

# Minnesota Pollution Control Agency Voluntary Investigation and Cleanup

## Guidance Document #12

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### Phase II Investigation Report

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#### 1.0 Purpose

This document provides guidance on preparing a Phase II Investigation Report (The Phase II Report). A Minnesota Pollution Control Agency (MPCA) approved Phase II Investigation Work Plan (see Guidance Document #11) is the basis for a complete Phase II Report. The Phase II Investigation is conducted to determine if potential sources of contamination identified during the Phase I Investigation are causing a release or threatened release of hazardous substances contaminants or pollutants to the soil and ground water on the property. The Phase II Investigation primarily entails gathering site specific data on soils and ground water. The Phase II Report summarizes the findings of the investigation. The Phase II Report includes information regarding all field, laboratory, and analytical results relating to the investigation, and any additional historical or otherwise relevant information concerning the site, its contamination status and potential remedies to be implemented if contamination is present.

The Phase II Report shall be submitted to the MPCA staff for review and approval. Information provided in the Phase II Report may be used to reach conclusions relative to site contamination and the eligibility voluntary parties for certain administrative or statutory assurances regarding enforcement actions or liability (see Guidance Document #4). The Phase II Report may be used to begin the remedy selection process and the need or desire for bench-scale studies, treatability studies or pilot studies. **However, for those sites requiring cleanup, voluntary parties are encouraged to study remedial options as part of the Phase II Investigation and include a description of the remedial option in the Phase II Report.** The Phase II Report, and any proposed remediation, must be approved before the voluntary party proceeds to implement a remedy at sites needing remedial action. Failure to do so may limit the extent to which the MPCA Commissioner can grant Land Recycling Act liability protections or other written assurances.

#### 2.0 Objectives

The objectives of the Phase II Report are to:

- document the investigation of potential sources of contamination described in the Phase II Investigation Work Plan;

- document the magnitude of the contaminant sources and determine the magnitude, extent and receptors of any releases or threatened releases;
- provide site information so MPCA staff can evaluate cleanup levels;
- provide site information to aid in or justify the selection of a remedial technology, if cleanup is necessary; and
- provide the MPCA staff an opportunity to comment on the investigation results in order to clearly understand site status with respect to further action required or eligibility of the voluntary party for administrative or statutory assurances regarding enforcement actions or liability.

### 3.0 Phase II Investigation Report

The critical components of the Phase II Investigation Report are:

- an accurate and legible site map clearly showing locations of prominent and relevant site features — both past and present, such as buildings, retaining walls, fences, tanks, pipelines, waste piles, storage areas, utilities, ponds or lagoons [**NOTE:** *All site maps shall include property boundaries, a north arrow and a bar scale.*];
- an accurate and legible site map depicting locations and depths of completed borings, monitoring wells, sampling locations, test pits or any other areas of investigation;
- a list of parameters to be investigated;
- a detailed description of the sampling protocol and analytical methods used and any changes made to protocols or methods proposed in the Phase II Investigation Work Plan;
- a description of quality assurance and quality control (QA/QC) measures to be used to ensure that data obtained by analytical techniques is reliable, repeatable and representative of conditions at the site; and
- a schedule of the laboratory or field work for any proposed bench-scale studies, treatability studies, pilot studies or remedial actions included as part of the Phase II Report.

#### 3.1 Site Investigation and Parameters/Sampling and Analysis Description

The Phase II Report shall include a list of the chemical and physical parameters collected from site soil and ground water. The Phase II Report shall also include the analytical methods used to measure the selected parameters, the reporting limits associated with the method and the laboratory report forms for each sample, duplicate, laboratory standard and field or laboratory blank.

Samples are collected to:

- obtain data for human health exposure to and safety from the release;
- obtain data for aquatic and terrestrial species, communities or ecosystem protection;
- determine the magnitude and extent of contamination;
- obtain site specific data for the soil to ground water pathway; and
- determine which technology may be appropriate for sites requiring remediation.

With the investigation results obtained during the Phase II Investigation, the voluntary party will need to provide a description of the sampling and analysis of the various environmental media actually sampled and a description of any materials stored on the site. These descriptions shall include:

- how decisions were made on what and where to sample;
- methods used to collect the samples;
- equipment and containers used to collect the samples;
- any filters used;
- sample preservation;
- number of samples collected;
- number of samples analyzed;
- laboratory methods of analysis; and
- when standard methods were not used, a list of parameters and their detection limits.

