



SITE INVESTIGATION PROCEDURE

**State of Vermont
Agency of Natural Resources
Waste Management Division
Sites Management Section**

Effective: June 2005

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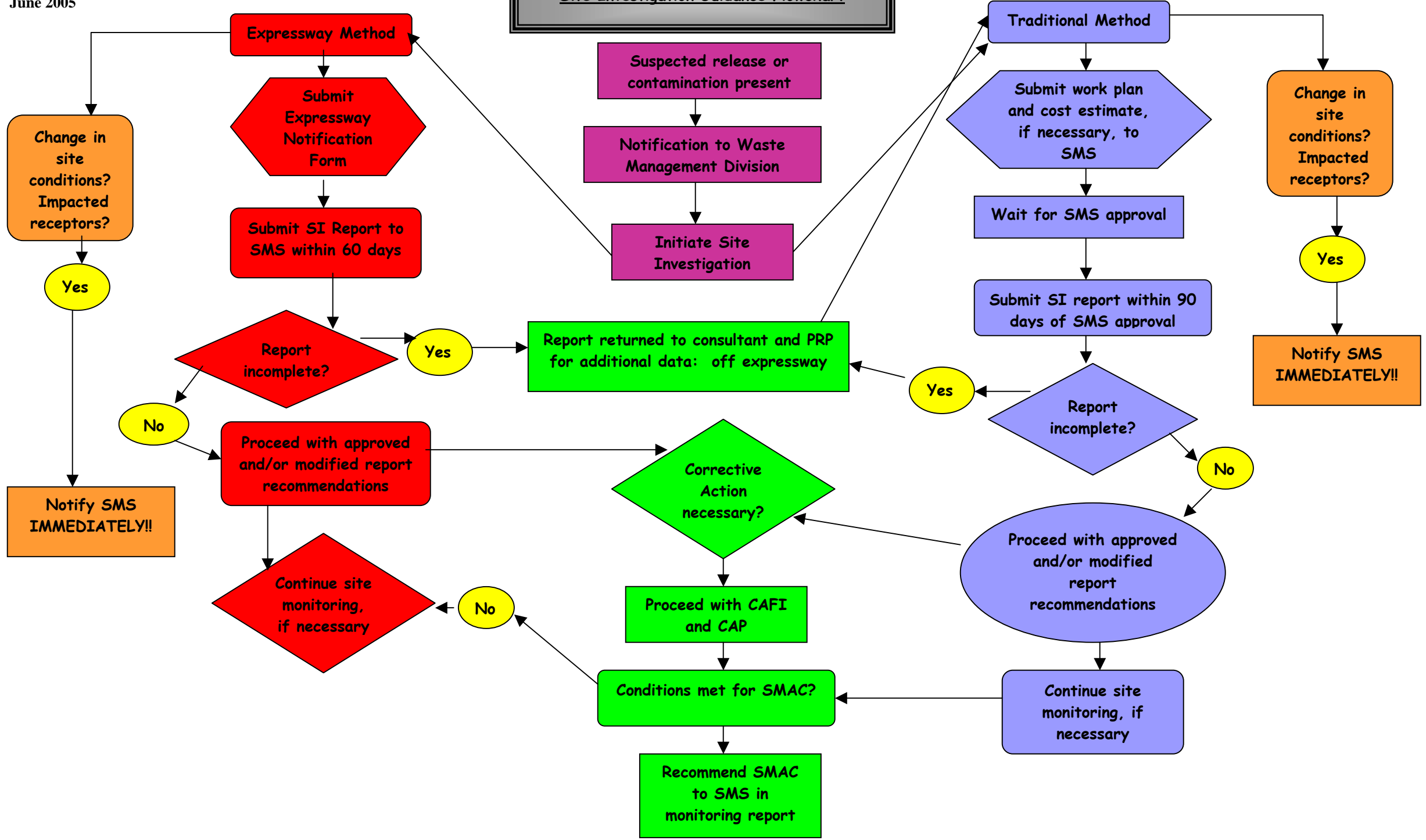
Introduction

The [Sites Management Section \(SMS\)](#) of the Waste Management Division, Vermont Department of Environmental Conservation, will require a site investigation be performed on properties where a [release](#) or suspected release of a [hazardous material](#) has occurred. This document lays out the requirements for conducting site investigations and preparing site investigation reports at properties in Vermont where a [release](#) of a [hazardous material](#) has occurred or is suspected. The [Underground Storage Tank \(UST\) regulations](#), [Hazardous Waste Regulations](#) and [10 V.S.A., Chapter 159, § 6615, §6615b, and §6616](#) dictate the [release notification](#) requirements and provide the SMS with the authority to oversee these investigations. These statutes and relevant definitions are summarized in the [Glossary](#) section of this Procedure.

