

Title 10 – DEPARTMENT OF NATURAL RESOURCES
Division 20 – Clean Water Commission
Chapter 10 – Underground Storage Tanks – Technical Regulations

PROPOSED RULE

PURPOSE: This rule establishes the general requirements for evaluating risks posed to human health, public welfare, and the environment by contamination resulting from a release of petroleum from a petroleum storage tank system.

10 CSR 20-10.075 Risk-Based Corrective Action Process

- (1) If the maximum soil or groundwater concentrations for chemicals of concern at a site exceed the default target levels established by the department and the remediating party does not choose to undertake corrective action to achieve the default target levels, the remediating party shall evaluate risks posed by chemicals of concern at the site in accordance with this rule.
- (2) Definitions. The following definitions apply to terms used in this rule.
 - (A) “Age-adjusted individual” means a human that is continuously resident on a property from birth to thirty (30) years of age.
 - (B) “Child” means a human that is continuously resident on a property from birth to six (6) years of age.
 - (C) “Remediating Party” means any party who is legally responsible for, or who is otherwise taking on at least partial responsibility for, the investigation, risk assessment, and remediation of property known or believed to be contaminated by spills or releases from petroleum storage tank systems. Owners and operators have legal responsibility for such activities under chapter 319, RSMo and implementing regulations.
- (3) The remediating party shall undertake the following actions to evaluate and determine appropriate corrective action to address risk posed by chemicals of concern at a site:
 - (A) Develop a conceptual model for the site and validate the model through site characterization in accordance with 10 CSR 20-10.076;
 - (B) Determine appropriate risk-based target levels for the chemicals of concern at the site using the tiered risk assessment process in 10 CSR 20-10.078;
 - (C) Compare concentrations of chemicals of concern to risk-based target levels to determine whether an unacceptable risk is present; and
 - (D) Undertake corrective action necessary to eliminate risk or reduce risk to an acceptable level at a site.
- (4) The remediating party shall develop a conceptual model for the site that integrates available data and information into a coherent description of geologic and hydrogeologic characteristics and conditions, distribution of chemicals of concern in affected media, actual and potential human and ecological receptors under current and reasonably

anticipated future conditions, and exposure pathways at a site. The conceptual model for the site shall consist of a narrative and graphical description of site characteristics and conditions.

(5) The conceptual model shall be used to identify data and information for the site that is missing or inadequate and as a guide for site characterization and corrective action. The conceptual model shall be revised and refined as additional or more detailed data or information is obtained to reflect current understanding of the site.

(6) The conceptual model shall be validated via the collection of site data pertaining to the source and distribution of chemicals of concern, geology and hydrogeology, human and ecological receptors, routes of exposure, exposure pathways, and chemical of concern transport mechanisms. All aspects of the conceptual model shall be validated using site-specific data, information obtained from approved literature sources, or both.

(7) Components of Conceptual Site Model. The conceptual site model shall include qualitative and quantitative information that describes the relevant site-specific factors that determine the risk chemicals of concern pose to human health and the environment. The conceptual site model shall including the following key elements:

(A) The chemical release scenario, known and suspected source(s), and chemicals of concern;

(B) Affected media;

(C) Spatial and temporal distribution of chemicals of concern in the various affected media including presence and extent of light non-aqueous phase liquid;

(D) Nature, geometry and setting of light non-aqueous phase liquid;

(E) Description of any known existing or proposed land or water use restrictions;

(F) Current and reasonably anticipated future land and groundwater use;

(G) Description of site stratigraphy, geology, hydrogeology, meteorology, determination of the predominant vadose zone soil type, and identification of surface water bodies that may potentially be affected by site chemicals of concern;

(H) Remedial activities conducted to date; and

(I) An exposure model that identifies human and ecological receptors, exposure pathways and routes of exposure under current and reasonably anticipated future land use conditions.

(8) Identification of chemicals of concern. Potential chemicals of concern at the site shall be identified based on the nature of the petroleum product or products known or suspected to have been released as listed in Table 1. The remediating party shall determine the specific chemicals of concern at a site based on laboratory analytical data for samples collected at the site.

