



Nebraska Department
of Environmental Quality

ENVIRONMENTAL GUIDANCE DOCUMENT

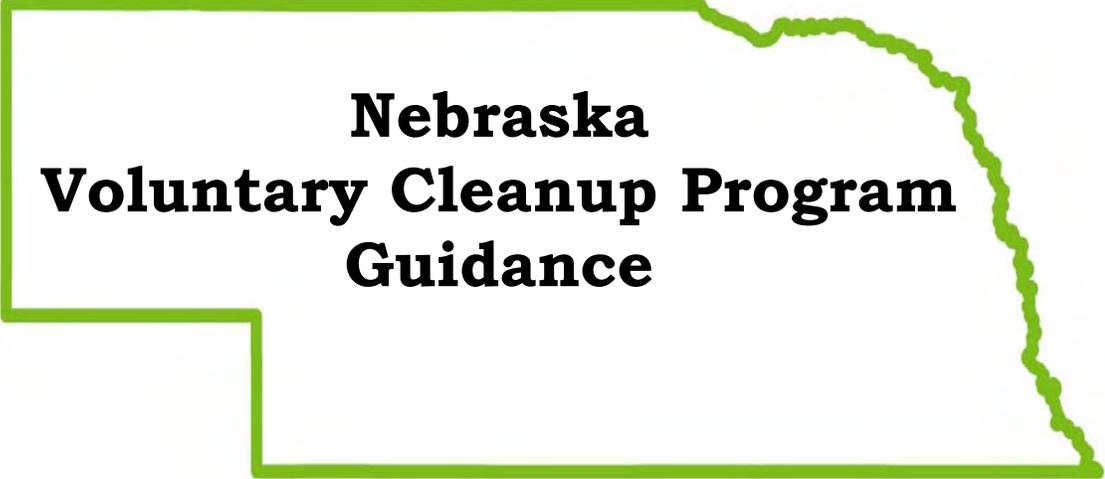
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NEBRASKA VOLUNTARY CLEANUP PROGRAM GUIDANCE

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**Nebraska
Voluntary Cleanup Program
Guidance**



August 2006

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Nebraska Voluntary Cleanup Program Guidance

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ABOUT THIS GUIDANCE

Welcome to the guidance document for Nebraska's Voluntary Cleanup Program (VCP). This document has been prepared by the Nebraska Department of Environmental Quality (NDEQ) to provide information and guidance for all persons and parties interested or actively involved in the VCP. It is written for two main audiences: prospective VCP applicants who want to know more about the program, and technical staff or consultants who are preparing documents for VCP applicants.

The first section – **Introduction to Nebraska's Voluntary Cleanup Program** – is written for prospective applicants. It provides general information about the VCP and specific information about how to apply. It also outlines the basic process that VCP applicants follow both before and after they are accepted into the program.

The next two sections are written for technical staff or consultants doing work for a VCP applicant. The **Remedial Action Plan Technical Guidance** is intended for use *prior* to entering the VCP. (One of the Attachments to the Remedial Action Plan Technical Guidance includes an important element of this guidance: The **Remediation Goal Lookup Tables**. These tables allow a consultant to quickly determine cleanup levels for a site based on the intended land use. They provide flexibility to the applicant while promoting high-quality, effective, and efficient cleanups that are protective of human health and the environment.) The **Remedial Action Report Technical Guidance** is intended for use *after* initiation of cleanup activities at a contaminated site. These sections describe the information that should be submitted and provide specific information about how to present it. In addition to the narrative, detailed and convenient checklists are included to assist with understanding all of the information that should be provided to NDEQ.

Finally, the **Appendices** and **Bibliography** at the back of the guidance provide examples of specific figures, tables, and other important documents and references to sources of technical information to make it easier for staff and consultants to collect, prepare, and submit the necessary information.

Carefully following the information and guidelines laid out in this document will increase the likelihood of successfully achieving cleanup within a reasonable timeframe and with minimal oversight costs.



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Section 1.0

**INTRODUCTION TO NEBRASKA'S
VOLUNTARY CLEANUP PROGRAM**



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SECTION 1.0 INTRODUCTION TO NEBRASKA'S VOLUNTARY CLEANUP PROGRAM

GENERAL INFORMATION

What Is The VCP?

The Nebraska Voluntary Cleanup Program (VCP) was established by the Remedial Action Plan Monitoring Act in 1995. It is a fee-based cleanup program for all entities interested in voluntarily cleaning up contaminated properties. Fees paid by the applicant (see Section 1.1) cover costs associated with the Nebraska Department of Environmental Quality (NDEQ) review, approval, and oversight of voluntary cleanup plans. The Nebraska VCP facilitates the redevelopment and reuse of brownfield sites. It utilizes a streamlined, results-based approach to environmental cleanup. It provides an alternative approach to more traditional federal cleanup programs such as the Superfund or RCRA programs. Finally, it provides state determinations of “no further action” upon successful completion of cleanup activities. These “no further action” determinations are important for those applicants seeking financing from a banking institution for redevelopment of the site following cleanup. The “no further action” determinations are also important to applicants who wish to join the program as an alternative to more traditional federal cleanup programs. In such a case, eligible response sites are provided protection from federal enforcement in EPA-approved state VCPs upon successful completion of voluntary cleanup activities.

The VCP is intended for property owners, potential property buyers, facility owners, local governments, and other interested parties who want to use this approach to voluntarily clean up contaminated properties while **maintaining compliance with all applicable State and Federal environmental regulations.**

What Are The Goals Of The VCP?

The primary goals of the VCP are to (1) protect human health and the environment, (2) return contaminated properties to productive use, (3) provide a streamlined, results-based approach to environmental cleanup, and (4) provide an alternative approach to traditional cleanup programs. An applicant achieves these goals by conducting a thorough environmental investigation and developing a conceptual site model. Then, based on the investigation, conceptual site model, and the intended land use of the site, applicants and their consultants work together to develop appropriate remedial actions. The outcomes of these actions should eliminate human exposure to contamination, mitigate adverse impacts to the environment, and prepare the site for redevelopment and reuse. (The Department recognizes that Goal 2 above may not apply to some sites where future land use is consistent with current land use and the applicant is only interested in joining the VCP as an alternative to traditional cleanup programs.)

What Are The Benefits of the VCP?

Participants who have completed remedial actions, paid all applicable fees, and met the provisions and objectives agreed to with NDEQ will have successfully completed the program. These participants will receive three desirable benefits:

- Determination by NDEQ that no further remedial action is required at the site
- Redevelopment and productive reuse of the property
- Protection to eligible response sites from federal enforcement in EPA-approved state VCPs upon successful completion of voluntary cleanup activities





How Is the VCP Different Than Traditional Cleanup Programs?