### **3.2 Storage Container, Conduit or Disposal System Description**

Provide descriptions for all storage containers, above and below ground, conduit or disposal systems, including:

- location, number, type, size, age and condition;
- information provided on container labels;

- contents, past or current, of containers, conduit or disposal systems (material type and amount); and
- whether conduit or disposal systems are currently in use.

### ***Notes on Investigation Techniques***

As part of the Phase II Investigation, storage containers, conduit or disposal systems are tested for integrity. The Phase II Report shall include descriptions of equipment and methods used during integrity tests. Please describe how testing equipment or methods varied from the appropriate MPCA Tanks and Spills Section Fact Sheets “Leak Detection for Pressurized Underground Piping,” “Leak Detection for Underground Suction Piping,” “Tank Tightness Testing and Inventory Control” and other information available from the MPCA Tanks and Spills Section [(651) 297-8679].

If tracer tests were conducted for conduit, submit the type of dye or other tracer to be used and methods used to collect and analyze the samples.

The use of geophysical techniques, such as infrared photography, seismic refraction, ground penetrating radar and magnetometer/gradiometer surveys used to supplement to the investigation of disposal sites, tanks, drums and other underground structures shall be fully described.

### ***Above-Ground Storage Investigations***

If above-ground storage containers (storage tanks, drums, etc.) containing hazardous substances or substances of unknown composition were evaluated for their integrity or to determine if they are the source of any potential releases at the site, provide a full description of the evaluation methods and results. The contents of such containers must be managed or disposed of in accordance with federal, state and local statutes, regulations and policies.

Results from any soil, ground water or surface water investigations related to the above-ground storage tanks shall be provided in the Phase II Report.

### ***Underground Storage, Disposal System or Conduit Investigations***

If underground storage tanks, drums, other storage containers, disposal systems or conduits (such as underground pipes, drainfields, seepage pits, oil and grease traps, septic tanks, etc.), which may have been or are being used for hazardous substance disposal, storage or transport were investigated, results of the evaluation shall be included in the Phase II Report. Methods of testing and investigating the integrity of tanks, conduits and disposal systems shall also be included. Please describe how testing equipment or methods varied from the appropriate MPCA Tanks and Spills Section Fact Sheets and other information available from the MPCA Tanks and Spills Section [(651) 297-8679].

### 3.3 Debris and Building Materials Investigations

Building materials and debris, such as asbestos, are generally not addressed by the VIC Program unless the materials are stored or disposed such that they may leach hazardous substances into the soil, ground water or surface water. Report the presence or evidence of any abandoned dumps or stored creosote-treated materials. Contamination from these sources is addressed in the VIC Program.

### 3.4 Air Quality and Soil Gas Investigations

Air quality and soil gas investigations that are reviewed under the VIC Program include explosive or toxic gases released from hazardous substances, contaminated soil or contaminated water. These investigations may also include measurements of contaminant-laden dust and airborne particulates carrying metals or other non-volatile pollutants. Air quality investigations of buildings (indoor air) located off-site are not generally reviewed under the VIC Program. Such investigations require the involvement of the Occupational Safety and Health Administration (OSHA), the Minnesota Department of Health (MDH) and local governmental representatives.

The Phase II Report shall include any characterization of site conditions and to determine relative concentrations of airborne contaminants at a site, air monitoring using meters or detector tubes or sampling for analysis. If any device is used to monitor vapors from drum contents, soil borings, soil or building gas, and excavations, the Phase II Report shall then include:

- a description of the monitoring locations (drums, stained soils, soil borings, buildings, utility lines, etc.) and criteria for their selection (visual, odor, depth, historical site use, etc.);
- the number of monitoring locations chosen;
- jar headspace analysis results conducted according to MPCA Tanks and Spills Section Fact Sheet on jar headspace analysis;
- the type of air monitoring equipment employed including model number, and where appropriate, frequency of calibration, calibration gas and lamp size [**NOTE: The ionization potential of the contaminants being investigated must be checked against the ionizing energy of the lamp. Generally, compounds must have a lower ionization potential than the ionizing energy of the lamp employed in order to adequately detect their presence. Many non-petroleum, chlorinated solvents have ionization potentials greater than 10.2 eV, a common lamp size used during field screening of soils at petroleum contamination sites. As a result, a 11.7 eV or higher lamp must be used to adequately screen for the presence of most solvents included in the MDH laboratory list for volatile organic compounds (Method 465 D) and will be required for virtually all sites in the VIC Program. The MPCA will only accept air sampling and soil screening data obtained using an appropriate lamp size for the known or suspected contaminants at a given site. Moreover, if a site was initially investigated as a petroleum site using a 10.2 eV lamp and enters the**