(A) Polycyclic aromatic hydrocarbons other than naphthalene shall be evaluated as chemicals of concern at sites where total petroleum hydrocarbons-diesel range organics or total petroleum hydrocarbons-oil range organics are detected in soil at a concentration at or above the required reporting limits.

(B) 1,2-Dibromoethane, 1,2-dichloroethane, and lead shall be considered potential chemicals of concern at sites where leaded gasoline may have been released.

(C) At sites where waste oil or used oil may have been released, potential chemicals of concern shall include arsenic, barium, cadmium, chromium, lead and selenium.

(9) Land use. The remediating party shall evaluate land use for all properties affected or potentially affected by chemicals of concern from the release under current and reasonably anticipated future conditions. Land use shall be identified as residential or nonresidential. Land use information shall be used to identify actual and potential receptors at the site.

(A) Determination of reasonably anticipated future land use. The department will make final decisions with respect to the reasonably anticipated future land use of each property that is a part of a site. The department will make such decisions in accordance with the following:

1. Decisions will be made in consideration of information relevant to the future use of a property provided to the department by the remediating party, the owner of an adjacent or nearby property affected by a release from the source property being evaluated by the remediating party, or either party's environmental consultant or other authorized designee.
2. The department may also consider information obtained from other sources, including but not limited to, local, county, state, and federal governmental entities and actual and prospective future purchasers, developers, tenants, and users of the property to which the decision pertains.
3. The department may request future land use information from the owner, or the owner's authorized designee, of an adjacent or nearby property affected by a release. Such owner or designee is not obligated to respond to the department's request.

(10) Groundwater use. The remediating party shall identify current and reasonably anticipated future use of groundwater in the vicinity of the site. All groundwater zones in the vicinity of the site that are, or may potentially be, targeted for installation of domestic water wells shall be identified and evaluated to determine whether and to what extent the zones are interconnected. Other non-domestic groundwater uses, if any, shall also be identified.

(A) The remediating party shall determine whether existing wells are present on the site and whether private wells are present within one quarter (0.25) mile or public wells are present within one (1) mile of the site. Any existing wells shall be evaluated to determine whether the wells or the groundwater zone they are situated in are or are reasonably likely to be affected by chemicals of concern associated with the site.

(B) Reasonably anticipated future use of groundwater for each identified groundwater zone shall be evaluated in accordance with the process shown in Figure 1 of this rule and the following criteria.

1. Activity and use limitations. Determine if an activity and use limitation is in place that minimizes or eliminates the potential that a specified groundwater zone

will serve as a future source of domestic water. The sufficiency of an activity or use limitation to prevent groundwater use shall be determined by the department.

2. Groundwater quality and yield. Groundwater shall be considered suitable for consumptive use if both the following criteria are met:

A. The groundwater contains less than ten thousand milligrams per liter (10,000 mg/L) total dissolved solids; and.

B. The groundwater zone is capable of producing a minimum of one quarter (0.25) gallon per minute or three hundred sixty (360) gallons per day on a sustained basis.

3. Sole source. A groundwater zone that is the only viable source of water at or in the vicinity of the site shall be considered to be a potential source of domestic water, irrespective of groundwater quality and yield considerations.

4. Reasonable probability of future groundwater use. The probability that a groundwater zone could be used as a future source of water for domestic use shall be a weight of evidence determination based on consideration of the criteria in the preceding paragraphs and the following factors:

A. Current groundwater use patterns in the vicinity of the site;

B. Availability of alternative water supplies, including consideration of other groundwater zones, municipal water supply systems, and surface water sources;

C. Urban development considerations for sites in areas of intensive historic industrial or commercial activity, having groundwater zones in hydraulic communication with industrial or commercial surface activity, and located within metropolitan areas with a population of at least 70,000 as established by the 1970 census; and

D. Aquifer capacity limitations that may affect the number of production wells that can be supported.

5. If a groundwater zone has a reasonable probability of future use as a domestic water supply, the groundwater zone shall be evaluated to determine if there is a reasonable probability that the groundwater zone is or could be affected by chemicals of concern associated with the site.

