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G.1 OVERVIEW

Contaminated groundwater and vapors can flow preferentially into and through underground utility lines and conduits. Gasoline, diesel/light fuel oils, jet fuel, kerosene, heavy fuel oils, used oil, crude oil, solvents, pesticides, and fertilizers present in the groundwater or vadose zone can enter drinking water/sanitary sewer/storm sewer pipe trenches, permeate plastic piping, gaskets, and linings, or leak through mechanical defects in pipe walls and joints.

Plastic pipe material, gaskets, and linings can react with petroleum and not petroleum-based contaminants in the gas, liquid, or solid phases in the surrounding external environment. The pipe materials most vulnerable to permeation when immersed in volatile organic compounds (VOCs) in descending order are polybutylene (PB), polyethylene (PE), chlorinated polyvinyl chloride (CPVC), polyvinyl chloride (PVC), and metal with gaskets.

Petroleum and non-petroleum VOCs can contaminate drinking water supplies through permeation of plastic pipes and gaskets. There are instances where US EPA Maximum Contaminant Level (MCL) violations have occurred at the point of consumption, although current provisions of the Safe Drinking Water Act do not require monitoring for VOCs beyond the point of entry to the distribution system. In most instances, the health risk threshold of chemical contaminants is substantially lower than either the taste or odor thresholds, suggesting that utilities cannot rely confidently on customers' perception of taste and odor for identifying contamination events. VOCs permeation is typically of most concern and most severe for small diameter, low-flow plastic drinking water pipes (e.g., water service lines).

Installation and repair of drinking water and other utility piping provide additional opportunity for contaminants in the subsurface environment to pose intrusion hazards into the pipeline as well as worker exposure.

This document in conjunction with the attached process flowcharts is designed to provide guidance to environmental consultants for assessing potential impacts on drinking water, sanitary sewer, and storm sewer lines as part of the North Dakota Risk-Based Corrective Action (NDRBCA) process. The NDRBCA process begins when a contaminated site is identified.

G.2 UTILITY LINES IMPACT ASSESSMENT

When a contaminated site is identified, a utility impact assessment must be performed. Locate all underground utility lines and conduits within the area of known or suspected soil and groundwater impact, both on-site and off-site, where the release may have migrated or may migrate in the future. Create a site map (Figure No. 3 of Appendix B-NDRBCA Technical Guidance) that shows the location of watermains and water service lines, sanitary and storm sewer mains and laterals, natural gas lines, and buried cables on-site and adjacent off-site. Label the map with the type of pipe material and gasket, backfill around the pipe, depth of the pipe, and direction of water flow in the pipe. This information can be obtained from the property owner and city/rural water system manager. Indicate the depth, thickness, and extent of non-aqueous phase liquid (NAPL) if any, and soil and groundwater contamination. Determine the depth of the water table and its seasonal fluctuation. All this information must be included in the Conceptual Site Model.

G.3 DRINKING WATER TESTING PROTOCOL

If a potential for petroleum and non-petroleum VOCs contamination to permeate drinking water lines exists based on plume location and pipe material, drinking water testing must be performed. Follow NDDEQ's VOC sampling instructions included in this appendix. Choose sample sites that are expected to yield the highest contamination levels in the drinking water. If necessary to valve off a water main to ensure that the water remains undisturbed, contact city/rural water system manager for assistance with locating and opening/closing valves. To accurately determine the degree of drinking water contamination that has occurred, the water contained in the pipe immersed in the plume should be sampled: to accomplish this, the volume of water between the pipe immersed in the plume and the tap must be calculated and purged. This will ensure that the water sample (at the tap) is drawn from pipe section immersed in the plume. To test for VOCs in drinking water, use US EPA methods: 502.2, 524.1 or 524.2. Attach documentation of drinking water monitoring results to Form No. 2 of NDRBCA report.

If the sample exceeds the drinking water criteria, immediately contact the public water system and the North Dakota Department of Environmental Quality.

G.4 SANITARY SEWERS

Petroleum and non-petroleum hydrocarbons can enter sanitary sewer trenches, permeate plastic pipes and gaskets, or leak through mechanical defects in pipe walls and joints.

Use field instrumentation to measure the vapor concentrations in underground manholes at sites where COCs are volatile. Attach documentation of utility vapor monitoring results to Form No. 2 in Appendix B of the NDRBCA technical guidance. If explosive conditions are believed to be present (Refer to *5.6.1 Protection Against Explosive Risk*), first responders must be contacted immediately. If sanitary sewers are suspected to contribute to vapor intrusion issues within nearby building(s), refer to *4.13 Distribution of Chemicals of Concern in the Vapor Migration to Indoor Air Pathway*.

In addition, COCs permeation/inflow into sanitary sewer pipes may have an adverse effect on the sewage treatment system. If the presence of COCs in a sanitary sewer collection system is confirmed, contact the North Dakota Department of Environmental Quality.

G.5 STORM SEWERS

Petroleum and non-petroleum hydrocarbons can enter storm sewer trenches and permeation/inflow into storm sewer pipes may provide a direct pathway for contamination to migrate to surface water. Use field instrumentation to measure the vapor concentrations in underground manholes at sites where COCs are volatile. Attach documentation of utility vapor monitoring results to Form No. 2 in Appendix B of the NDRBCA technical guidance.

If the presence of COCs in a storm sewer collection system is confirmed, contact the North Dakota Department of Environmental Quality. If explosive conditions are believed to be present (Refer to *5.6.1 Protection Against Explosive Risk*), first responders should be contacted immediately.

G.6 PIPING MATERIALS AND ENGINEERING CONTROLS

If the utility exists or must be placed within a contaminated area, appropriate pipe materials and engineering controls must be selected to prevent residual and migrating contamination from entering the pipe trenches and impacting the piping.

Using the most protective pipe materials based on the level of contamination, encasing the pipe immersed in contamination plume, or rerouting the pipe around the contamination plume must be considered for watermains. Copper piping must be used for water service lines immersed in contamination plume. Although be aware that stray current corrosion can occur on underground copper water pipes when a source of stray DC electricity (e.g., an impressed-current cathodic protection system used for UST facilities or oil and gas transmission pipelines) exists in the area. Welded joints or petroleum resistant nitrile gaskets must be utilized for water pipes. Hydrant weep holes must be plugged.

Replace any water plastic pipes and gaskets permeated by VOCs contamination as decontamination is not feasible.

Since contamination migrates along pipe trenches, engineering controls (e.g., impermeable bentonite clay barriers) must be utilized where necessary.

The most protective materials and engineering controls must be used as well for sanitary sewers suspected to contribute to VI issues within nearby building(s).

Contact the NDDEQ UST Program for assistance with pipe material and engineering controls selection.