Any person who is determined to be liable for the [release](#) or threatened release of a hazardous material as established in [Section 6615](#) must conduct site investigation work within the timeframes established in [Section 6615b Corrective Action Procedures](#), which is included in Appendix B of this document. The person determined liable for cleanup of the release is also responsible for hiring a qualified environmental consultant, and ensuring that work is conducted in a timely manner. **In most cases, the environmental consultant works for the owner or responsible party of the property, not the State of Vermont, Agency of Natural Resources, Department of Environmental Conservation, Waste Management Division, Sites Management Section.**

The cost of petroleum related site investigations may be eligible for **reimbursement** under the state [Petroleum Cleanup Fund \(PCF\)](#), if the source of the contamination is from a qualifying petroleum [Underground Storage Tank \(UST\)](#) or [Above Ground Storage Tank \(AST\)](#) and there is no private insurance to cover investigation and cleanup expenses. At sites where costs are eligible for reimbursement from the PCF, the consultant still works for the responsible party, NOT the State of Vermont. The procedure for reimbursement of eligible costs from the PCF are described in the [Procedures for Reimbursement From the Petroleum Cleanup Fund](#), which can be found at <http://www.anr.state.vt.us/dec/wastediv/sms/pubs/PCFReimb2004.pdf>

Site Investigation Guidance Flowchart



*******The remainder of this document discusses what a Site Investigation is, how it should be developed, and what it must include. The following sections are particularly tailored to the entity conducting the Site Investigation, usually the ENVIRONMENTAL CONSULTANT.*******

The Site Investigation

The Site Investigation is a comprehensive study of a hazardous materials [release](#) and relevant site conditions. Multiple site investigation phases are often required. The purpose of the investigation is to develop sufficient site characterization information to provide recommendations for future activities at the site. This process begins with an initial site investigation and ends with a [Site Management Activity Completed \(SMAC\) designation](#). The investigation develops a [Conceptual Model](#) (see Conceptual Model discussion below) that provides the framework for determining the full extent of the [release](#), characterizes the geology and hydrogeology by conducting appropriate surface and subsurface investigations, and establishes the parameters necessary for an understanding of [corrective actions](#).

One of the most critical steps in the site investigation is to identify [sensitive receptors](#) that are directly affected or threatened by the [release](#). The SMS must be notified *immediately* if receptors are directly affected. All affected parties must be notified *immediately* when contamination is discovered.

If the SMS determines that a Site Investigation has not been completed in accordance with this document, the Site Investigation report will be returned so that the deficiencies may be corrected. Costs associated with any additional work needed to correct deficiencies may not be considered eligible for reimbursement under the [Petroleum Cleanup Fund \(PCF\)](#) program.

A Site Investigation is REQUIRED when:

- ⇒ [Notification of a release](#) has occurred;
- ⇒ Contamination is present in soils at concentrations which may pose a risk to [receptors](#);
- ⇒ [Free product](#) or a [product sheen](#) is present (For example in an excavation, test pit, sump, soil boring, monitoring well, groundwater or surface water);
- ⇒ There are directly affected or threatened [sensitive receptors](#);
- ⇒ There is a reason to suspect [contamination](#) has reached groundwater and/or has been determined to be contaminated above [Vermont Groundwater Enforcement Standards](#) as

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defined in the Department of Environmental Conservation's Groundwater Protection Rule and Strategy, <http://www.anr.state.vt.us/dec/watersup/gwrule/gwprs2000.pdf>;

- ⇒ There is reason to suspect the presence of **non-aqueous phase liquid (NAPL)**; or
- ⇒ There is a known or suspected **release** of **hazardous material** or **hazardous waste**.

The OBJECTIVES of a Site Investigation are to provide sufficient information to determine if there is a risk to human health or the environment, and which **corrective action measures are necessary. The following must be addressed in a Site Investigation:**

- ⇒ Define the source(s), degree and extent of the contamination;
- ⇒ Define all possible pathways for **contaminant** migration;
- ⇒ Present data that quantifies the amount of contaminants migrating along each pathway;
- ⇒ Determine the fate of the contaminants (adsorption, degradation, etc.);
- ⇒ Identify all affected or potentially affected **receptors** and determine the risk of contamination directly affecting **receptors**;
- ⇒ Identify the parameters needed to determine possible **corrective actions** that may be appropriate to control, mitigate, and/or monitor the effects of the **release**;
- ⇒ Provide a preliminary recommendation, with justification, for the need to conduct additional investigation, **corrective action** and/or monitoring at the site.

Site Investigation Methods & Process

There are two acceptable methods of voluntarily conducting site investigations:

- The **Traditional Method** of conducting site investigations requires the potentially responsible party to submit a written site investigation **work plan (see below for additional information on acceptable work plans)** to the SMS for review and approval prior to beginning a site investigation. In an emergency situation, it may not be possible

to obtain prior approval of a work plan, but all reasonable efforts should be made to involve SMS staff in the decision making process during the emergency. *** **If there is a significant change in site conditions which would change management of the site, such as an impacted receptor, the SMS must be notified *immediately*.*****

- The **Expressway Method** of conducting site investigations allows the completion of an initial site investigation without the submittal of any work plan or cost estimate, or any written authorization from the SMS for any non-RCRA, State supervised site.

When the [Expressway Method](#) is used, a site investigation can begin almost immediately once the site is identified, which can significantly reduce project costs, and eliminates the need to wait for the SMS to review consultant work plans.

If the Expressway method is being utilized, the SMS requires:

- ⇒ The SMS be notified of this action by submitting an [expressway notification form \(Appendix A\)](#). An Expressway notification form is included with underground storage tank (UST) Removal Forms, which are provided by the Waste Management Division's UST Program when tank pulls are scheduled. For non-UST sites, the notification form can be found at the end of this document or by contacting the SMS.
- ⇒ The work is completed in accordance with this Procedure;
- ⇒ Appropriate reports are submitted to the SMS within **60 days** of the [Expressway notification](#);
- ⇒ For sites eligible for reimbursement from the [Petroleum Cleanup Fund \(PCF\)](#), costs must be within the Consultants Fee Schedule which is located in the Procedures For Reimbursement from the Petroleum Cleanup Fund, <http://www.anr.state.vt.us/dec/wastediv/sms/pubs/PCFReimb2004.pdf>

***** If there is a significant change in site conditions which would change management of the site, such as an impacted receptor, the SMS must be notified *immediately*.*****

The SMS does not respond with an Expressway notification approval letter, but retains the right to disallow using the Expressway Method at sites that may not be suitable to conventional investigation techniques.