A. The evaluation shall consider the nature and extent of contamination at the site, site hydrogeology including the potential presence of karst features, contaminant fate and transport factors and mechanisms, and other pertinent variables.

(11) Surface water and sediment. The remediating party shall identify any streams or other surface water bodies that are or potentially may be affected by the release or by chemicals of concern at the site. The characteristics of the surface water body shall be identified.

(A) Actual and potential impacts to streams and other surface water bodies from a release shall be evaluated and surface water quality protected in accordance with the requirements of 10 CSR 20-7.031.

(12) Utilities. The remediating party shall identify and evaluate underground utilities within a site and their ability to serve as conduits for migration of light non-aqueous phase liquid or chemicals of concern. In addition, the remediating party shall determine whether and to what extent chemicals of concern pose risk due to infiltration or permeation of the utility lines themselves, in particular water lines.

(13) Exposure Model. The remediating party shall develop an exposure model that identifies the environmental media affected by the release that could be a source for exposure, actual and potential receptors, exposure pathways linking the affected media to a receptor, and routes of exposure for all contaminated media at a site under current land use conditions and reasonably anticipated future land use conditions. If chemicals of concern have migrated from the property at which the release occurred on to adjacent or nearby property or properties, exposure pathways at the affected adjacent or nearby property must be considered independent of the exposure pathways on the property at which the contamination originated.

(A) If the exposure model developed demonstrates that no exposure pathways are complete at the site under current and reasonably anticipated future land use conditions, the remediating party may request that the department make a no further remedial action determination subject to the conditions in section 10 CSR 20-10.082(4).

(14) The exposure model shall identify:

(A) All complete exposure pathways for current and reasonably anticipated future land use;

(B) The exposure domain for each exposure pathway found to be complete; and

(C) The point of exposure for each exposure pathway.

(15) Receptors. The remediating party shall identify actual and potential human and ecological receptors at the site.

(A) All actual and potential human receptors shall be identified. At a minimum, the following receptors shall be considered at all sites:

1. Resident, including a child, adult and age-adjusted individual.
2. Non-resident adult worker.
3. Adult construction worker.

(B) Actual or potential ecological receptors and habitats shall be identified. The screening process in 10 CSR 20-10.075(16) shall be used to determine the presence of ecological receptors to be considered.

(16) Exposure pathways. The remediating party shall identify exposure pathways linking the affected media to a receptor and routes of exposure at the site and determine which exposure pathways are complete and which are incomplete under current or

reasonably anticipated future conditions. All exposure pathways shall be included in the exposure model for the site and the remediating party shall clearly explain which pathways are complete and why an exposure pathway is or is not complete and support that conclusion with site-specific data.

(A) An exposure pathway shall be considered complete where there is an affected environmental media, a mechanism by which chemicals of concern in the environmental media can result in exposure to a receptor, and an actual or potential receptor is identified under current or reasonably anticipated future land use conditions. The specific concentration of chemicals of concern in an environmental media shall not be considered in determining whether an exposure pathway is complete.

(B) At a minimum, the remediating party shall evaluate the following exposure pathways for human exposure for inclusion in the exposure model for the site.

1. Surficial soil. Exposure pathways applicable to surficial soil shall include, at a minimum:

- A. Ingestion of soil, dermal contact with soil, and outdoor inhalation of vapors and particulates from surficial soils;
- B. Leaching of chemicals of concern from soil to groundwater and domestic use of groundwater;
- C. Leaching of chemicals of concern from soil to groundwater followed by migration of vapors from groundwater to indoor air; and
- D. Leaching of chemicals of concern from soil to groundwater and subsequent migration to a surface water body.

2. Subsurface soil. Exposure pathways applicable to subsurface soil shall include, at a minimum:

- A. Indoor inhalation of vapor emissions from subsurface soil;
- B. Leaching of chemicals of concern from soil to groundwater and domestic use of groundwater;
- C. Leaching of chemicals of concern from soil to groundwater followed by migration of vapors from groundwater to indoor air;
- D. Leaching of chemicals of concern from soil to groundwater and subsequent migration to a surface water body

3. Groundwater. Exposure pathways applicable to groundwater shall include, at a minimum:

- A. Indoor inhalation of vapor emissions from groundwater;
- B. Ingestion of water, dermal contact with water, and inhalation of vapors from water if the domestic use of groundwater pathway is complete;
- C. Migration to a surface water body and potential impacts to surface waters.