Traditionally, environmental investigations and remedial actions were often required to follow a regimented, step-by-step process that required extensive regulatory oversight. Cleaning up and returning a contaminated property to productive use often took many years. Nebraska's VCP, however, is designed to work as quickly and simply as possible. Applicants are encouraged to use a streamlined, results-based approach tailored to accomplish site-specific goals. NDEQ has developed user-friendly tables (see Attachment 2-6) that allow a consultant to quickly determine cleanup levels for a site based on its intended land use. By using these lookup tables and following this guidance carefully, the administrative procedures normally associated with environmental investigations and remedial actions can be reduced, and VCP applicants can complete remedial actions cost effectively. VCP applicants can:

- Control investigation and cleanup costs by choosing an appropriate environmental consultant
- Combine investigation and remediation activities when possible, while maintaining strict compliance with all applicable regulations
- Propose remedial actions that are appropriate for future land use (or current land use, if land use will not change) based on cleanup levels from the VCP lookup tables
- Maintain control over remediation activities
- Receive technical and regulatory assistance from NDEQ

Since the VCP is designed to be more flexible than traditional cleanup programs, a greater responsibility is placed on the applicant and consultant to **collect and submit correct and complete information to NDEQ**.

How Is The VCP Similar To Traditional Cleanup Programs?

While the Nebraska VCP is different in certain respects from traditional cleanup programs, it is similar to traditional cleanup programs in the following areas:

- Cleanup decisions are protective of human health and the environment
- A complete and thorough investigation is necessary
- All activities must be in compliance with all applicable state and federal laws and regulations
- Risk-based cleanup goals are within the acceptable risk range of federal cleanup programs

What Is The Streamlined, Result-Based Approach?

Nebraska's VCP is a streamlined, results-based approach to environmental cleanup. This approach minimizes the number of steps in the regulatory review process and involves setting goals to focus on achieving specific outcomes, or results, as a means of cleaning up contaminated sites. It provides VCP applicants with the latitude to determine how to achieve these goals.



One example of the streamlined, results-based approach is the responsibility of VCP applicants to perform a complete and thorough investigation prior to joining the VCP. As a result, NDEQ will not be involved in the review and approval of any investigation work plans that would typically be submitted as part of the process for more traditional cleanup programs. Another example of the streamlined, results-based approach is the integration of the investigation and cleanup steps that are typically separate parts of the process in more traditional cleanup programs. This approach also bases cleanup decisions on risk assessment, future land use, and ground water use. The approach encourages the use of presumptive remedies and innovative cleanup technologies. Finally, the approach includes the use of performance-based cleanups where submittal of detailed engineering design plans are no longer necessary and focus is placed on ensuring that an adequate performance monitoring plan is submitted to demonstrate how the cleanup goals for the site will be achieved.

Although the VCP program utilizes a streamlined, results-based approach, this does not mean that the remedial actions are less protective. All investigation and cleanup work must conform to federal and state environmental laws and regulations. NDEQ believes that the streamlined, results-based approach is important because it helps applicants complete their project in a timely manner and it makes best use of limited government resources.

1.1 PROCESS OVERVIEW

The flowchart in Attachment 1-1 outlines the streamlined process that applicants should follow as they progress through the VCP. This process is designed to eliminate the multi-stage review process that occurs when individual workplans and reports are submitted at each stage of an investigation and cleanup. The Remedial Action Plan (RAP), for example, is a single, comprehensive document that describes all stages of an investigation as well as the plans for cleaning up the site. RAPs conforming to this guidance will facilitate and expedite NDEQ review and approval.

The first step taken by an applicant should be to complete an investigation to define the full nature and extent of contamination at the contaminated site. Should interim remedial actions be necessary to address an imminent threat to human health or the environment, the applicant can complete these actions before proceeding to the application stage.

VCP applicants are expected to have completed an investigation to define the full nature and extent of contamination *prior to submission of the application.*

A complete application package includes an application form, a non-refundable \$5,000 application fee, a refundable \$5,000 initial deposit, and a signed written agreement. The application form (see Attachment 1-2) asks the applicant to identify critical information such as the site's point of contact, the type of contamination present at the site, land use and operational history, and future use of the site.

An application consists of:

1. A completed **application form** (see Attachment 1-2)
2. A nonrefundable **\$5,000** application fee
3. A refundable **\$5,000** initial deposit
4. A **written agreement** signed by the applicant (see Attachment 1-3)

The written agreement (see Attachment 1-3), once signed by both parties, establishes that the applicant will reimburse NDEQ for the costs of all review, oversight, and guidance. This written agreement is based on language within the Remedial Action Plan Monitoring Act (RAPMA). Because the written agreement is based on state statute, flexibility within the agreement is limited. It also establishes that the applicant submit the refundable \$5,000 initial deposit with the written agreement, prior to any technical reviews by NDEQ. If oversight costs exceed the \$5,000



initial deposit, additional fees will be required over the course of VCP participation. NDEQ typically issues invoices for additional oversight costs on a quarterly basis. However, invoicing frequency may be adjusted to address site-specific issues. Also, NDEQ may consider providing quarterly invoices reflecting the remaining balance of the initial deposit on a case-by-case basis. More complex or resource-intensive projects may require establishment of a pre-payment plan.

The complete application package must be submitted to the following address:

**VCP Coordinator
Nebraska Department of Environmental Quality
Suite 400, The Atrium
1200 "N" St.
P.O. Box 98922
Lincoln, NE 68509-8922
(402) 471-6411**

The application will be reviewed by NDEQ to determine if all requested information has been provided. Incomplete applications will be returned to the applicant for revision. The applicant has sixty (60) days to resubmit the application or the application will be denied. If an application is determined to be complete and acceptable, NDEQ will approve the application, making the applicant and site valid participants in the VCP.

After an application has been approved by NDEQ, the applicant will have 90 days to submit the first technical document: the Remedial Action Plan (RAP; see Section 2.0). A RAP consists of an Investigation Report (IR), which presents a conceptual site model based on a thorough investigation, and a Remedial Action Work Plan (RAWP), which outlines the plan for cleaning up the site.

NDEQ will then conduct a technical review of the RAP. While NDEQ will review the RAP in as timely a manner as possible, the actual review time will be dependent on factors such as NDEQ staffing levels, work load, size and complexity of the site, future land use, and quality of the documents submitted. If there are any outstanding issues identified by the technical review, the applicant will be asked to submit a complete, revised plan. NDEQ may require the applicant to submit a work plan for additional investigation.

Upon receipt of an approvable RAP, NDEQ will public notice its intent to approve the plan (see Attachment 1-4). An administrative record will be prepared by NDEQ containing all the information forming the basis for preliminary approval of the plan. The administrative record will be located in a local repository in the geographical area of the site. During the thirty (30) day public comment period, any person may submit written comments or request a hearing. (Sites subject to RCRA permitting and corrective action requirements that are using the VCP as an alternate cleanup program may require a 60-day public comment period.) Following the thirty (30) day public comment period, and any public hearing, if appropriate, final approval of the plan will be given and clean up of the site may begin. Initiation of cleanup must begin within six (6) months and be completed within twenty-four (24) months, excluding long-term operation, maintenance, and monitoring. NDEQ will monitor the implementation of remedial actions and provide guidance as necessary.

Within sixty (60) days of completion of remedial actions, the applicant will prepare the second technical document: the Remedial Action Report (RAR; see Section 3.0). The purpose of the RAR is to document the remedial actions and to demonstrate to NDEQ and the public that the site is cleaned up as proposed in the approved RAP. NDEQ will then review this document. In those instances where the outcome of



remedial activities is unsatisfactory, NDEQ will inform the applicant and indicate the actions necessary to achieve the desired outcome. If the cleanup is satisfactory, NDEQ will prepare a No Further Action (NFA) letter to declare that no further action is necessary, and the property is ready for redevelopment and reuse.

