Guidance for Documenting the Investigation of Utility Corridors

RR-649 October 2013

PURPOSE

The purpose of this guidance is to assist persons who prepare site investigation reports and closure request submittals and Department of Natural Resources (Department) staff when reviewing such submittals for completeness at hazardous substance release sites. It presents an introduction to how utility corridor investigations should be conducted. It is not complete or comprehensive technical guidance on how to conduct such investigations. It is not guidance on how to remediate contamination that has migrated within utility corridors. It is technical guidance and does not address legal issues such as obtaining access to utility corridors and liability for damaging utilities.

This guidance is potentially applicable to all types of contamination cases. However, it should be noted that explosive or flammable vapor/free product problems might be less likely to occur at non-petroleum release sites, depending on the nature of the release.

DISCLAIMER

This document is intended solely as guidance and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

GUIDANCE REVISIONS

This guidance will be updated as needed. Comments and concerns may be sent to "Guidance Revisions", Gary Edelstein - RR/5, DNR, P.O. Box 7921, Madison, WI 53707, phone number - 608-267-7563, email - gary.edelstein@wisconsin.gov.

DEFINITION

For the purpose of this guidance, "utility corridor" means an underground or buried utility line or pipe, including any excavated and subsequently backfilled trench that the utility line or pipe was constructed or laid in. Utility corridors include, but aren't limited to: sanitary and storm sewers, water lines, gas lines, sewer force mains, buried electric power distribution lines and buried telephone, cable TV or telecommunication lines. Utility corridors are present in public right of ways, including streets or roads, as well as on the properties being served by the utilities.

REQUIREMENTS

Depending on site conditions, utility corridors may be contaminant migration pathways. Section NR 708.05(2), Wis. Adm. Code, requires emergency situations to be addressed immediately. Explosive vapors or flammable free product in utility corridors may present such an emergency situation and must be addressed upon discovery, usually before an investigation begins. Section NR 708.05(3), Wis. Adm. Code, requires immediate actions to halt the migration of hazardous substances when discovered, even if an emergency isn't present. Contaminants migrating within a utility corridor may require such immediate actions to halt or minimize their migration. This

guidance applies to site investigation and closure submittals, which are normally prepared after an emergency situation is addressed and immediate actions are taken.

Section NR 716.11(5)(a), Wis. Adm. Code, requires all field investigations to evaluate buried utility and drainage improvements as potential contaminant migration pathways. All site investigations should include this evaluation. The scope of this evaluation is entirely dependent on site characteristics. For sites without utility corridors, the evaluation would be documentation that there are none. It's expected that all investigations will address this requirement, so an investigation with no information addressing the requirement should be considered incomplete.

INVESTIGATION OVERVIEW

This section lays out a suggested process for investigating utility corridors and describes possible investigative methods. The process is outlined in the generalized flowchart provided at the end of this document.

Gather Existing Information, Maps and Diggers Hotline

Before any field work begins, the investigator should gather available information about the site. This information is then used to begin to develop a site conceptual model and determine where to conduct actual field work. For utility corridors, the relevant information can include, but is not limited to, utility maps, soil maps, results from other nearby investigations and historical use maps, including Sanborn insurance maps and USGS topographic maps. Having general knowledge of the extent of a release, soil and groundwater conditions in the site area, combined with examination of actual utility maps can help the investigator develop a conceptual model and make an initial determination of whether utility corridors may be potential migration pathways.

Maps can vary in accuracy, depending on their age and method of preparation. Completely accurate maps are not needed if the site conceptual model shows that utility corridors aren't migration pathways. At some sites, limited field investigation work to determine the extent of the release may proceed before making a concerted effort to gather existing information like utility maps, especially if it's difficult to locate or obtain them. For example, if the extent of the release was limited enough so as to not migrate toward utility corridors, then utility maps are unnecessary.