The site may also be directly routed to the Enforcement Division, in those cases where it is

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determined that the “Expressway” notification was not followed with timely action by the responsible parties.

If site conditions are too complex to allow completion of the expressway process, the site should follow the traditional site investigation process where work plans are submitted to the SMS for approval prior to each phase of the investigation.

For all work conducted using the Expressway Method which may be eligible for reimbursement from the Petroleum Cleanup Fund, all costs must follow the “Consultant Fee Schedule” which is published in the document titled, “Procedures for Reimbursement from the Petroleum Cleanup Fund”, and follow the PCF Procedures, and be completed within the 60 day timeframe, or will not be eligible for reimbursement from the PCF. The PCF Procedures may be viewed at <http://www.anr.state.vt.us/dec/wastediv/sms/pubs/PCFReimb2004.pdf>

If a site investigation is not “voluntarily” completed by the responsible party, the SMS may use one of its Site Investigation Contractors to conduct the necessary site investigation work, and seek cost recovery at a later date and/or refer the site to the Enforcement Division which may result in the imposition of penalties and fines.

If the Site Investigation results indicate that site conditions require corrective action, a Corrective Action Feasibility Investigation (CAFI) will be necessary. This follow-up study is intended to evaluate several potential cleanup technologies for the site. Based on the results of the CAFI, a corrective action strategy will be recommended. Information regarding both the CAFI and the Corrective Action Plan (CAP) process can be found in the Corrective Action Guidance document, <http://www.anr.state.vt.us/dec/wastediv/SMS/pubs/capdoc1197.pdf>.

Site Investigation Development

Traditional Work Plans:

For sites in which the Expressway Method is NOT being used, a work plan is always required. The work plan must be approved by the SMS prior to the initiation of onsite work. In some cases, multiple site investigation phases may be necessary to adequately characterize the site. In these cases, there will need to be an approved work plan for each phase of the investigation.

At sites which are eligible for reimbursement from the Petroleum Cleanup Fund (PCF), a cost estimate must accompany the work plan. The cost estimate must include a detailed breakdown of

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all proposed costs.

The site investigation work plan should include (but not be limited to) the following:

- review of existing site information including physical description of the site, **hazardous materials** known or suspected to be used on site, known or suspected **releases**, known or suspected **receptors**, site owner, owner and consultant contact information, and the results of any previous investigations performed at the site;
- an initial **Conceptual Model** (see section on Conceptual Model below) based on existing information (this should be updated during the investigation as new data are gathered);
- the goal(s) of the proposed investigation;
- proposed field sampling locations;
- proposed data gathering techniques such as mapping, geophysics, drilling methodologies, sampling techniques and procedures; (approved GPS methodology is included in **Appendix B** of this document)
- proposed laboratory and field analytical methods and quality assurance and quality control techniques;
- **standard operating procedures** (trade secrets may be kept confidential);
- description of computer or analytical models that will be used in analyzing the investigation data;
- work schedules, and;
- other as appropriate to the site.

Flexible Work Plans:

The Sites Management Section encourages the use of **flexible work plans** (also called **dynamic** work plans) where appropriate. **Flexible work plans** allow the investigation to react to actual site specific data as they are collected. As these data are collected, the work plan is then revised to best reflect actual site conditions and to best investigate the contamination. This helps the investigation to be more accurate with less field mobilization phases and often at lower costs than are associated with non flexible work plans. **Flexible work plans** must include the same data as required in the traditional work plan, but must provide differing site scenarios

and the actions which will be taken depending on the specific site conditions encountered. When a **flexible work plan** is used, the work plan must include a decision making process tree or written plan that details how changes will be made in the work plan during an investigation and how the SMS staff will be involved in the decision making process.

One type of flexible work plan method is referred to by the US EPA as the Triad method. This method uses real time data/analytical methodologies, systematic project planning, and dynamic work strategies. Documents detailing this type of investigation strategy can be found in numerous references including, <http://www.epa.gov/superfund/programs/dfa/>, <http://www.itrcweb.org/SCM-1.pdf>, <http://clu-in.org/triad/>, and <http://www.itrcweb.org/SCM-1.pdf>, <http://www.norisc.com/>.

A flexible work plan would not be appropriate at sites which have been referred to the Enforcement Division, or at sites where there have been only small releases with limited contamination.

Conceptual Model:

The SMS requires a **Conceptual Model** be developed while preparing investigation work plans to ensure that the Site Investigation will be conducted in an efficient manner and gather enough information to allow the SMS to fully understand site conditions and therefore make informed decisions. A Conceptual Model is a model of how chemicals were released at a site, their transport mechanisms, and exposure routes for both ecological and human receptors. In general terms a **Conceptual Model** provides the context for the Site Investigation, to ensure that investigation phases are pertinent to identifying the site related risks. An initial **Conceptual Model** developed prior to beginning a site investigation can be as simple as “an underground storage tank leaked gasoline into a surficial aquifer” or a generalized diagram of residual phase DNAPL trapped in the pore spaces of the aquifer matrix. As more data is collected from a site, it is incorporated into the Conceptual Model. Therefore, the example of “an underground storage tank leaked gasoline into a surficial aquifer” can become, “the gasoline leaked into a multi-layer glaciolacustrine stratigraphy with fining upwards crossbedded deposits underlain by karst geology with a downwards hydraulic gradient”. The more data collected, the clearer the **Conceptual Model**, allowing for a more predictable site investigation outcome. The Conceptual Model must include all past sampling data and their identifying parameters.