Typical oversight costs associated with NDEQ review of a VCP site may range between \$3,000 and \$75,000, depending on the complexities of a site. An applicant may be able to offset some oversight costs with EPA Subtitle A funding.

1.2 ELIGIBILITY

RAPMA establishes that any entity may voluntarily apply for NDEQ monitoring of remedial actions for land or water pollution through the VCP. Additionally, certain sites may be eligible for protection from federal enforcement under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund. Exclusions from this federal enforcement bar eligibility include:

Some property owners are already eligible for protection from federal enforcement under the **Small Business Liability Relief and Brownfields Revitalization Act**. These owners include: *bona fide prospective purchasers, innocent landowners, and contiguous property owners.*

1. Sites that are subject to a planned or ongoing CERCLA removal action
2. Sites that are listed or proposed for listing on the National Priorities List
3. Sites that are subject to a unilateral administrative order, court order, administrative order on consent, or consent decree under CERCLA
4. Sites that are subject to a unilateral administrative order, court order, administrative order on consent, consent decree, or permit under the Resource Conservation and Recovery Act (RCRA), Clean Water Act (CWA), Toxic Substances Control Act (TSCA), or Safe Drinking Water Act (SDWA)
5. Sites that are subject to corrective action under RCRA 3004(u) or 3008(h) to which a corrective action permit or order has been issued or modified requiring the implementation of corrective measures
6. Land disposal units with closure notification submitted and closure plan or permit
7. Sites that are subject to the jurisdiction, custody, or control of the federal government
8. Sites with polychlorinated biphenyl (PCB) contamination subject to remediation under TSCA
9. Sites which have received assistance from the Leaking Underground Storage Tank Program for a response activity

Although the types of sites listed above are specifically excluded from CERCLA enforcement protection, individual sites listed under bullets 1, 4, 5, 6, 8, and 9 may be afforded CERCLA enforcement protection on a case-by-case determination if it can be shown that participation in the VCP will:



1. Protect human health and the environment, **and**
2. Either:
 - Promote economic development, or
 - Enable the creation of, preservation of, or addition to parks, greenways, undeveloped property, other recreational property, or other property used for nonprofit purposes

1.3 PETROLEUM SITE ELIGIBILITY

RAPMA establishes that any entity may voluntarily apply for NDEQ monitoring of remedial actions for land or water pollution through the VCP. This includes petroleum sites that are low risk sites for which the current property owner is not the responsible party and for which a viable and liable responsible party does not exist. However, in most cases, petroleum contaminated sites will be managed by the NDEQ Petroleum Remediation (PR) Section, for the following reasons:

- The NDEQ PR Section has technical expertise in working with petroleum releases.
- The NDEQ PR Section has an established, functioning, risk-based corrective action program that may have less stringent screening or cleanup levels than those remediation goals established for the Nebraska VCP.
- Funding for many petroleum release investigations and cleanups may be available through the PR Section Title 200 reimbursement fund and federal LUST Trust Fund.
- The property owner will not incur oversight cost fees for work through the PR Section.

1.4 ADDRESSING MULTIPLE SITES

In some cases, a prospective applicant may want to enter multiple sites into the VCP. For example, an owner of a chain of dry cleaners may want to voluntarily clean up several sites in different locations. In such cases, the applicant must submit individual VCP applications, Written Agreements, fees, Remedial Action Plans, and Remedial Action Reports for each site and will receive separate No Further Action letters for each site.

1.5 PARCELING AND CONSOLIDATING PROPERTIES

In some cases, an investigation and cleanup may be more practical if one large property can be addressed in pieces. This practice is referred to as parceling. For example, if your prospective VCP project site is a large industrial complex that consists of manufacturing and shipping facilities as well as a large green space that has never been used for any manufacturing, you may choose to divide the site into parcels. The advantage of dividing the project into parcels is that the green space can usually be investigated more quickly and, if the investigation confirms that the parcel does not require any remediation, the green space can be developed very quickly. Parceling also allows a large, complex VCP project to be divided into phases. If a VCP applicant decides to divide a project into parcels, the applicant must submit individual VCP applications, Written Agreements, fees, Remedial Action Plans and Remedial Action Reports for each parcel and will receive a separate No Further Action letter from NDEQ for each parcel.



In other cases, an investigation and cleanup will be more practical if several contiguous properties are consolidated into one project. This practice is referred to as consolidating. For example, your prospective VCP project may encompass several real properties that include a former salvage yard, former landfill, fertilizer plant, and shipping terminal. One of the advantages to consolidating several real properties into one project is that you pay only one set of fees and submit one VCP application, Written Agreement, Remedial Action Plan, and Remedial Action Report for the entire project. Upon completion of the project, you will then receive one No Further Action letter for the entire project.

Consolidating multiple real properties into one VCP project is only allowed if the properties are contiguous. If one or more of the properties are not contiguous, that property(ies) must be addressed as a separate VCP project.

It is up to each VCP applicant to determine whether one of these approaches is practical for their project. Factors that tend to influence the approach to a project include financing and project completion timeframes.

It is important to note that because the number of VCP applications, Written Agreements, and fees are based on whether a project is divided into parcels or consolidated into one project, each applicant must decide before submitting their application whether to divide the project into parcels or consolidate multiple real properties into one project. Both the VCP application and the Written Agreement must include the geographic extent of the subject property.

If the RAP for the subject property does not address the entire property, as specified in both the VCP application and Written Agreement, the RAP will be considered incomplete and it will be returned to the applicant. If NDEQ returns the RAP because it does not address the entire subject property, the applicant must revise and resubmit the RAP.

Issues regarding parceling and consolidating properties will be handled on a case-by-case basis. Such issues may include the cleanup of only certain contaminants (as opposed to all contaminants discovered) where different sources exist or issuing NFA letters for addressing different environmental media (i.e., soils vs. groundwater). Each applicant should contact NDEQ to discuss how the application should be prepared.

1.6 ENFORCEABILITY & TERMINATION

As set forth in the Remedial Action Plan Monitoring Act (RAPMA; see Attachment 1-5), voluntary remedial action plans approved by NDEQ are enforceable if NDEQ demonstrates that the applicant has failed to fully implement the approved plan. NDEQ may require additional actions if other state statutes administered by the agency authorize such actions.

NDEQ may terminate (in writing and with explanation) a voluntary remedial action plan if the applicant:

- Violates any terms or conditions of the plan or fails to fulfill any obligations of the plan (including submission of an acceptable plan within a reasonable period of time)



- Fails to address an immediate and significant risk to public health and the environment in a timely and effective manner
- Fails to initiate the plan within six months after NDEQ approval or to complete the plan within 24 months after NDEQ approval, excluding long-term operation, maintenance, and monitoring (unless NDEQ grants an extension)

Under RAPMA, an applicant may unilaterally terminate a voluntary remedial action plan approved by NDEQ prior to completion of investigative and remedial activities if the applicant leaves the property in no worse condition, from a human health and environment perspective, than when they initiated voluntary remedial actions and NDEQ is reimbursed for all outstanding costs.