Most communities keep water and sewer system maps, normally showing the location and depths of sanitary and storm sewers, water mains and sewer force mains (pipes carrying the pressurized flow output from a sewage pumping or lift station). Such maps also normally show the locations of sewer manholes, sewer and trench slope, water main valves and fire hydrants, which are helpful to the investigator when locating utility corridors in the field. Some communities may have information on how the utility was constructed, including sewer and water main materials and trench bedding (specified material that is different than general backfill the pipe or line is laid on and covered with) and backfill materials. This sort of utility construction information may be of poorer quality for older utilities. Communities normally keep such maps at the office responsible for the utilities, often at a City Engineering department, Director of Public Works or sewer or water utility office.

Utility owners normally have maps showing gas, electrical and telecommunication lines. These may or may not have depth information. Valve locations and access points are normally on such maps, which are useful when locating the utilities in the field. Materials of construction are normally known, and sometimes bedding and backfill materials are known.

Generally, sewers and water mains are often deeper than gas, electrical and telecommuncation lines. Where maps showing utility depths are unavailable or unreliable, it may be possible to measure the depths of utilities by dropping a tape measure down an access point, such as a sewer manhole or telecommunications handhole.

Provided they are available and willing to cooperate, utility owners and their construction crews can be interviewed, as they may have information about existing contamination that they may have encountered while working on their utilities.

Map owners may or may not be willing to handle direct requests for copies of maps.

The Diggers Hotline service in Wisconsin keeps a database of most underground utility owners. An investigator can call the hotline, which will notify the owners of any pending investigation and ask that they mark the location of their utilities in the field using standardized colored markings at the site. However, these markings are based on the utility owner's best understanding of their location based on their maps, and they are not guaranteed to be 100% accurate. Also, utilities on private property, such as laterals and service lines, may not be marked and should be considered during a site investigation. It may take several working days for the utilities to be marked before field work can begin.

The Diggers Hotline phone number is (800) 242-8511 and (414) 259-1181 in the Milwaukee area.

Refine Site Conceptual Model through Field Work

Soil borings, monitoring wells (permanent and temporary pushed wells, such as geoprobe wells) and soil gas monitoring are utilized to determine the soil types, groundwater characteristics, migration pathways and extent of contamination at a site (note: general investigation techniques for soil and groundwater are addressed in other guidance and will not be discussed here; guidance on investigating near and in corridors is presented below). This information is utilized to develop a site conceptual model, so the actual and potential migration pathways are understood. Investigators will need to determine if contaminated groundwater, free product or contaminant vapors are migrating towards, into, along or within utility corridors, if the conceptual model show that such migration is possible or is already occurring. It may be possible to determine if a utility corridor is or isn't a potential migration pathway without actually sampling in or near the corridor. The conceptual model may show that utility corridors are migration pathways if one or more of the following conditions exist:

- A utility corridor is more permeable than the surrounding native soil;
- A utility corridor intersects a saturated zone impacted by the release;
- A utility corridor intersects or is adjacent to free product, a significant vapor migration zone, a recent release or significant residual contamination; or
  (Note: Fresher releases have a greater potential for free product and/or vapor migration, however, recent site excavation/disruption/backfilling <u>may</u> provide additional pathways for contaminants from older sources to migrate towards utility corridors)
- The utility corridor provides a direct pathway to a receptor such as a basement or other structure.

Utility corridors at sites where the native soil is of a lower permeability than backfill and bedding materials are of greater concern than sites without these conditions. At such sites, vapors or free product could migrate within a utility corridor regardless of the groundwater depths. Vapors could migrate in any direction, while free product may tend to migrate in the downslope direction along a trench. Free product or vapor migrating in a corridor could be carried to buildings that are serviced by or connected to a utility.

Sites with low permeability native soil may still be of concern, even where it is suspected or known that native material was used for backfill or bedding. This is because the act of digging the original trench destroys the native soil structure, excavation and movement disturb the backfill and bedding material and construction settlement efforts and natural settlement over time may not result in the soil reverting to the same structure as the surrounding undisturbed soil.

At many sites, contaminated groundwater may be the only migration route of concern, since vapors and free product are not present. At those sites, if the groundwater elevations are below the base of the utility corridors, then the corridors are not of concern, regardless of the soil types.