When developing the initial **Conceptual Model and work plan, the first step is to collect all available information about the site including, but not limited to: land use, suspected or known contamination source, topography, surrounding land uses, suspected geology from published literature or visual observations at the ground surface, etc. These data are put together to help develop an initial global view of the site and to help raise and focus questions that will need to be answered by the investigation.**

Risk Evaluation:

Generally, qualitative and quantitative approaches are used in determining risk to **sensitive receptors** at hazardous sites. The qualitative approach uses site specific information such as sampling results from groundwater, soil, surface water and indoor air, and compares the results to existing standards such as the Vermont Groundwater Enforcement Standards (VTGWES) or published risk based concentrations, such as EPA Region III's Risk Based Concentration (RBC) Tables (<http://www.epa.gov/reg3hwmd/risk/human/rbc/rbc0404.pdf>) or Region IX's Preliminary Remediation Goals (PRGs) (<http://www.epa.gov/Region9/waste/sfund/prg/files/02table.pdf>). The quantitative approach uses site specific data including, but not limited to, geology, hydrogeology, analytical results, and soil types in order to determine the predicted movement of contamination over time, as well as the adsorption, desorption, and retardation of the **contaminant**, and the naturally occurring degradation processes in order to then predict the risks and effects of the contaminants of concern on **sensitive receptors**.

The SMS has not adopted any particular modeling approach for determining risk. The SMS accepts any valid approach to modeling as long as it can be supported for the case in which it is used. Consultants must work with the SMS site manager to ensure that the model being used is appropriate for the individual site.

EPA's Risk Assessment Guidance for Superfund (RAGS) (<http://www.epa.gov/superfund/programs/risk/ragsd/tara.htm>) is a technical guide for performance of site-specific risk assessments. Toxicity/carcinogenicity information about various hazardous substances is available in EPA's Integrated Risk Information System (IRIS), www.epa.gov/iris

Formal risk assessments which involve calculating risk based on toxicity/carcinogenicity of a substance are rarely used at sites on the Vermont Active Hazardous Sites List. However, if this type of risk assessment is found to be necessary at a site, it must follow standard Environmental Protection Agency (EPA) and Vermont Department of Health (DOH) risk assessment methodology. The SMS strongly recommends consultants with expertise in risk assessment conduct these types of risk assessments.

Site Investigation Report Elements

Report Format:

The information collected during the Site Investigation must be presented to the [potentially responsible party \(PRP\)](#) and the SMS in one or more written reports as outlined below. Each report must be well organized, concisely written, and highly visual. As such, certain minimum formats for presentation are recommended. **Reports not meeting the minimum requirements will be returned to the PRP for completion.** Where multiple investigation phases are required, each phase of the investigation must be clearly and completely described in one or more written reports.

All reports must be submitted on **double-sided recycled paper**.

All reports and correspondence regarding hazardous waste sites **must be submitted digitally as well as a paper copy**. Reports and correspondence (including all figures, tables, images and attachments, including laboratory reports) shall be provided as Adobe Acrobat (.pdf) text-searchable (not image) files. Reports shall be provided as a single PDF file, unless the original report is large enough to be separated into volumes. Images that are not part of reports (such as photos from a site inspection) shall be provided as JPEG files. SMS project managers may require on a case-by-case basis site data, including data from field instrumentation, field analytical results and laboratory analytical results as Microsoft Excel spreadsheets (.xls) or Microsoft Access database (.mda) files. Microsoft Office files must be compatible with Microsoft Office 97 or later versions.

Files smaller than 2 MB in size may be delivered by electronic mail directly to the project manager. Files larger than 2 MB in size can be delivered on mailable storage media (e.g. CD-ROM), or may be transmitted to the VT ANR ftp site at <ftp.anr.state.vt.us>. Contact the [SMS](#) directly for instructions on using this site.

Site Investigation Reports MUST include:

- ⇒ **Title Page** - including: SMS site name, site address, mailing address, SMS site number, latitude/longitude determined by ge positioning system ([GPS](#)) of site (see Appendix B), names, addresses, and phone numbers of contacts (PRPs and consultants). Title page should identify if the property is enrolled in either the [Redevelopment of Contaminated Properties Program \(RCPP\)](#) or EPA's [Brownfields](#) programs.
- ⇒ **Executive Summary** - brief summary of findings, conclusions and recommendations of Site Investigation.