*VIC Program for non-petroleum contamination, the absence of vapor monitor response for soils screened with the lower lamp size may not be accepted as evidence of absence of solvent-related compounds.];*

- detection limits of the air monitoring equipment;
- parameters the equipment is able to detect; and
- how the monitoring was accomplished (jar headspace analysis, ambient air, air immediately above a potential source, high volume air sampler, etc.).

### 3.5 Soil investigations

The Phase II Report shall include the results of soil investigations completed for all known or potential sources of soil contamination at the site. The Phase II Report needs to describe sample collection methodology employed and how it differs from the soil sampling guidelines available from the VIC Program staff. Soil sampling guidelines can be obtained by calling (651) 296-7291.

During drilling or sampling, many parameters are collected on-site and recorded in boring logs. A required Boring Log Format shall be used to present data in the Phase II Report. The required format will assist consultants and MPCA staff in developing a three-dimensional picture of the site. The required format simplifies interpretation of the data and accelerates MPCA staff review time. Please refer to Guidance Document #9.

It is also important to include copies of pertinent field notes used during soil sampling, including but not limited to:

- weather conditions;
- odors;
- visual observations;
- organic vapor analyzer readings;
- drilling or sampling anomalies; and
- other facts that may assist MPCA staff in the ultimate review of reports.

The MPCA staff may request copies of field notes if they are not provided in the Phase II Report.

The Phase II Report shall also include a description of techniques used to decontaminate field instruments such as drills, soil probes and other tools. Methods used to dispose of or containerize drill cuttings and investigation derived wastes shall also be reported.

In some cases, soil and geologic borings are part of ground water monitoring well construction (see section 4.7 below). In many cases, borings are used solely to obtain soil and geologic parameters, and must be sealed properly by “backfilling” with materials that seal the boring from potential surface contamination or from transmitting below surface contamination to uncontaminated regions of the soil or geologic profile. Sealing techniques used in the Phase II Investigation shall be described. Ultimately, sealing techniques must adhere to the MDH Rules Relating to Wells and Borings, Minnesota Rules, Chapter 4725.

If a soil metals survey is conducted using an X-ray fluorimeter (XRF), calibration, sampling, and data interpretation methods shall be included in the Phase II Report.

### ***Mobile Field Analytical Screening Equipment for Soils***

Drive Point Devices and Screened Augers, such as Geoprobe™ and Hydropunch™ etc., have been used successfully in Minnesota as methods to investigate soil or soil gas. Phase II Reports shall include a description of such devices, including how the devices were employed and in which of several optional “modes” they were operated.

### ***Establishing Soil Cleanup Levels***

Data obtained from soils investigations shall be used to generate cleanup levels for soil contamination. Soil cleanup levels for contaminated sites will be based on the assumption that the future use of the site will reflect the most stringent human health or ecological exposure scenario. All routes of human and ecological exposure shall be evaluated with one resulting in the most stringent cleanup level used in site cleanup.

Soil cleanup levels can be calculated for various human health routes of exposure at the site and the soil-to-ground water pathway. The more stringent of the various exposure pathways will dictate the site cleanup level. Routes of exposure may include ingestion and dermal contact, inhalation of vapors and particulates, ingestion of contaminated crops, fish, wildlife, surface water and ground water. For all routes of exposure, the Procedures for Establishing Soil Cleanup Levels (see Guidance Document #13) shall be used to determine cleanup level requirements unless the voluntary party proposes background or non-detectable soil cleanup levels. The ground water route of exposure is assessed using site specific soils data collected during site investigation and is developed in conjunction with the Approach to Ground Water Cleanup (see Guidance Document #14).