Gravity sanitary and storm sewers, building foundation drains and other drain pipes that are open to the atmosphere can carry groundwater or free product downstream and vapors in any direction regardless of the soil types present. Sanitary sewers can carry free product or vapors into buildings that are connected to the sewer system. This is especially true if the drain or sewer has bad or open joints or is a perforated pipe designed to drain the groundwater. Often, sanitary sewers have bad joints or cracked pipes. Storm sewers are often constructed without gaskets in their joints. Such sewers are not normally pathways for migration at sites where contaminated groundwater is the only concern, the sewer is above the groundwater elevation and free product and vapors are not present.

A gravity sewer could be a source of soil and groundwater contamination where contaminants leak out of the sewer through bad joints or cracked or damaged pipe. The contaminants leaking out may originate from a waste discharge to the sewer or from free product or contaminated groundwater leaking into the sewer at some point upstream. A sewer can't be a source of contamination at points were the groundwater is above the elevation of the sewer, as the groundwater will tend to leak into the sewer at those locations, unless the sewer is flowing under surcharged conditions. Certain wastes or contaminants can degrade sewer joint and pipe materials, which can increase leakage. A sewer force main could also be a source of contamination if the pipe leaks.

In theory, contaminants in contact with a water main could be drawn into the main through a bad or degraded joint (depending on the contaminant and the pipe and joint material, the contaminant could degrade a pipe or joint) if the water main developed a negative pressure. This could occur if a fire department pumping truck drew on the main.

Certain pipe and joint materials could be degraded by contact with contaminants. For example, certain organic compounds, such as solvents or the organic compounds in gasoline could soften PVC pipe. In such instances, there would be the concern about utility integrity in addition to concerns about contaminant migration.

Many sites in Wisconsin have native soil that has similar or higher permeability than the backfill and bedding material in utility corridors. In those cases, the utility corridors should not be of concern unless the utility is a sewer or drain below contaminated groundwater elevations or there is free product or vapors near such a sewer or drain.

Individual utility corridors may act as migration pathways for contaminants from more than one site or contamination source. In those cases, attempts can be made to identify the various sources and deal with them separately, but it may often be more efficient to perform a single, joint investigation of various sources migrating within the same utility corridors.

Sampling Methods

Where the site conceptual model shows a utility corridor to be a potential migration pathway, it will normally be necessary to sample in or near the corridor to determine the extent of contamination. This section discusses some of the possible sampling methods in or near a utility corridor for free product, vapor and contaminated groundwater migration. The sampling method or methods chosen should be based on site-specific factors, using the preliminary investigation and existing information when developing the site conceptual model, as described above. As discussed below, different sampling methods have varying degrees of usefulness. The method or methods chosen should provide enough information to determine the degree and extent of contaminant migration in utility corridors if they are shown to be potential migration pathways when developing the site conceptual model.

At sites where backfill and bedding materials are unknown, it may be necessary to dig pits or use a hand auger to determine the nature of that material. This is especially important for sites with low permeability native soil.

In some situations the exact location of a utility corridor must be determined to allow accurate sampling and to avoid damaging the utility or posing a safety risk to investigators, but maps or markings are determined to be of questionable accuracy. This is especially important when using powered drilling methods. In those cases, it may be necessary to dig pits or use remote sensing techniques (ground penetrating radar, resistivity, etc.) to better define the location of utility corridors. Remote sensing accuracy can be affected by interferences and may limit its applicability. Starting with powered excavating or drilling equipment and finishing with hand equipment may be a way to minimize safety risks and utility damage where maps or markings are questionable.

Investigators who have little experience in dealing with utility damage and safety issues are encouraged to contact other investigators with such experience. To encourage such networking, a list of known sites where utility corridors have been investigated is provided as a supplement to this guidance. Investigators may contact the Region where a site is located to obtain information about a site and arrange to examine the file. Investigators may provide information about other sites where utility corridors have been investigated to Mr. Dale Ziege for inclusion on this list. His address is on page 1, above.

Investigators may need to plan for ongoing maintenance at sampling locations, even after the sampling work is complete. For example, potholes may form at excavation and drilling locations in paved roads or streets until they are repaved. This may require an agreement with the utility or right of way owner to perform ongoing maintenance.