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- ⇒ **Site Information** - table of names, addresses and phone numbers of site owners (past and present), site operators, site land owners, **potentially responsible parties**, and adjacent landowners.
- ⇒ **Conceptual Model** - See previous section on Conceptual Model for a complete description.
- ⇒ **Site History** - past and present owners, land use, waste storage or disposal areas, potential sources of contamination, hazardous materials disposal practices, previous hazardous materials releases with location of release or releases, if known, and estimated volume(s) or mass released. Presentation may include copies of historic maps (Insurance maps, Town maps) and copies of Town Directories. Identify current land use (residential, commercial, industrial) and any known land use restrictions.
- ⇒ **Receptor Study/ Risk Evaluation** - Identify Source Protection Areas, residential water wells, surface waters, buildings with basements, wetlands, sensitive ecological areas, areas of direct soil contact threat, utility corridors, and others as identified. A list of the names and addresses of impacted or threatened third parties must be included. See previous section on Risk Evaluation for a complete discussion.
- ⇒ **Contaminant/s** - Identify all pertinent contaminants and contaminant properties such as viscosity, density, K_{oc} , etc. as appropriate. Include any Vermont Groundwater Enforcement Standards, Maximum Contaminant Levels, Vermont Department of Health health advisories, or other risk-based screening levels, as appropriate. MSDS sheets must be included for all known onsite chemicals of concern, and review of waste manifests, where available.
- ⇒ **Maps and Photographs-**
 - **Vicinity Map (or Property Map)**- including boundary lines, surrounding land use, buildings, street names, receptors, engineered structures (ie. asphalt parking surfaces, concrete sidewalks, drainage ways, diversion ditches, drain tiles, manholes, lined areas, leachate collection systems, septic systems, sewer lines); chemical storage or process areas, waste storage and disposal areas, **hazardous materials**, drums and tank and any other pertinent property features.
 - **Area Map**- a copy of the most recent USGS 7.5 minute topographic quadrangle that includes the site. Map should include contour interval and name and date of USGS quadrangle.
 - **Site (Investigation) Map**- showing locations of all sampling locations (soil borings,

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ground water monitoring wells, drinking water wells, test pits, sediment and surface water sampling, background sampling locations, etc.)

- **Photographs** – color images showing the site and pertinent features.
- ⇒ **Geology** - regional and site specific soils and bedrock information, boring logs, well logs and groundwater confining layers.
- ⇒ **Hydrogeology** - regional and site specific hydrogeologic information, horizontal and vertical groundwater flow gradients and direction.
- ⇒ **Plume Definition** – Compound specific isoconcentration maps, migration pathways for free product, groundwater, and vapors.
 - ⇒ **Contaminant Fate and Transport** – describe/model contaminant distribution in the subsurface, migration pathways, the amount of migration occurring, the predicted movement of the contamination over time, and as appropriate, the adsorption, desorption, and retardation of the contaminant and the naturally occurring degradation processes.
 - ⇒ **Work plan protocol deviations.** – Any deviations from the approved work plan must be discussed.
 - ⇒ **Discussion** – a descriptive analysis of how the data gathered constructs the **Conceptual Model** of the site, and whether the validity of the data is sufficient to establish credible recommendations. The discussion must also establish that the data collected are suitable to determine the risk posed by the contaminant(s), and the potential remedial actions.
- ⇒ **Data Interpretation** - all data should be organized in narrative and tabular and graphical form, including maps and cross sections as appropriate.
- ⇒ **Conclusions and Recommendations** - a discussion of the findings of the investigation and, specifically, the risk contaminants pose to identified **receptors**, the identification of potentially appropriate remedial methods, proposed monitoring frequency, and need for further investigation and/or **corrective action**, etc.
- ⇒ **References.**
 - **Monitoring Well and Soil Boring Logs**- A description and discussion of monitoring well and soil boring installation(s). Logs must include well/boring information and field screening results. This should include explanation of any

problems encountered or anomalies discovered. Monitoring wells must also be shown graphically on appropriate site maps.

- **Field notes** – Copies of the original field notes. Field notes shall include documentation of weather conditions, documentation of sampling timeline with locations, low flow sampling logs, and calibration information for each field analytical equipment.
- **Laboratory Results** - a copy of the actual laboratory results and all QA/QC data, as specified in the approved work plan must be included. Any deviations from QA/QC must be identified and discussed.

⇒ **Calculations** – All calculations, such as travel and migration time, [natural attenuation](#), and groundwater flow directions. If computer modeling is conducted, a reference to the model used, the data inputs, and data output package must be included (this may be submitted solely in electronic format).

⇒ Note: Tables and Appendices may be used as appropriate to present data, well and boring logs, and maps, etc.

Site Investigation Reports MAY include the following:

⇒ **Orthophoto** - a copy of the most recent coverage that includes the site. Orthophoto should include sheet name and date. www.state.vt.us/tax/vermontmapping.htm

Additional maps and diagrams may be submitted, when appropriate (ie. groundwater elevation contour map, isopleth contaminant concentration map, receptor survey, soil gas survey, geology maps). All maps must include scale (including bar scale), north arrow, legend, and point of latitude/longitude coordinates.

⇒ **Geology** - values for soil bulk density, porosity, fraction organic content, pH, REDOX potential, etc. as appropriate. This can also include geologic maps, fracture trace maps, geophysical data, cross sections, etc., as appropriate to the site.

⇒ **Hydrogeology** - hydraulic conductivity, transmissivity, and other parameters, as appropriate.

⇒ **Subsurface Contaminant Source Areas** – identify the portion or portions of the subsurface where immiscible liquids (free-phase or residual [NAPL](#)) are present either above or below the water table, as appropriate.