## **3.6 Ground Water Investigations**

The MPCA requires that ground water be investigated at those sites where ground water impacts are likely (i.e., due to mobility or volume of the contaminant release, or due to the depth to ground water) and at sites where written assurances relative to ground water are requested. If ground water

is not investigated, any written assurances stating that the MPCA is not currently requiring further response actions at a site will contain disclaimers stating that ground water at the property was not addressed during site investigation. [**NOTE:** *Voluntary parties and their consultants should note that ground water samples collected from environmental boreholes or through drive point devices (including Hydropunch ) do not constitute reproducible or confirmable ground water samples and should only be used to obtain general, qualitative information or to position permanent monitoring wells. Ground water data taken from boreholes or drive point devices cannot be used to obtain assurances regarding ground water quality, or to draw conclusions regarding ground water levels or flow direction.*]

If a ground water investigation is conducted the Phase II Report shall include a description of:

- ground water levels and flow direction;
- ground water chemistry; and
- any physical properties of the aquifer that may be used to justify the selection and implementation of a remedy.

The Phase II Report shall include a description of monitoring well design and construction. Ultimately, certain aspects of well design and construction are governed by the MDH Rules Relating to Wells and Borings, Minnesota Rules, Chapter 4725. It is recommended that the voluntary party contact the MDH staff directly at (651) 627-5177 to obtain additional information on this subject. The Phase II Report shall include information on filter packs, screen types, casing materials, sealing and grouting materials, and other pertinent information specific to the investigation of the site.

Documentation is required during well drilling, installation and maintenance, and should be provided as submittals to MPCA staff for review and approval. A required Boring Log Format and Well Log Format has been developed by the MPCA staff and shall be used for reporting well installations in the Phase II Report (see Guidance Document #9 regarding Reporting Requirements).

Once wells are installed, certain procedures are required to obtain reliable information on ground water quality from well samples. Ground water sampling data obtained by methods other than those prescribed in MPCA guidance documents may not be considered acceptable by MPCA staff. Ground water sampling guidelines and an example sampling protocol are described in "Minnesota Pollution Control Agency Ground Water Sampling Guidelines." This publication is available on request from the Program Development Section of the Ground Water and Solid Waste Division of the MPCA [(651) 296-7700]. The Phase II Report shall include a description of the protocol and methods used to sample ground water monitoring wells.



A minimum of two sampling events separated by a minimum of two weeks is required to confirm sampling results and to obtain enough data on which to base decisions regarding ground water quality. Longer ground water monitoring periods may be required depending on the nature of the site, the contaminants present, and the assurances sought by the voluntary party.

Ground water levels or piezometric surfaces shall be plotted for all Phase II Investigations that involve the installation or use of monitoring wells. The method used to plot lines of equal water level or piezometric head shall be stated in the Phase II Report. Specifically, both the method of interpolation and the water levels or piezometric heads at the monitoring wells shall be reported in appropriate figures and tables.

The same methodology applies to contaminant concentrations in ground water or soil. Both the monitoring point concentrations and the interpolation method for plotting lines of equal concentration shall be provided if such figures are used to define a plume.

### ***Mobile Field Analytical Screening Equipment for Ground Water***

Drive Point Devices and Screened Augers, such as Geoprobe™ and Hydropunch™ etc. have been used successfully in Minnesota as methods to screen ground water for contamination. Phase II Reports shall include a description of such devices, including how the devices were employed and in which of several optional “modes” they were operated.

These techniques, when coupled with gas chromatography mobile laboratory services, have proven to be fast, cost effective methods to obtain qualitative type ground water data. While these techniques have an application as screening tools, it is important to exercise care in interpreting the ground water data generated.

Current research indicates that while such techniques can prove contamination exists at a site, they do not provide the level of quality control necessary to quantify contaminants and cannot prove the absence of contamination. This point is important to any voluntary party seeking to obtain administrative, technical or liability assurances under the VIC Program solely on the evidence provided by these techniques and who have not installed and sampled permanent ground water monitoring wells.

The MPCA staff in the VIC Program views data collected using these technologies to be an estimate of ground water quality, and detections of contamination as tentative. The protocol for collecting a water quality sample using these methodologies does not meet those criteria specified in the ground water sampling guidance established by the MPCA staff.