- Free Product Migration

Where the utility corridor intersects free product floating on the groundwater, use of monitoring wells within the utility backfill material is the best method for detecting free product migrating within a corridor. If it's not possible to install permanent monitoring wells, temporary wells, such as geoprobe wells installed in the backfill may be acceptable. Depending on the contaminant, soil gas monitoring in the upper soils of the corridor may indicate horizontal free product migration, but may also indicate only vapor migration. When free product is highly volatile, soil gas monitoring results may indicate that free product is not present if the vapors aren't present. Sometimes, contaminated groundwater and floating free product can leak into a gravity sewer through bad joints, a cracked pipe or the walls of a manhole. Vapor monitoring in manholes may indicate whether free product is flowing within a sewer. However, the presence of vapors or product in a sewer in of itself may not be of much value in determining how far free product has migrated laterally along a trench - it is only an indicator that the material is present and has entered the sewer at some point upstream. Also, vapors can migrate in the air space in a gravity sewer in any direction away from their source, regardless of the flow direction in the sewer. It may be possible to determine the location of the sewer segment where free product enters a sewer, as the first manhole upstream from the entry location will not have free product flowing in it. Such sampling or observations in manholes should occur at the same time. If significant free product is migrating laterally along a corridor or leaking into a sewer, then the condition might be an emergency situation that must be addressed immediately upon discovery, usually before a full investigation begins.

Where free product could be migrating in a utility corridor and the corridor is above the groundwater, soil borings or test pits within the utility backfill material are the best methods for detecting the product. It may be necessary to use angle borings. Where it isn't possible to install borings, alternative methods include soil gas sampling near and above the corridor and checking gravity sewers and manholes for product. However, the same limitations for determining lateral

migration described in the previous paragraph apply to these methods. Again, it should be noted that if significant free product is migrating laterally along a corridor or leaking into a sewer, then the condition might be an emergency situation that must be addressed immediately upon discovery, usually before a full investigation begins.

- Vapor Migration

Soil gas monitoring in and near the corridor and vapor monitoring within sewers and their manholes are the preferred methods for checking vapor migration. Where monitoring in and near the corridor isn't possible, it may be possible to show through a simple analytical model that the lower explosive limit (LEL) or threshold vapor level (if appropriate) for various substances won't be reached or exceeded based on the concentrations found in groundwater and soil vapor. A simple model might utilize Henry's Law or known soil vapor information from sampled locations near the inaccessible utility. It should not be necessary to create a long computational model. Useful references on this topic are provided at the end of this guidance. However, such modeling methods will likely be less effective at sites with low permeability native soils.

Again, it should be noted that if significant vapor migration is occurring, then this might be an emergency situation that must be addressed immediately upon discovery, usually before a full investigation begins. Indoor air quality as well as the potential for explosion should be considered when determining if an emergency situation exists.

- Contaminated Groundwater Migration

Where the utility corridor intersects the groundwater, use of monitoring wells within the utility backfill material is the best method for detecting contaminated groundwater migrating along or within a corridor. Where it may not be possible to install permanent monitoring wells, temporary wells, such as geoprobe wells installed in the backfill may be acceptable. Sometimes, contaminated groundwater leaks into a gravity sewer through bad joints, a cracked pipe or the walls of a manhole. Sampling the sewage or water in a sewer may indicate if contaminated groundwater is flowing within a sewer. However, the presence of contamination in a sewer in of itself may not be of much value in determining how far contaminated groundwater has migrated laterally along a trench - it is only an indicator that the contamination is present and has entered the sewer at some point upstream. Also, the ability to determine if groundwater contaminants are in sewage or water in a sewer will depend on the type and concentration of the contaminant, it's loading rate into the sewer and if contaminants may normally be present in sewage or coming from a source upstream of the contaminant entry point. It may be possible to determine the first sewer segment where contaminated groundwater enters a sewer, as the first manhole upstream from the entry location will not have contaminated groundwater flowing in it. Such sampling or observations in manholes should occur at the same time.