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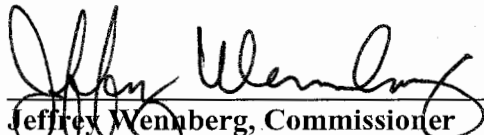
- ⇒ **Free Product** - map with areal extent, thicknesses, and product removal logs.
- ⇒ **Standard Operating Procedures (SOPs)** – must be immediately available upon request (trade secrets may be kept confidential).

Reimbursement of Oversight Costs to the State

The state may require reimbursement of oversight costs at non-Petroleum Cleanup Fund sites. However, at sites being voluntarily investigated and remediated, the SMS may choose not to require reimbursement of oversight costs unless the site or release conditions require substantial SMS oversight.



Site Investigation Procedure Approval:


Jeffrey Wenberg, Commissioner
Department of Environmental Conservation

6/9/05
Date

Glossary

Above Ground Storage Tank (AST): any tank, other than an underground storage tank, used to store any of the following petroleum products: gasoline, diesel, kerosene, used oil or heating oil.

Brownfields: real property, the expansion redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant or contaminant.

<http://www.epa.gov/Compliance/cleanup/brownfields/index.html>

Conceptual Model: A model of how chemicals were released at a site, their transport mechanism, and exposure routes for both ecological and human receptors.

Contaminant: Any physical, chemical, biological, or radiological material that can potentially have adverse impacts on environmental media, or that can adversely impact public health and the environment. It represents any undesirable substance/material that normally is not present in the environmental media of concern.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): Commonly known as Superfund, was enacted by Congress on December 11, 1980. This law created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. Over five years, \$1.6 billion was collected and the tax went to a trust fund for cleaning up abandoned or uncontrolled hazardous waste sites. CERCLA established prohibitions and requirements concerning closed and abandoned hazardous waste sites; provided for liability of persons responsible for releases of hazardous waste at these sites; and established a trust fund to provide for cleanup when no responsible party could be identified.

Corrective Action: Remedial actions taken when a release of a hazardous material has occurred and has impacted the environment. A typical example involves the remediation of chemical contamination in soil and groundwater.

Dense Nonaqueous Phase Liquid (DNAPL): liquids (generally organic) that have low aqueous solubilities (they are immiscible) and have a greater density than water (they will sink in water). They are characterized by their component composition, density, viscosity, and interfacial tension with water. Common DNAPLs include compounds that have been and are still widely used in industrial and commercial processes. Possibly the most common DNAPLs are halogenated solvents such as trichloroethylene (TCE) and tetrachloroethylene (PCE). These DNAPLs have been used as degreasers in many industrial processes and have frequently been released to the subsurface. Other DNAPLs include, but are not limited to, coal tar, creosote, some pesticides, and polychlorinated biphenyls.

Free Product: refers to an immiscible fluid such as gasoline or a chlorinated solvent. In the

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subsurface free product may be continuous and able to flow independently of groundwater.

Flexible/Dynamic Work Plan: a workplan that allows the project teams to make decisions in the field about how subsequent site activities will progress. Workplans provide the strategy for how dynamic field activities will take place. As such, they document a flexible, adaptive sampling and analytical strategy. <http://www.epa.gov/superfund/programs/dfa/dynwork.htm>

Global Positioning System: a network of satellites that continuously transmit coded signals that make it possible to precisely map locations on the earth's surface. See Appendix C.

Hazardous Material: Defined in 10 V.S.A. Section 6602(16)(A) and (B) as: all petroleum and toxic, corrosive or other chemicals and related sludge included in any of the following:

- (i) any substance defined in section 101(14) of the federal Comprehensive Environmental Response, Compensation and Liability Act of 1980;
- (ii) petroleum, including crude oil or any fraction thereof; or
- (iii) hazardous wastes, as determined under 10 V.S.A. Section 6602 (4).

Does not include herbicides and pesticides when applied consistent with good practice conducted in conformity with federal, state and local laws and regulations and according to manufacturer's instructions.

Hazardous Waste: As defined in 10 V.S.A. Section 6602(4): any waste or combination of wastes of a solid, liquid, contained gaseous, or semi-solid form, including but not limited to those which are toxic, corrosive, ignitable, reactive, strong sensitizers, or which generate pressure through decomposition, heat or other means, which in the judgment of the secretary may cause, or contribute to an increase in mortality or an increase in serious irreversible or incapacitating reversible illness, taking into account the toxicity of such waste, its persistence and degradability in nature, and its potential for assimilation, or concentration in tissue, and other factors that may otherwise cause or contribute to adverse acute or chronic effects on the health of persons or other living organisms, or any matter which may have an unusually destructive effect on water quality if discharged to ground or surface waters of the state. All special nuclear, source or by-product material, as defined by the Atomic Energy Act of 1954 and amendments thereto, codified in 42 U.S.C Section 2014, is specifically excluded from this definition.

Hydrogeology: the study of groundwater, including its origin, occurrence, movement, and quality.

Light Nonaqueous Phase Liquid (LNAPL): liquids (generally organic) that have low aqueous solubilities (they are immiscible) and have less density than water (they will float on water). They are characterized by their component composition, density, viscosity, and interfacial tension with water. Common LNAPLs include petroleum products such as gasoline, diesel fuel, and home heating oil.

Non-aqueous phase liquid (NAPL): Non-aqueous phase liquids are liquids that are sparingly soluble in water. Because they do not mix with water, they form a separate phase. For example,

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oil is an NAPL because it does not mix with water, and oil and water in a glass will separate into two separate phases. NAPLs can be lighter than water ([LNAPL](#)) or denser than water ([DNAPL](#)). Hydrocarbons, such as oil and gasoline, and chlorinated solvents, such as trichloroethylene, are examples of NAPLs. (as defined by the United States Geological Study).