1.7 GENERAL COMMENTS ON VCP GUIDANCE

Please note that the specific guidance contained herein under Sections 2.0 and 3.0 has been written for a “typical” facility or property where both soil and groundwater contamination exists. It is possible that some of the information requested within the guidance may not apply to a specific site. Where requested information does not apply, it is not necessary to collect this information. However, if such information is not collected, it should be noted in the appropriate report provided to NDEQ why the information was not collected. It is the responsibility of each applicant to determine which parts of the guidance are applicable and which parts are not.

NDEQ would also like to clarify that the level of effort for conducting a complete investigation is not based on future land use. That is, even if the site land use was, and will remain as commercial or industrial use, **the extent of contamination must still be defined to the most conservative (i.e., residential) remediation goals** (as documented in the Remediation Goals Lookup Tables found in Attachment 2-6).

The intent of the VCP guidance is to provide a process or “framework” for conducting a site investigation. Sites will vary considerably in respect to property size, historical uses, extent and degree of contamination, geology, etc. Therefore, the guidance cannot provide specific details or particulars on such investigative concerns as the number and location of analytical samples, specific sampling and analysis methods, determination of appropriate chemicals of concern, etc. Such determinations will need to be made by the applicant and their contractor based on their professional judgment.

A primary focus of the Nebraska VCP is to provide an applicant with options in determining remedial action objectives and remediation goals that are appropriate for their site. Towards that end, the NDEQ has developed a protocol that utilizes a three-tiered approach to establish or select specific remediation goals for a site. This tiered approach is presented in a separate guidance document, *Protocol for VCP Remediation Goals Lookup Tables*, Section 3.0. The NDEQ recommends that applicants familiarize themselves with this protocol prior to preparing the Remedial Action Work Plan.

Lastly, NDEQ wishes to note that the information requested within this guidance document is presented as **guidance**, and are not requirements promulgated under state statute or regulation. As such, the applicant is not required to strictly follow the framework provided in the guidance. However, the applicant’s project will progress more quickly if the guidance is followed. Following the guidance, as well as complying with all federal and state regulations, will provide protection to eligible response sites from federal enforcement in EPA-approved state VCPs upon successful completion of voluntary cleanup activities.



Section 2.0

**REMEDIAL ACTION PLAN
TECHNICAL GUIDANCE**



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SECTION 2.0 REMEDIAL ACTION PLAN TECHNICAL GUIDANCE

INTRODUCTION

After NDEQ approves an application, the applicant must submit a Remedial Action Plan (RAP) within ninety (90) days. The RAP consists of two main elements:

- An Investigation Report (IR)
- A Remedial Action Work Plan (RAWP)

The IR contains fundamental information – what is known about the site, where the contamination is located, who is or could potentially be affected by the contamination – and presents a conceptual site model based on this information. The RAWP contains the cleanup plan for the site. It presents the remedial action objectives, describes how, when, and to what degree the site will be cleaned up, and explains why the proposed remedy has been chosen.

There are several ways in which this section of the technical guidance is designed to help environmental consultants prepare a complete and thorough RAP:

- 1) The **narrative** of the guidance describes how to collect information and present it in the RAP. The narrative also provides some discussion of the relationships among the collected data. Example figures and tables are provided in Appendix A to further illustrate how to present information in the RAP.

The intent of the VCP guidance is to provide a process or “framework” for conducting a site investigation. Sites will vary considerably in respect to property size, historical uses, extent and degree of contamination, geology, etc. Therefore, the guidance cannot provide specific details or particulars on such investigative concerns as the number and location of analytical samples, specific sampling and analysis methods, determination of appropriate chemicals of concern (COCs), etc. Such determinations will need to be made by the applicant and their contractor based on their professional judgment.

- 2) The **checklist** within this guidance (Attachment 2-1) outlines the information that should be collected and where it can be found. Although it is impossible to provide an exhaustive list of every piece of information that may appear in a RAP, the checklist does provide a *detailed* list of the common pieces of information and potential sources of this information. For a more extensive list of information sources, a bibliography has been provided at the end of the guidance. To expedite NDEQ review of the RAP, the checklist should be completed and submitted along with the RAP.
- 3) The investigation process **flowchart** (Attachment 2-2) illustrates the relationship among the various pieces of information and depicts the overall investigative sequence.

In general, the outline of the RAP should parallel the organization of the technical guidance. However, the guidance is intended to provide sufficient flexibility to accommodate different types of VCP sites. Some elements of this guidance may apply to your site, and others may not. For example, this guidance describes how you should summarize previously reported investigations at your site in the IR. If no previous investigations (other than the VCP investigation) exist for your site, you will not have such a



summary in your report. It is the responsibility of each applicant to determine which parts of the guidance are applicable and which parts are not.

2.1 EXECUTIVE SUMMARY

The first part of the RAP should be an executive summary that presents an overview of the entire plan. The executive summary should be clear and concise, yet contain enough information to give the reviewer a basic understanding of the site, the nature and extent of contamination, potential receptors, and the proposed remedial action. It should include all of the following elements:

- Summary and conclusions of the completed investigation
- A list of potential receptors
- A conceptual site model
- A description of any interim remedial actions completed before entering the VCP
- Future land use plans
- The remedial action objectives (RAOs), including the proposed remediation goals from the Remediation Goals Lookup Tables
- A description of the proposed remedial action and how it meets the five remedy evaluation criteria and the RAOs developed for the site
- Any other site-specific issues that should be considered during completion of remedial actions

Generally, no more than 4-5 pages are recommended. However, the length of the Executive Summary depends on the number and complexity of issues at the site. See the checklist in Attachment 2-1 for additional details about creating an Executive Summary.

2.2 INVESTIGATION REPORT

VCP applicants should complete a comprehensive, scientifically valid investigation *before* submitting an application. The methods and findings of this investigation should be presented in the **Investigation Report (IR)**. The IR should present background information, describe how this information was used to devise a thorough field investigation, and describe the nature and extent of contamination at the site. It should present information regarding the fate and transport of the chemicals found at the site and potential receptors that may be impacted by the contamination. Finally, the IR should present a conceptual site model based on this information. The information presented in the IR will be the basis for your selection of remedial actions. Thus, having a technically sound and complete report will facilitate and expedite NDEQ's review of the feasibility and adequacy of the selected remedial action.

The IR should contain the information outlined in the checklist (see Attachment 2-1) and should be organized according to the sequence in this guidance (Sections 2.2.1 – 2.2.8). All maps, figures, tables, and graphs should be included in appendices to the RAP. While conducting the investigation, you should



use the investigation process flowchart (Attachment 2-2) to visualize how the various pieces of information fit within the overall investigative sequence.

NDEQ would also like to clarify that the level of effort for conducting a complete investigation is not based on future land use. That is, even if the site land use was, and will remain as commercial or industrial use, ***the extent of contamination must still be defined to the most conservative (i.e., residential) remediation goals*** (as documented in the Remediation Goals Lookup Tables found in Attachment 2-6).