4. The following pathways shall be evaluated up to the depth of construction for the construction worker receptor:
 - A. Ingestion, dermal contact with, and inhalation of vapor emissions and particulates from soil from the surface up to the depth of construction;
 - B. Outdoor inhalation of vapor emissions from groundwater;
 - C. Outdoor inhalation of vapor emissions from light non-aqueous phase liquid;
 - D. Dermal contact with groundwater, if the depth to groundwater is or will be less than the depth of construction.
 - E. Direct contact with light non-aqueous phase liquid constitutes an acute hazard and shall be evaluated qualitatively based on the depth of the light non-aqueous phase liquid and depth of construction.
5. Surface water and sediment. Exposure pathways applicable to surface water and sediment shall include, at a minimum:
 - A. Ingestion of surface water;
 - B. Contact with surface water during recreational activities (ingestion, inhalation of vapors, and dermal contact);
 - C. Contact with sediments (ingestion and dermal contact);
 - D. Ingestion of fish or other aquatic organisms that have accumulated chemicals of concern as a result of surface water or sediment contamination
6. Other pathways that may need to be considered if relevant to the site include, but are not necessarily limited to, the following:
 - A. Ingestion of produce grown in impacted soils;
 - B. Use of groundwater for irrigation purposes; and
 - C. Use of groundwater for industrial purposes.

(C) Groundwater use pathway. The remediating party shall identify the point of exposure for domestic groundwater use. The point of exposure shall be an existing well or hypothetical well at the nearest down-gradient location that could reasonably be considered for installation of a water supply well regardless of the presence of chemicals of concern. The point of exposure might be on the site itself.

1. The current groundwater domestic use pathway shall be considered complete if existing wells or the groundwater zones they intersect are or may be affected by chemicals of concern associated with the site.
2. For each groundwater zone, the future groundwater use pathway shall be considered complete if all of the following conditions are met:
 - A. There is no ordinance that prohibits well drilling combined with a Memorandum of Agreement regarding the ordinance between the department and the governing body that issued the ordinance;

B. The groundwater zone is suitable for use and there is a reasonable probability of future use or the groundwater zone is the only viable source of future water supply, and

C. There is a reasonable probability that the groundwater zone is or could be affected by chemicals of concern associated with the site.

(D) Exposure domain. The remediating party shall determine the exposure domain for each complete exposure pathway. The exposure domain is the area of environmental media that contributes to actual or potential exposure by a receptor to chemicals of concern at the site. The remediating party shall use concentrations of chemicals of concern measured from sample points within each exposure domain to determine the maximum and representative concentrations for each complete exposure pathway.

(17) Ecological screening assessment. The remediating party shall use the conceptual site model and the qualitative screening assessment in this section to identify whether any ecological receptors or habitats exist at or near the site and evaluate actual and potential exposure.

(A) The remediating party shall use checklists developed by the department and the following decision criteria.

1. If the answers to all of the questions on checklist 1 are negative, no ecological receptors are identified at the site and no further ecological evaluation is necessary.
2. If the answer to one or more of the questions on checklist 1 is positive, an ecological receptor or a habitat exists on or near the site and the remediating party shall complete checklist 2.
3. If the answers to all of the questions on checklist 2 are negative, no complete exposure pathway for ecological receptors exists and no further ecological evaluation is necessary.
4. If the answer to one or more of the questions on checklist 2 is positive, a complete exposure pathway for ecological receptors exists and the remediating party shall conduct a level two or level three ecological risk assessment in accordance with section 10 CSR 20-10.078(5) to determine whether contamination at the site poses an unacceptable risk to ecological receptors.