In addition, the data generated by these techniques are point-in-time and cannot be duplicated or used to validate the absence of ground water contamination. Actual ground water monitoring well data shall be provided before the MPCA Commissioner will issue a No Action letter, Certificate of Completion or other types of written assurances regarding ground water at a given site.

### *Establishing Ground Water Cleanup Levels*

Calculation of ground water cleanup levels is determined by various criteria established in the Approach to Ground Water Cleanup (see Guidance Document #14). If ingestion of ground water is the appropriate criterion, then a non-degradation standard or National Interim Primary Drinking Water Standards, Maximum Contaminant Levels (MCLs) or MDH Health Risk Levels (HRLs) are considered applicable criteria for ground water ingestion. Until promulgated, the MDH Recommended Allowable Limits shall be used in the absence of MCLs or HRLs. Other ground water criteria may include non-consumption uses which may be more or less stringent than a drinking water criteria.

If the ground water discharges to surface water, the appropriate surface water criteria may be applicable depending on whether the ground water is also protected for consumption and whether the surface water criteria are more or less stringent than drinking water criteria.

Please consult the Approach to Ground Water Cleanup (see Guidance Document #14) for more information regarding ground water cleanup levels.

### **3.7 Surface Water Investigations**

The Phase II Report shall include a description and results of surface waters (lakes, rivers, drainage ditches, lagoons, wetlands, etc.) investigations. A surface water investigation may include physical and analytical testing. The Phase II Report shall include a description of physical testing methods such as flow velocity measurements, flow pattern testing, and methods and equipment used to collect the data.

### **4.0 Management of Investigation Derived Wastes**

The Phase II Report shall include a description of the manner in which byproducts of site investigation activities, were stockpiled, containerized, or otherwise stored or treated. These byproducts are derived during soil and geologic investigations, and during well and piezometer installation. These byproducts are wastes that are often hazardous due to the fact that they are comprised of the contaminated ground water or source material being investigated.

### **5.0 Duty to Notify**

If investigation activities cause a release of a hazardous substance or a release is identified that has not been previously reported, that release must be reported to the MPCA through the Minnesota Duty Officer, Division of Emergency Management. The notification must be made within 24 hours. Contacting the Duty Officer will fulfill obligations for the notification requirements under Minn. Stat. § 115.061. The number for the Duty Officer is **(651) 649-5451** (Metro) and **1-800-422-0798** (Greater Minnesota). TDD numbers are (651) 297-5353 and 1-800-627-3529.

## 6.0 Remedial Options

After the development of the Phase II Investigation Work Plan and before drafting of the Phase II Report, the MPCA staff recommends that the voluntary party and the consultant consider meeting with the MPCA staff to begin discussions of remedial options. The MPCA staff believes the Phase II Investigation and the Phase II Report be developed to answer two principal questions: 1) If contamination is present that requires remediation, what is the proper remedy? and 2) Will implementation of the anticipated remedy achieve the applicable cleanup levels? Traditionally, a Focused Feasibility Study (FFS) (see Guidance Document #16) is developed after the Phase II Investigation to select one or several remedial options based on the need or desire for bench-scale studies, treatability studies, or pilot studies. **However, voluntary parties are encouraged to study remedial options as part of the Phase II Investigation, including a description of the remedial option in the Phase II Report.** This “fast track” approach eliminates the need for submittal of a separate FFS, and is often employed due to:

- the voluntary party’s desire to expedite site cleanup; and
- the consultant’s knowledge of limited remedial options given the nature of the site and its contaminants.

### *Remedy Selection Framework*

Remedy selection for all sites in the VIC Program shall take place within the following framework. The framework shall be consulted once results of the Phase II Investigation have been compiled and evaluated. Voluntary parties are encouraged to contact the MPCA staff in the VIC Program for discussions regarding which elements of the framework may apply to a given set of investigation results. For all potential remedies, the following VIC Program Guidance Documents will need to be consulted:

- Procedures for Establishing Soil Cleanup Levels (Guidance Document #13);
- Approach to Ground Water Cleanup (Guidance Document #14);
- Remedy Selection Treatment Technology (Guidance Document #15); and
- Design Criteria – Vapor Extraction, Ground Water Modeling (Guidance Document #17).