Because sites differ in regard to setting, conditions, and contamination, IRs will vary from site to site. The checklist of information should be used and adapted to appropriately address each site, but regardless of the specific site characteristics, all IRs will share some common elements:

- A discussion of background information, including physical setting and operational history, and identification of data gaps based on review of this information
- Details of the methods, objectives, and procedures of the field investigation
- Physical characteristics of the site based on the field investigation, including site-specific hydrology, geology, and hydrogeology
- Nature and extent of contamination in impacted media and locations of contaminant sources based on the results of the field investigation
- Discussion of contaminant fate and transport based on site conditions and chemical characteristics of contaminants
- Identification of potential human and ecological receptors, including a well survey and land use survey of the site and surrounding area
- Presentation of a conceptual site model based on the investigation results, potential receptors, and the intended land use of the site
- Summary and conclusions of the investigation

The IR should provide enough information to justify the proposed remedial action presented in the Remedial Action Work Plan (RAWP) (see Section 2.3). All conclusions of the investigation should be supported by scientifically valid, defensible data. All results, whether positive or negative, should be included. For example, if samples of groundwater were taken, the IR should show the results of these samples whether or not they indicated contamination. If information from previous investigations is used to support the conclusions of the investigation, this data should be cited in the body of the report, and copies of the source documents should be provided in the appendices. Data tables should include both compiled historical data and data collected during the field investigation.

For sites that include multiple contiguous properties, a comprehensive, integrated IR may be submitted.

2.2.1 Compilation and Analysis of Background Information

The compilation and analysis of background information is an essential part of a successful investigation. By researching a site's physical setting, operational history, and previous environmental investigations, an investigator can identify data gaps – those pieces of information that are unknown, but necessary in order



to fully characterize the site. These data gaps can then be addressed by conducting a field investigation. The information from the background study and field investigation can be integrated to define the full nature and extent of contamination.

The search for information about the site's physical setting, historical operations, and current use need not be exhaustive, but should be comprehensive. In other words, if multiple sources of information are available about an aspect of the site, but one or two of these sources are sufficient to adequately describe it, the remaining sources need not be included in the report. However, if information about a particular aspect of the site is unavailable, the IR should clearly indicate that all available sources were reviewed.

The RAP checklist (Attachment 2-1) provides a list of sources for documents such as aerial photographs and topographic maps that can be used to collect background information. The bibliography (Appendix C) contains additional resources.

2.2.1.1 Site Information

Since the RAP is intended to be a stand-alone document, basic information about the site and its owners/operators should be provided (even though this information is also requested on the application form). The site name should be provided and the site location should be described and illustrated on a U.S. Geological Survey 7.5-minute quadrangle. This section should also include contact information for the owner of the site and the environmental contractors or consultants hired to prepare the RAP.

Finally, documentation should be included that indicates that the applicant holds or can acquire title to all lands, or has the necessary easements and rights-of-way required for the investigation and remedial process. See the checklist in Attachment 2-1 for additional details about what to include regarding site information.

2.2.1.2 Physical Setting

This section of the IR should present information about the physical setting of the site at local as well as regional scales. Detailed descriptions of the surface features, climate, vegetation, hydrology, soils, geology, and hydrogeology of the site and the surrounding area should be included. The following discussions briefly outline the types of information that should be submitted. For a more detailed listing of information, refer to the checklist in Attachment 2-1.

Surface Features

Both natural and manmade surface features should be described. A detailed site layout map showing these features should be provided. Ideally, this map will serve as a base map for other maps throughout the rest of the report. Site grids should be based on latitude/longitude, and coordinates should be referenced to the State Plane coordinate system NAD 83. See the RAP checklist in Attachment 2-1 for more information about preparing a site layout map.

Climate and Meteorology

Climatic descriptions should include information about the average annual rainfall, temperature, wind velocity, wind direction and daily variances in these parameters. If available, figures such as wind roses and precipitation or temperature graphs should be included.



Vegetation

Descriptions of vegetative cover should address the type and density of plant cover, with an emphasis on identifying sensitive environments (e.g., wetlands, vineyards, gardens), both locally and regionally.

Topography and Hydrology

This section should provide information about surface water flow, flood frequency, drainage direction, and topography. Wetlands, floodplains, and other hydrologic features should be described and indicated on a map.

Soils and Geology

This section should include general descriptions and maps of soil units found at the site. This information can be obtained from a U.S. Department of Agriculture Soil Survey or other source.

Descriptions of regional geology should include geologic formations, lithology, unconformities, and structural features such as faults and joints. Any available geologic cross-sections and maps should be referred to in this section. Local geology should address geologic heterogeneity and complex stratigraphy. Features that might act as preferential pathways, such as coarse-grained channels or horizons, solution cavities, and/or features that may impede the downward movement of contaminants, such as paleosols or clay-rich horizons, should be emphasized.

Hydrogeology

Descriptions of regional hydrogeology should include information about the estimated depth to groundwater, estimated depth to bedrock, and groundwater flow direction and rate. Local hydrogeologic considerations should include describing the locations of springs or seeps, perched aquifers, or large-volume extraction wells nearby. Report the thickness of the primary aquifer, the orientation and general depth of the water table, and refer to any available maps for the area that show these characteristics.

2.2.1.3 Historical Operations and Site Conditions

This section should describe the results of a comprehensive review of the site's industrial or commercial history. It is important to conduct a thorough review of this information because it will be used to help focus your investigative efforts. Special emphasis should be given to potential contaminant sources throughout the site's history, as this information will be used to define the list of sampling parameters for the field investigation. This section should include detailed information regarding the following:

- A list of the previous owners and ownership dates
- Any alternative or historical facility names
- A discussion of the historical use of the site, previous business operations, and periods of operation
- Possible contaminant sources
- Information regarding historical non-hazardous wastes generated, received, disposed of, or managed at the site



- Types, quantities, management practices, and rates of hazardous wastes historically generated, received, disposed of, or managed at the site
- Historical aerial photographs
- Processing or storage locations
- A chronology and description of known or suspected environmental incidents, spills, or releases of hazardous substances or pollutants

The checklist in Attachment 2-1 contains detailed information about each of the topics listed above, including suggested sources of the information.

2.2.1.4 Current Operations and Site Conditions

This section should present the business operations and conditions under the current owner or operator. The description should emphasize possible contaminant sources currently associated with the facility. In addition to the sources listed in the checklist, interviews with the site owner, administrator, or former employees can reveal useful information. This section should include the following information:

- Discussion and illustration of site use and current business operations, including all readily available aerial photographs, topographic maps, or city directories
- Potential sources of contamination
- Types, quantities, management practices, and rates of hazardous constituents currently generated, received, disposed of, or managed at the site
- Known or suspected releases of hazardous constituents
- Location, number, type, size, age, and condition of all above and below ground product or waste storage, transfer, and/or disposal vessels/tanks and systems
- Descriptions of existing institutional controls
- List of current environmental permits
- Descriptions of interim remedial actions
- Descriptions of any ongoing investigations, remediation, or monitoring activities
- A list of search results indicating whether the site or property adjacent to the site appears on federal or state environmental databases
- Results of interview with site owner, administrator, or former employees

The checklist in Attachment 2-1 contains additional information about what to submit.



2.2.1.5 Previously Reported Investigations

Previously reported investigations should be summarized, evaluated for data quality, and attached to the RAP. Examples of previous investigations may include Superfund preliminary assessments/site investigations, RCRA facility investigations, Title 118 investigations, and Phase I or II environmental site assessments. Existing information in such reports can be used to streamline the investigation by focusing the investigative efforts or eliminating some data collection efforts altogether. To determine whether previously reported data should be used in your investigation, you are encouraged to summarize these reports and thoroughly evaluate the data quality and temporal variability of data in each.