(18) Determination of risk-based target levels. The remediating party shall determine risk-based target levels for chemicals of concern in environmental media for all exposure pathways identified as complete in the exposure model for the site. Risk-based target levels shall be determined for each complete exposure pathway using the process in 10 CSR 20-10.077.

(A) Determination of risk-based target levels shall be consistent with the risk assessment tier being applied under 10 CSR 20-10.078 and may include:

1. Tier 1 risk-based target levels;
2. Tier 2 site-specific target levels; or

3. Tier 3 site-specific target levels.

(B) Groundwater use. Target levels for groundwater use shall be the maximum contaminant level if one exists for a chemical of concern or a risk-based target level if a maximum contaminant level is not available.

1. The responsible party shall identify one or more point of demonstration wells located between the source and the point of exposure identified in subsection (16)(C) of this rule unless the point of exposure is located within the groundwater solute plume at the site. Risk-based target concentrations shall be developed and used or applicable maximum contaminant levels shall be used as target levels for the point of demonstration wells to protect against applicable target levels being exceeded at the point of exposure.

(C) Surface water. Target levels for surface water shall be water quality criteria based on the classification and beneficial use designations of the surface water body in accordance with 10 CSR 20-7.031. If water quality criteria do not exist for a chemical of concern, a risk-based target level may be developed using methodology approved by the department.

(D) Sediment. The remediating party shall compare sediment sample data with sediment criteria that are protective of human health and ecological receptors available from literature or develop site-specific target levels and delineate any sediment contamination based on the criteria determined to be applicable. Site-specific target levels must be developed using methodology approved by the department.

(19) Application of risk-based target levels. The remediating party shall compare risk-based target levels to measured concentrations of chemicals of concern from samples of environmental media at the site. The concentration used for comparison to risk-based target levels shall be a representative concentration or the maximum concentration appropriate for the complete exposure pathway based on the exposure domain.

(A) For surficial soil in a residential setting, the remediating party shall compare risk-based target levels to the maximum concentration based on the exposure domain.

(B) Representative concentrations. The remediating party shall determine the representative concentration in an environmental media appropriate for each complete exposure pathway at the site, unless the maximum concentration does not exceed the risk-based target level for the exposure pathway. The representative concentration for an exposure pathway shall be the concentration of chemicals of concern in an environmental media that reflects an average exposure concentration for a receptor in the exposure domain over the duration of exposure. The representative concentration for an exposure pathway shall be determined using a methodology established by the department or other appropriate method approved by the department.

(20) Evaluation of light non-aqueous phase liquid. At sites where light non-aqueous phase liquid is present, the remediating party shall determine concentrations for chemicals of concern associated with the light non-aqueous phase liquid using values for the effective solubility and vapor pressure or another method approved by the department. The equilibrium dissolved and vapor-phase concentrations for chemicals of

concern in light non-aqueous phase liquid shall be used to evaluate the risks posed by the light non-aqueous phase liquid and to develop representative concentrations for use in the risk assessment.

(A) For tier one and tier two risk assessments, the default composition values for petroleum product or products determined by the department may be used to calculate dissolved and vapor phase concentrations associated with light non-aqueous phase liquid at a site.

(B) For a tier three risk assessment, the remediating party may determine light non-aqueous phase liquid physical properties and composition using analytical methods approved by the department. The equilibrium dissolved and vapor-phase concentrations for chemicals of concern shall be determined based on the mole fraction of each chemical of concern in the light non-aqueous phase liquid.

Nuisance conditions. The remediating party shall document and report to the department any nuisance conditions that exist at a site including, but not limited to, objectionable taste or odor in groundwater, aesthetic problems with discharging groundwater, and odor from soils remaining in place.

Table 1. Potential 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

PAHs ²						
Acenaphthene	NC	X	X	X	X	X
Anthracene	NC	X	X	X	X	X
Benzo(a)anthracene	NC	X	X	X	X	X
Benzo(a)pyrene	NC	X	X	X	X	X
Benzo(b)fluoranthene	NC	X	X	X	X	X
Benzo(k)fluoranthene	NC	X	X	X	X	X
Chrysene	NC	X	X	X	X	X
Dibenzo(a,h)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