Natural Attenuation: an in-situ approach to cleanup that uses natural processes to contain the spread of contamination from chemical spills and reduce the concentrations and amounts of pollutants in contaminated soil and groundwater. Natural subsurface processes, such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials, are allowed to reduce concentrations of contaminants to acceptable levels.

Petroleum Cleanup Fund: established under the authority of [10 V.S.A. Chapter 59 Section 1941](#), was created to pay, subject to available funding, for certain uninsured costs for the cleanup and restoration of contaminated soil and groundwater caused by releases of petroleum from aboveground storage tanks (ASTs) and underground storage tanks (USTs) and for compensation of third party claims for injury and damage caused by such a release.

Potentially Responsible Party (PRP): Any person, potentially liable under 6615, which may include, but is not necessarily limited to, an individual or organization, including owners, operators, transporters, or generators, who is potentially responsible for or contributed to contamination at a site.

Product sheen: A layer of light non-aqueous phase liquid (LNAPL) that is too thin to measure but is visible on top of water.

Redevelopment of Contaminated Properties Program (RCPP): a property cleanup program which enables certain interested parties to request assistance of the secretary in reviewing and overseeing work plans to investigate, abate, remove, remediate and monitor vacant, abandoned, or substantially underutilized properties in exchange for protection from certain liabilities under [10 V.S.A. Chapter 159 Section 6615a](#).

Release: As defined in [10 V.S.A. Section 6602\(17\)](#): any intentional or unintentional action or omission resulting in the spilling, leaking, pumping, pouring, emitting, emptying, dumping, or disposing of hazardous materials into the surface or groundwaters, or onto the lands in the state, or into waters outside the jurisdiction of the state when damage may result to the public health, lands, waters or natural resources within the jurisdiction of the state.

Release Notification: Releases of hazardous materials into the surface or groundwater or onto the land of the State are prohibited. Releases or suspected releases must be reported to the State according to [Section 8-602 of the State of Vermont Underground Storage Tank Regulations \(\[http://www.anr.state.vt.us/dec/wastediv/ust/ust_regs.htm\]\(http://www.anr.state.vt.us/dec/wastediv/ust/ust_regs.htm\)\)](#), section 7-105 of the Vermont Hazardous Waste Management Regulations, [\(<http://www.anr.state.vt.us/dec/wastediv/rcra/regs.htm>\)](#), 10 V.S.A. Sections 6615 and 6615b, [\(<http://www.leg.state.vt.us/statutes/fullsection.cfm?Title=10&Chapter=159&Section=06615>\)](#), and 10 V.S.A. Section 6616, [\(<http://www.leg.state.vt.us/statutes/fullsection.cfm?Title=10&Chapter=159&Section=06616>\)](#).

Resource Conservation and Recovery Act (RCRA): A Federal law enacted in 1976 that established a regulatory system to track hazardous substances from their generation to their disposal. The law requires the use of safe and secure procedures in treating, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent the creation of new, uncontrolled hazardous waste sites.

Secretary: the Secretary of the Agency of Natural Resources or his or her duly authorized representative.

Sensitive Receptors: Areas which may be affected by a release of a hazardous material. These may include public or private water supplies; surface waters; wetlands; sensitive ecological areas, outdoor and indoor air; and enclosed spaces such as basements, sewers, and utility corridors.

Site Management Activity Completed (SMAC) designation: Sites which the Waste Management Division (WMD) have determined require no further management are given a SMAC designation. The designation does not release the responsible party from any past or future liability which may arise from the contamination which originated at the site. The SMAC designation does mean that the Sites Management Section (SMS) isn't requiring any additional work be performed at the site in response to the initial contamination.

Sites Management Section: The Sites Management Section (SMS) is a section of the State of Vermont Agency of Natural Resources, Department of Environmental Conservation, Waste Management Division which provides state oversight for the investigation and cleanup of properties where a release of a hazardous material has contaminated the environment including soils, groundwater, surface water and indoor air. The primary authority for this oversight can be found in 10 V.S.A. Section 6615. The SMS manages a state Brownfields program (Redevelopment of Contaminated Properties) and provides support to the federal EPA Brownfields program. The SMS also participates with EPA on the management of sites listed on the national priorities list (Superfund).

http://www.anr.state.vt.us/dec/wastediv/SMS/sites_management_section.htm

Standard Operating Procedures (SOPs): A detailed set of instructions for performance of a specific, discrete task. It should identify the necessary equipment and provide step-by-step instructions for performance of a task. It needs to be written clearly and unambiguously so that the task described will be performed the same way regardless of who is performing the task. SOPs are commonly developed for many hazardous site investigation activities, including sample collection, decontamination, and field screening techniques. The Vermont Department of Environmental Conservation (VTDEC) Sites Management Section (SMS) does not publish or distribute SOPs for activities associated with hazardous site investigations and cleanups, but may from time to time review contractor SOPs and recommend or require modifications or revisions.