Summary of Previous Reports

Information from previously reported investigations of the site should be summarized in the narrative of this section. Data from the reports should be tabulated, and the original reports should be included in an appendix. The narrative of this section should refer to the location of these tables and reports. This summary section should include the following:

- Narrative summary of previous reports in chronological order
- Copies of any relevant correspondence from NDEQ, Environmental Protection Agency (EPA), private entities (such as consulting firms), or other federal and state agencies regarding previous environmental reports
- Summary of findings, conclusions, and recommendations of previously reported investigations

Data Quality and Temporal Variability

The investigation report should include an evaluation of the quality and temporal variability of data from each of the previous reports. To minimize the labor and time spent on this task, use best professional judgment to determine the level of effort required for each type of data.

The evaluation of data quality should include a review of the Quality Assurance/Quality Control (QA/QC) standards and procedures, sample collection records, and laboratory method detection limits of the previous reports to ensure that they are adequate for the intended use of the data. The QA/QC sample results should be reviewed to determine whether any data quality problems exist. To define data quality expectations for technical defensibility, please refer to the quality assurance documents (such as EPA Requirements for Quality Assurance Project Plans [QAPP] [EPA QA/R-5]) listed in the bibliography. Field data sheets and chain-of-custody records should be reviewed to determine whether proper procedures were followed and whether the holding times for any of the sampling parameters were exceeded. It will be especially important to determine whether the laboratory method detection limits used in any of the previous reports were below the *current* maximum contaminant levels (MCLs) commonly used as groundwater cleanup standards. If the detection limits were higher than current MCLs, the previously collected data may not be appropriate to determine the lateral and vertical extent of contamination at or below the level of the MCLs. For example, if a previous report indicates that the method detection limit for trichloroethene (TCE) was 20 micrograms per liter ($\mu\text{g}/\text{l}$) instead of 5 $\mu\text{g}/\text{l}$ (the current MCL for TCE), it will not be appropriate to use this data to define the extent of a TCE plume to the level of the MCL.

You should also determine the temporal variability of the previously collected data. Temporal data is data that may change significantly over relatively short time periods, such as between separate field



investigations. Examples of such data include chemical data used to define the extent of a groundwater plume and water level data from monitoring wells. An example of data that is not temporal is data from geotechnical boring logs used to define physical lithologic characteristics. If temporal data presented in previous reports is likely to be outdated, you may need to collect additional data.

Finally, this portion of the IR should include a map that depicts site features and all previous sampling locations, and a table of the sampling results from each location. Briefly discuss these maps and tables in the narrative and refer to their locations in the report.

2.2.1.6 Potential Chemicals of Concern

A list of potential chemicals of concern should be identified based on a review of previous investigations, historical operations, and facility documents. This list will aid in identifying data gaps and selecting analytical parameters. It is important to note that the list of potential chemicals of concern should be based on all materials used on-site, not simply on a list of the wastes processed or disposed on-site.

The following narrative is an example description of potential chemicals of concern based on a hypothetical site that was previously operated as a metal salvage facility.

“The transformers received on-site may have contained PCBs, so PCBs were included as a potential chemical of concern. The facility had underground tanks for storage of gasoline and diesel fuel, so benzene, ethyl benzene, toluene, total xylenes, and MTBE were identified as potential chemicals of concern. The facility received demilitarized munitions, so black powder, TNT, and RDX were identified as potential chemicals of concern. The pile of lead acid batteries may have been a source of sulfuric acid, lead and other metals, so soil and groundwater were analyzed for pH, sulfate, and metals. Motor vehicle air conditioners may have been a source of CFCs, so soil and groundwater were analyzed for CFCs.”

2.2.1.7 Data Gaps

This section should summarize the significant data gaps and/or deficiencies found based on review of all existing historical data and previous investigations. Data gaps are key unknown conditions or unresolved issues that are needed to characterize the site or solve the problem being investigated. For example, if there was a coal gasification plant formerly on the property, but none of the previous field activities examined coal gasification related waste, this is a data gap. Another example of a data gap is an area or subsurface interval in which there is a lack of data points regarding contaminant concentrations. This is a data gap because without that information, you cannot fully define the horizontal and vertical extent of contamination.

Data gaps should be summarized in bulleted lists under one or more of the following categories:

- Physical site characteristics
- Nature and extent of contamination
- Contaminant fate and transport
- Potential receptors

See the checklist in Attachment 2-1 for more information regarding data gaps.



2.2.2 Field Investigation

This section of the IR should describe how a scientific field investigation to fill data gaps and define the nature and extent of contamination at the site was planned and conducted. The following aspects of the investigation should be described in this section:

- Investigation objectives
- Data quality objectives
- Sampling and analysis procedures
- Health and safety
- Investigation-derived waste management

2.2.2.1 Investigation Objectives

This section should state the objectives of the field investigation. Investigation objectives are statements that clearly identify the major inputs needed to fill data gaps, answer key questions, and support further decisions about the investigation and cleanup of the site. Examples of investigation objectives include:

- Determine whether contamination exists at the site;
- Identify the source areas of contamination;
- Determine the magnitude and lateral and vertical extent of contamination (e.g., groundwater contamination should be defined to the MCLs and soil contamination defined to the most conservative residential soil remediation goals [found in the Remediation Goals Lookup Tables]), and;
- Determine whether any potential human or ecological receptors are being exposed to contamination.

For some sites, this information may already be known. For example, based on a previous Phase I environmental site assessment, it may already be known that both the soil and the groundwater are contaminated. Therefore, the investigation objectives might be more specific, such as:

- Define the extent and magnitude of soil and groundwater contamination, or;
- Determine whether nearby private drinking water supply wells are contaminated.

Briefly state the basis for each investigation objective in this section. The rationale should be based upon the compilation and analysis of background information. For example:

“Historical operations indicate that Building A was used to wash machine parts with industrial solvents, including PCE. Interviews with employees suggest that these solvents may have been spilled during these operations. PCE has been detected in groundwater in a down-gradient, on-site well. Based on this information, the investigation objective is



to define the full nature and extent of PCE and its degradation products in the soil and groundwater both near and down-gradient from Building A.”

The specific details of the investigation, such as methods, design, and analysis, should be reserved for the Sampling and Analysis section (2.2.2.3) below.

2.2.2.2 Data Quality Objectives

Data Quality Objectives (DQOs) are statements that define the quality of data required to make valid, defensible conclusions about the nature and extent of contamination at the site based on the investigation objectives. DQOs may include statements about the minimum detection limits required to carry out the investigation objectives. If, for example, the investigation objective is to distinguish areas where cleanup is needed from areas where cleanup is not needed, the DQOs should specify detection limits that are lower than the concentration values given in the VCP lookup tables for that contaminant. If the investigation objective is to determine whether gross contamination exists on-site, the DQOs might specify higher detection limits that are adequate for making screening-level decisions.

By using DQOs throughout the investigation process, you are more likely to collect scientifically valid, defensible data and conserve resources by answering the right questions. The annotated bibliography contains references to material that can be used to assist you in defining DQOs.

2.2.2.3 Sampling and Analysis Procedures

This section of the report should describe and explain the design, methods, and rationale of the investigation. It should include information about field sampling as well as laboratory analyses of these samples. In addition, the QA/QC measures that were employed throughout the investigation should be described.