- Utility Protection Statute - Section 182.0175, Stats.

(Note: This portion reflects the views of Department of Natural Resources and Public Service Commission legal staff.)

Section 182.0175, Stats., requires that excavators, except those performing utility work, maintain minimum clearances from utility lines and associated facilities (both underground and above ground). The clearances are 18" if the utility pipe or line isn't exposed and 2 times the limit of control of the cutting edge or point of the excavation equipment or 12", whichever is greater, if the pipe or line is exposed. The minimum clearances only apply to power-operated excavating or earth moving equipment, not to hand shovels.

Despite this requirement in s. 182.0175, Stats., an investigator may contact a utility owner to obtain permission to perform work closer to the underground pipe or line. The utility owner may grant permission for the investigator to proceed with the proposed investigation or may authorize

the investigator to act on its behalf to do work directly on the utility lines. The utility owner may require that its representative be present when another party does this work. In some cases, the utility owner may require that it will do the work itself and bill the responsible party.

Investigators should work closely with utility owners when performing work near underground utility pipes and lines and obtain any necessary permission on a site-specific basis.

CLOSURE REQUEST SUBMITTALS

Closure request submittals should include site conceptual model information and, if necessary, actual investigation results to document the presence or absence of a contaminant migration problem within or along utility corridors. As discussed above, it may be possible to show that utility corridors are not migration pathways based on site conceptual information. For example, it may be as simple as indicating utility corridors aren't present or the only problem is contaminated groundwater that is deeper than the corridors. Such submittals should show how contaminant presence and/or migration into and along utility corridors has been addressed acceptably, in accordance with chs. NR 140 and NR 700 - 726, before closure may be granted.

There may be cases where contaminant migration along or within utility corridors is of concern, but a closure request indicates that the corridors couldn't be investigated or investigated properly due to access problems. In those cases, the submittal should clearly and completely document the attempts that were made to gain access. Department program staff should then discuss the case with Department legal staff. Department staff may be able to assist investigators who have been unsuccessful in obtaining access. In some instances, it may be necessary to deny closure until the corridor is properly investigated, even if there are access problems.

Investigators who are inexperienced in dealing with access issues are encouraged to discuss these issues with other investigators who have such experience. The Department hopes the list of known sites where utility corridors were investigated will encourage such networking. In addition, the Department will provide, as a supplement to this guidance on the Internet, copies of actual access agreements once they are provided to the Department by investigators. Investigators may provide copies of such agreements to Mr. Gary Edelstein for inclusion in this supplement. His address is on page 1, above. The Department recommends that names, addresses and other identifying information be removed before submittal.

