kg
Benzo(k)fluoranthene	8270C ²	10 µg/L	8270C ²	660 µg/kg
Chrysene	8270C ²	10 µg/L	8270C ²	660 µg/kg
Dibenzo(a,h)anthracene	8270C ²	10 µg/L	8270C ²	660 µg/kg
Fluoranthene	8270C ²	10 µg/L	8270C ²	660 µg/kg
Fluorene	8270C ²	10 µg/L	8270C ²	660 µg/kg
Naphthalene	8260B ¹ , 8270C ²	10 µg/L	8260B ¹ , 8270C ²	660 µg/kg
Pyrene	8270C ²	10 µg/L	8270C ²	660 µg/kg

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METALS				
Arsenic	6010B	50 µg/L	6010B	2500 µg/kg
Barium	6010B	5 µg/L	6010B	500 µg/kg
Cadmium	6010B, 6020	5 µg/L	6010B, 6020	500 µg/kg
Chromium	6010B, 6020	5 µg/L	6010B, 6020	500 µg/kg
Lead	6010B, 6020	5 µg/L	6010B, 6020	500 µg/kg
Selenium	6010B	50 µg/L	6010B	2500 µg/kg
Analytical Methods for Soil Vapor Sample Analysis				
Any of the following may be used: TO-14A, TO-15, 8021, 8260				

FOOTNOTES:

1. When gasoline was the only product released, naphthalene should be analyzed by Method 8260B; if the petroleum released was other than or in addition to gasoline, naphthalene should be analyzed by Method 8270C.
2. For 8270 where a detection limit lower than the Estimated Quantitation Limit is required, measures to increase the sensitivity of the method should be taken.

NA Not Applicable

AUTHORITY: Sections 319.109 and 319.137 RSMo Supp. 2007. Original rule filed February 13, 2009.