Underground Storage Tank (UST): UST means any one or combination of tanks including underground pipes connected to it or them, which is or has been used to contain an accumulation

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of regulated substances, and the volume of which, including the volume of the underground pipes connected to it or them, is 10 percent or more beneath the surface of the ground.

http://www.anr.state.vt.us/dec/wastediv/ust/ust_regs.htm

Waste Management Division: A Division within the Department of Environmental Conservation which oversees the use, treatment and handling of hazardous and solid wastes. The Division performs emergency response for hazardous materials spills, issues permits for federal and state programs regulating hazardous wastes, solid wastes, and underground storage tanks, and manages cleanup at hazardous sites under state and federal authorities, including the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response Compensation and Liability Act (CERCLA, also known as Superfund).

Appendix A

Waste Management Division
103 South Main Street/West Office
Waterbury, Vermont 05671-0404
(802) 241-3888, FAX (802) 241-3296

SITE INVESTIGATION EXPRESSWAY NOTIFICATION FORM

Site Owner:

Site Name, Town:

Yes, this site will participate in the Site Investigation Expressway Process.

No, this site will not participate in the Site Investigation Expressway Process.

If yes, please complete the checklist below:

T Contamination present in soils above action levels Yes No

If yes, summarize levels:

T Free product observed Yes No

T Groundwater contamination observed Yes No

T Surface water contamination observed Yes No

T Suspected release of hazardous substances Yes No

If yes, please explain:

T Affected receptors Yes No

If yes, please identify receptors including names and addresses of third party receptors:

Please provide an estimated date of when you expect to submit Site Investigation Report:

Owner's Signature/Date: _____ **Consultant's Signature/Date:**

Appendix B: GPS Data Specification

Hazardous Sites Location Accuracy Specification

Required submissions for site locations:

- GPS location coordinates – Latitude and longitude reported in degrees:minutes:seconds to the nearest one tenth of a second
- E911 Address for site, if available
- Location illustrated on a USGS topo quad map

GPS location coordinates – Hazardous waste site locations must be recorded using a GPS receiver within a <15 meter locational accuracy. This level of accuracy can be achieved using consumer, professional or survey quality GPS receivers as long as the proper techniques are employed to assure the accuracy.

- The GPS unit must have at least 12 receiver channels.
- The receiver must take at least a 5 minute fix at the location to be recorded.
- Each recorded location must be a 4 satellite 3-D fix.
- Circular error probability [CEP] is not to exceed 40 feet.
- Satellites constellations tracked shall be evenly distributed [i.e. overhead and at 45 degrees above the horizon]
- The location coordinate shall be collected under clear tracking conditions – no obstructions such as tree canopy, buildings, vehicles or large metal objects closer to the GPS user than 15 feet.
- The location coordinate shall be collected in the vicinity of the main structure at the site or, if no structure exists, in the vicinity where the release of hazardous substances has occurred.

Appendix C

Title 10: Conservation and Development

Chapter 159: WASTE MANAGEMENT

§ 6615b. Corrective action procedures

Any person who is determined to be liable for the release or threatened release of a hazardous material as established in section 6615 of this title shall take all of the following actions to mitigate the effects of the release:

- (1) Submit for approval by the secretary a work plan for an investigation of the contaminated site. This shall be submitted within thirty (30) days from either the date of the discharge or release or the date that the release was discovered if the date of the discharge or release is not known, or within a period of time established by an alternative schedule approved by the secretary. The site investigation shall define the nature, degree and extent of the contamination, and shall assess potential impacts on human health and the environment;
- (2) Perform the site investigation within ninety (90) days of receiving written approval of the work plan by the secretary, or within a period of time established by an alternative schedule approved by the secretary. A report detailing the findings of this work shall be sent to the secretary for review;
- (3) Submit a corrective action plan, within thirty (30) days from the date of final acceptance of the site investigation report by the secretary, or within a period of time established by an alternative schedule approved by the secretary;
- (4) Implement the corrective action plan within ninety (90) days upon approval of the plan by the secretary, or within a period of time established by an alternative schedule approved by the secretary. The corrective action activity shall be continued until the contamination is remediated to levels approved by the secretary. The secretary may allow for the remediation of a site contaminated with a hazardous material without requiring certification and permitting under sections 556, 6605 and 6606 of this title, provided such activity will not, in the secretary's opinion, adversely affect either public health and safety or the environment, and provided such activity is conducted in accordance with standards developed by the secretary; and
- (5) Submit to the secretary all investigative, corrective action and monitoring reports, including all analytical results related to subdivisions (3)-(5) of this subsection, as they become available. (Added 1997, No. 132 (Adj. Sess.), § 11, eff. April 23, 1998.)

Appendix D

Sources of Information

Statutes:

10 V.S.A. Title 10:

- Chapter 47 Water Pollution Control, Section 1283
- Chapter 59 Underground Liquid Storage Tanks, Sections 1926, 1941
- Chapter 159 Waste Management Sections 6615, 6615a, 6615b, 6616, 6617
- Chapter 48 Groundwater Protection

Regulations:

- Underground Storage Tank
- Hazardous Waste Management Regulations
- Solid Waste
- Groundwater Protection Rule and Strategy

Other Pertinent Sites Management Section (SMS) Guidance Documents:

- Underground Storage Tank Closure and Site Assessment Requirements
- Corrective Action Guidance
- Site Management Activity Completed Procedure
- Procedures for Reimbursement from the Petroleum Cleanup Fund
- Policies and Procedures Manual For Third-Party Claims Against the Petroleum Cleanup Fund
- Agency Guidelines for Petroleum Contaminated Soils and Debris
- Guidance for Construction of Public Works Projects in Areas Where Contamination is Suspected or Known