Field Sampling Procedures

This section should include the following information:

- *Sample Locations and Intervals*—The rationale for the selection of sampling locations and intervals should be described in this section. The rationale should be based on the review of the operational history, materials received, processed and/or disposed on-site, and the vertical and horizontal extent of the data gaps identified previously. Refer to the page numbers of maps showing the locations of sampling points and tables listing the sampling intervals in the report. For example:

“To determine whether PCBs were present in the on-site soils, soil samples were collected from various locations. Eighteen soil samples were collected from six locations near the area where the transformers were stockpiled, and nine soil samples were collected from three locations near the transformer shear area (see Figure 5 - Sampling Locations). Soils were collected from 6” and 18” below ground surface, and from just above the water table.”

- *Sample Types*—Samples for site characterization are generally collected from various media; groundwater, surface water, soil, sediment, and/or air. The media that were sampled during the investigation should be identified.



- *Sample Collection*—This section of the IR should describe the sample collection procedures, including whether grab or composite soil samples were collected, well purging method and rate, the number of samples collected, the labeling and identification system used, and the order in which they were collected. For example, at sites that have groundwater contaminated with volatile organic compounds (VOCs), samples should be collected from the upgradient well(s) first, then in order from the least contaminated to most contaminated downgradient wells.
- *Field Screening Methods*— Describe all field screening methods employed during the investigation.
- *Sampling Equipment*—The equipment used during the investigation should be identified and described.
- *Analytical Parameters*—This section of the IR should describe the rationale used to select analytical parameters. The rationale should be based on the list of potential chemicals of concern described above, and the chemical and physical properties of each. All analytical parameters should be listed in the IR.
- *Analytical Methods*—The laboratory analytical methods should be appropriate to achieve the data quality objectives. For any one contaminant, there are usually several different laboratory analytical methods capable of measuring contaminant concentrations. However, some laboratory analytical methods are capable of detecting lower contaminant concentrations than other methods. The sensitivity of an analytical method is referred to as the practical quantitation limit (PQL). If the goal is to characterize a groundwater plume to the MCL, the laboratory analytical method should have a PQL that is less than the MCL. Similarly, if the goal is to demonstrate that you have identified all soils where the metals concentrations exceed the cleanup levels, the laboratory analytical method should have a PQL that is less than or equal to the levels given in the VCP lookup tables. Prepare a table, organized by media and contaminant, showing the EPA analytical method used for each parameter. For groups of parameters that have a common laboratory analytical method, such as VOCs, it is not necessary to list each analytical parameter individually. The table may specify that VOCs in groundwater were analyzed using method 8260b. See the checklist in Attachment 2-1 for a complete list of information to include regarding analytical methods.
- *Well purging data*—When groundwater samples are collected, well purging data should be reported in tables at the end of the RAP. This information includes purging dates, techniques, rates, volumes removed, and stabilization parameters, such as pH, temperature, conductivity, redox, turbidity, or dissolved oxygen, as recorded over time. Information regarding the detection of immiscible layers should also be included.

Quality Assurance/Quality Control

In general, the information provided in this section should explain why the data collected and analyzed is of the appropriate type, quantity, and quality for making suitable decisions about what, where, and how to clean up the site.

Careful sampling design and methodology is essential for performing a good-quality investigation. Ideally, variability among samples will be indicative of variable levels of the contaminant(s) in the environment. Such variability can be used to understand the actual nature and extent of contaminant



concentrations at the site. However, other natural factors and/or human procedural errors can produce variability among samples. Such variability yields false results about the contamination at the site.

Variability between media properties (i.e. groundwater and surface water) and/or temporal variability in weather can result in natural variations in sample results. By selecting sampling location, time, and medium carefully, errors due to these variations can be minimized.

Erroneous results are also caused by sampling errors such as incorrect sampling procedures, cross-contamination, and improper sample preservation. Sampling errors may result in false negative results (a substance is not detected, but is present at the site) or false positive results (substance is detected, but is not present at the site). Because contaminant concentrations in air, soil, and water can potentially be diluted by environmental influences, proper sampling procedures are particularly important. Even minimal sample contamination or loss could significantly affect analytical results. By choosing the correct type of sample for site-specific conditions and contamination, you increase the likelihood of receiving accurate results.

To minimize the chance for variability due to procedural errors and poor design, a Quality Assurance Project Plan (QAPP) should be prepared and used. The QAPP should state how data collection activities will be implemented and how the results will be assessed. A QAPP defines the specific QA/QC procedures that will be applied. Defining and following the QAPP in detail can reduce erroneous results. A copy of the QAPP should be included in the Appendices to the IR. Please refer to the quality assurance documents (such as EPA QA/R-5) listed in the bibliography to define data quality expectations for technical defensibility.

Please note – Although you will generally not provide a QAPP for NDEQ review prior to conducting fieldwork, if you a recipient of Brownfields funding you must submit a QAPP for NDEQ’s review and approval before fieldwork begins.

Current EPA requirements for QAPPs identify four major areas that must be addressed:

- ***Project management.*** This section of the QAPP describes the project history, objectives, and roles and responsibilities of the investigation team. It ensures that the project goals and approach are clearly understood and that project planning is documented.
- ***Measurement and data acquisition.*** This section of the QAPP describes the measurement system design and implementation and the document sampling, analysis, data handling, and QC methods that will be used.
- ***Assessment and oversight.*** This section identifies activities for assessing the effectiveness of project implementation and associated QA/QC efforts. Assessment and oversight activities ensure that the QAPP is implemented as described.
- ***Data validation and usability.*** This section describes the QA/QC activities that occur after data collection. Such activities ensure that the data collected conforms to stated acceptance criteria and achieves the DQOs.

One QAPP may be developed for the entire process – from the investigation through the completion and confirmation of remedial action. Alternatively, the QAPP for the investigation may be modified for the planned remedial action if the results of the investigation indicate that this is necessary. Please refer to the bibliography (Appendix B) for more information about developing a QAPP.



The following QA/QC samples and procedures should be described in the QAPP:

- *Trip blanks.* Trip blanks are used to assess the potential for sample contamination during handling, shipment, and storage. Trip blanks are sample bottles filled with an uncontaminated medium that are sealed and transported to the field. There should be one trip blank per sample container. They are kept with empty sample bottles, and then with the investigative samples throughout the field effort. When sampling is completed, they are returned to the laboratory for analysis with the investigative samples.
- *Field blanks.* Field blanks are samples of an uncontaminated medium that are exposed to the sampling environment at the same time that investigative samples are collected. They are used to assess contamination resulting from ambient conditions. A minimum of 10% field blanks should be collected.
- *Equipment rinsate blanks.* Some equipment, such as portable pumps, soil samplers, and groundwater samplers, can introduce cross-contamination if not operated properly. Equipment rinsate blanks are collected to assess the cleanliness of the sampling equipment and the effectiveness of equipment decontamination. Equipment rinsate blanks are collected by pouring analyte-free water over the decontaminated surfaces of sampling equipment that contact sample media. A minimum of 10% equipment rinsate blanks should be collected.
- *Field split samples.* Field split samples are usually a set of two or more samples collected from a larger homogenized sample. Field split samples can be sent to two or more laboratories and are used to provide comparison data between laboratories.
- *Field duplicate samples.* Field duplicate samples are independent samples collected as close as possible in space and time to the original investigative sample, using the same collection methods. Field duplicates are sent to the same laboratory and are used to provide data on precision of the field procedures and the laboratory. Field duplicates also can provide information on the heterogeneity of the sample matrix. A minimum of 10% field duplicate samples should be collected.
- *Matrix spike and matrix spike duplicates.* Matrix spike (MS) and matrix spike duplicate (MSD) samples are each single samples of uncontaminated media, usually collected from a single location at double the normal sample volume. In the laboratory, MS and MSD samples are spiked with known amounts of analytes. Analytical results of MS/MSDs are used to measure the precision and accuracy of the laboratory analytical program.