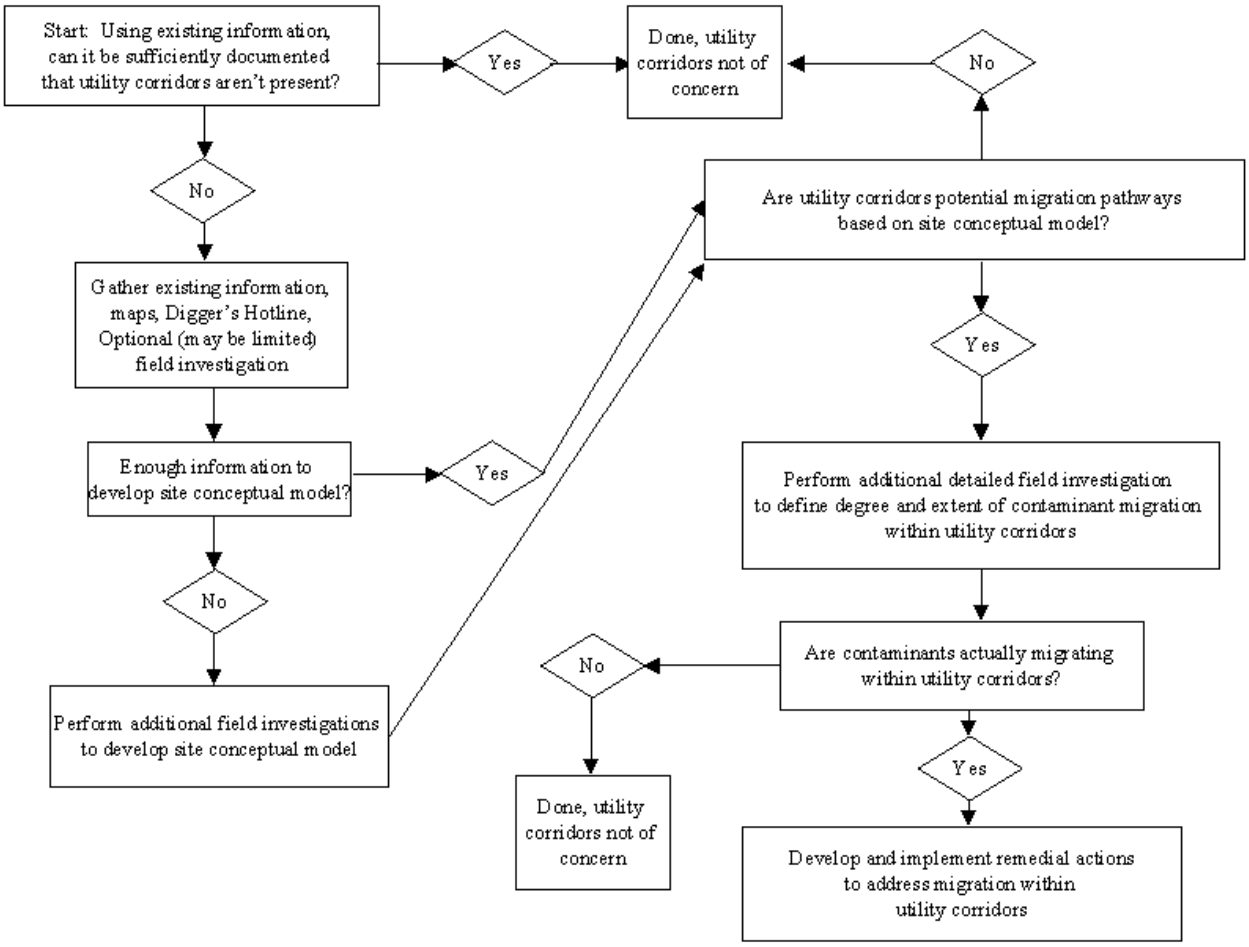
Verified exceedances of groundwater enforcement standards require a groundwater use restriction for case closure under ch. NR 726, Wis. Adm. Code. In some situations, where minor residual soil contamination remains in or near a utility corridor, a deed notice may not be required for closure. However, documentation that the utility owner has been notified of residual contamination can be required as a condition of closure as a way to document that concerned parties are informed of the residual contamination, in case future utility work occurs in the contaminated area. The Department's database (DNR Database on the Web) may provide another means to give notice.

REFERENCES

1. Relationship between Contaminated Ground Water Concentration Levels and Explosion Potentials in Sewer Systems by William J. Peterson, p.116, Spring 1997, Ground Water Monitoring and Review

2. Assessing the Significance of Subsurface Contaminant Vapor Migration to Enclosed Spaces – Site Specific Alternatives to Generic Estimates, American Petroleum Institute publication number 4674, December 1998

Generalized Utility Corridor Investigation Process Flowchart



List of Sites Known to Have Utility Corridor Investigations

Site Name	Location	Region	BRRTS Number
Kwik Trip # 606	Fond du Lac	NER	03-20-002102
Mr. Marine	Fond du Lac	NER	03-20-001963
Badger Station Charcoal House	Appleton	NER	03-45-113034
Chilton Farm and Home Center	Chilton	NER	03-08-001136
Utschig and Froehlich	Appleton	NER	03-45-002050
Gas Stop/Garrow Oil	Appleton	NER	03-45-000585
Lafayette County Coop	Darlington	SCR	03-33-000171
Rohmeyer Realty Property	Marshfield	WCR	03-72-197907

Persons may provide information about other sites where utility corridors have been investigated to Gary Edelstein for inclusion on this list, see address on page one.