### **Shallow Soil Contamination**

When site contamination (i.e., contaminated source material) is limited to the shallow soil (soil extending from the surface to a depth which is easily excavated by conventional heavy construction equipment), a remedy often includes excavation and treatment of the contaminated soil or source material. If ground water is affected by contaminated source material, cleanup of ground water to applicable requirements will be necessary.

### **Deep Soil Contamination**

When contaminated source material extends to the deeper regions of soil profile, technologies such as vapor extraction or soil venting shall be considered as an alternative to, or in combination with excavation. Site soil conditions may limit the type and applicability of such technologies. If so, the MPCA staff recommends that the Remedy Selection Treatment Technology (see Guidance Document #15) be consulted. If ground water is affected by contaminated source material, cleanup of ground water to applicable requirements will be required.

### **Limited Yield Ground Water Aquifers**

If the ground water is affected by contaminated source material, but the aquifer yields little usable ground water for human consumption, is not connected to surface waters or wetlands, and is not connected to aquifers of higher yield or aquifers used for human consumption, then excavation and remediation of the source may need to be combined with ground water containment. Ground water containment shall achieve the non-degradation standard for surrounding uncontaminated ground water and may include, but is not limited to, drainage, creation of a holding pond, pumping or pumping with treatment, depending on the level of contamination as defined by the applicable criteria (see Guidance Document #14) for ground and surface waters. A No Action determination or a requirement for monitoring of ground water may also be considered depending on applicable criteria.

### **Moderate to High Yield Ground Water Aquifers**

Moderate to high yield ground water aquifers affected by contaminated source material may require a separate set of considerations depending on the applicable criteria for ground and surface waters. Such aquifers may need to be protected or remediated for current or potential future use. Additionally, these aquifers may be connected to protected surface waters or below or above ground ecosystems, necessitating additional review for associated ecological risks.

### **Ground Water Contamination Less Than Applicable Criteria**

When ground water contamination is less than applicable criteria for a given contaminant or set of contaminants, then source removal combined with ground water containment may be necessary to achieve non-degradation for surrounding ground waters and surface waters. Since contaminant concentrations will be low relative to the applicable criteria, the effects of attenuation may be considered when calculating how to achieve the non-degradation standard.

### **Presence of Dense, Non-Aqueous Phase Liquids**

When ground water is contaminated with a special class of contaminants known as Dense, Non-Aqueous Phase Liquids (DNAPLs), any remaining contaminated source material shall be removed from shallow soils, consideration given to vapor extraction or DNAPL mobilization for deeper soils, and containment and treatment of the ground water plume contaminated with dissolved

DNAPLs shall be implemented. In addition, DNAPLs may be treated or contained to limit the amount of ground water pumped and treated for dissolved contaminants. DNAPL source treatment or containment reduces the need for long-term pumping and the wasteful discharge of a valuable natural resource.

### **Aquifers affected by Off-Site Sources**

When ground water beneath a site impacts the site from an already contaminated aquifer (i.e., ground water upgradient of the site is contaminated), the efficacy of addressing ground water impacts from site releases may be considered and evaluated within the context of nearby monitoring or remediations, aquifer use and potential attenuation effects. The removal of source contamination on the site will be evaluated regardless of decisions made concerning ground water.

## **7.0 The Next Step**

For those sites which do not require cleanup, the MPCA Commissioner may, after review of the Phase II Report, determine that no further action is needed to address soils or ground water at the site, or to address the observed or threatened releases at the site. This determination may result in the issuance of a technical review letter, a No Association Determination letter or a No Action letter. (See Guidance Document #4, Types of Written Assurances, for a description of available written assurances.) For those sites impacted by an off-site source of contamination, the MPCA Commissioner may issue an Off-Site Source Determination to the voluntary party .

For those sites requiring cleanup, completion of the Phase II Report is followed by development of an FFS (see Guidance Document #16) or a Response Action Plan (see Guidance Document #18). Subsequent studies or plans shall be submitted within 90 days receipt of the MPCA staff review comments and/or approval of the Phase II Report to remain active in the VIC Program.

Upon completion of the cleanup actions, the MPCA Commissioner may issue a No Action letter, a Certificate of Completion or enter into an Agreement (Consent Order) with the voluntary party. Once again, please refer to Guidance Document #4, Types of Assurances, for a description of available written assurances.