2.2.2.4 Health and Safety

All investigative field activities should be carried out according to a site-specific Health and Safety Plan (HSP), consistent with the requirements of the Occupational Health and Safety Administration (OSHA). The HSP will not be reviewed by NDEQ and does not need to be attached to the RAP. However, a written statement indicating that a HSP was prepared and followed in accordance with 40 Code of Federal Regulations (CFR) 1910.120 should be provided.

2.2.2.5 Investigation-Derived Waste

Investigation-derived waste (IDW) includes soil cuttings, drilling mud, well development water, purged groundwater, decontamination fluids, disposable sampling equipment, and disposable personal protective



equipment. Minimizing IDW helps to leave the site in the same condition or no worse than prior to the investigation and reduces wastes that pose an immediate threat to human health or the environment. This section of the IR should describe how IDW was managed during the investigation. In addition, this section should explain the procedures that were used to ensure compliance with all relevant federal and state regulations. NDEQ has a guidance document that should be used to help you manage IDW (see Attachment 2-3).

2.2.3 Physical Site Characterization

This section of your IR will describe the occurrence and character of each of the significant physical features of the site: Surface Water, Soils, Geology, and Hydrogeology. This section should consist of a written summary of the physical site characteristics as determined by the field investigation. The summary should focus on significant findings that characterize the site **beyond what was known from the physical setting information and previously reported investigations**, as detailed in Sections 2.2.1.2 and 2.2.1.5, respectively, of this guidance. The details of the physical site characterization should be presented in tables and figures in the last part of the RAP (see example Tables and Figures in Appendix A). The narrative should discuss these results and refer to their location in the document. Categories of physical features are discussed below. Please refer to the checklist (Attachment 2-1) for a more detailed list of information that should be provided for each feature.

2.2.3.1 Surface Water

Surface water data may be collected from aerial surveys, ground mapping, surficial sampling, and measurements of water levels. The narrative of this section should contain information related to the physical aspects of surface water bodies (e.g., lakes, rivers, impoundments) and related features (e.g., gullies, sedimentation). Flow rates, channel dimensions and elevations, river stage, historical flooding characteristics, and surface water/groundwater relationships should be summarized. The specific details of these features should be provided in maps, diagrams, and tables at the end of the RAP. Refer to these details in the narrative of this section, and indicate the nature of the information shown, important findings, and the location of the relevant figure or table. Provide topographic map information that shows the relationship of the property to surface water bodies, elevation above flood stage, etc.

2.2.3.2 Soils and Geology

Soil and geologic data can be obtained from surficial soil sampling, soil borings, monitoring well borings, direct-push sampling, or geotechnical laboratory analysis. This section should summarize the findings of these sampling efforts. This summary should refer to information from the tables, figures, and appendices, and their locations in the report. The following figures should be included in the report:

- *Sampling location maps* should be prepared to show the locations of soil borings or direct-push sampling locations. If multiple media are investigated, it may be appropriate to prepare more than one sampling location map.
- *Geologic cross-sections* should be prepared to illustrate the vertical and horizontal geometry and lithology of geologic strata underlying the site. At least two cross sections oriented at right angles to each other should be prepared. If possible, one should be oriented parallel and the other perpendicular to the direction of groundwater flow. If oriented features such as paleochannels, fractures, stratigraphic terminations, or man-made structures exist in the subsurface, include additional cross sections oriented parallel and perpendicular to these features.



2.2.3.3 Hydrogeology

Hydrogeologic data may be derived from samples collected from monitoring wells or direct-push sampling points. This section should summarize these findings and refer to specific data in the tables, figures, and appendices. The following figures and tables should be included in the report:

- Sampling location maps should be prepared to show the locations of monitoring wells, piezometers, direct-push probe locations, or other investigation points used to characterize hydrogeology.
- Potentiometric surface and water table maps should be provided to illustrate the observed water levels at the site. If significant changes in the potentiometric surface or water table are observed over time, several maps should be provided to illustrate these variations. Control points, such as piezometers or monitoring wells, and water-level elevations at these points, should be shown and clearly labeled on the map(s). All elevations should be given in relation to mean sea level.
- Aquifer characteristics, such as hydraulic conductivity and transmissivity, should be summarized in the narrative and listed in tables at the end of the RAP.
- Well completion information should be reported in the tables and appendices. This information includes dates of completion, the Nebraska Department of Natural Resources well registration numbers and any other well identification system(s) used, well elevation data, screen lengths and intervals, and construction material specifications.

2.2.4 Nature and Extent of Contamination

This section of the IR should describe the full nature and extent of contamination in each of the environmental media (air, surface water and sediments, soils and vadose zone, groundwater) at the site. The lateral and vertical extent of groundwater contamination should be defined to the MCLs (or some other health-based standard for those contaminants not having an MCL) and soil contamination defined to the most conservative residential soil remediation goals (found in the Remediation Goals Lookup Tables). It is important to describe the horizontal *and* vertical extent of contaminants in all media, both at the site and migrating from the site. You should also describe how the contamination relates to specific source areas identified during the investigation.

In order to make sound conclusions about the nature and extent of contamination, you should evaluate all valid data from the study as well as previous investigations, interpret the results, and describe the contamination based on scientific reasoning. You should explain your reasons for refuting or accepting certain hypotheses. For example, if a low-permeability layer separating upper and lower aquifers is observed beneath the site, you might hypothesize that the layer impedes the downward flow of contaminants. To support this hypothesis, you should provide data to show that the lower aquifer is not contaminated. If you don't have any data from the lower aquifer, you can't make valid conclusions about the ability of the low-permeability layer to impede contaminant migration.

You should summarize and interpret screening and analytical data for each of the media listed below. Field screening and laboratory analytical results should be tabulated and included at the end of the RAP. Refer to these tables in the discussion and indicate the page numbers where the tables can be found. For these tables, high values (i.e. values that exceed MCLs or soil remediation goals) should be formatted



with a bold font or otherwise emphasized. In addition, refer to tables containing the QA/QC sample results for each media.

A general discussion of the information that should be provided for each media is provided below. Please refer to the checklist in Attachment 2-1 for a more detailed list of information that should be considered.

2.2.4.1 Sources

The discussion of sources should identify known and suspected on-site sources, potential sources of any contamination that is migrating from off-site, and any contamination “hot spots” identified on-site. Refer to maps showing the locations of tanks, lagoons, pits, contaminated soil, “hot spots,” or other sources.

Suspected source areas should be identified based on historical, background, and regulatory research, then investigated during the field activities. If contamination is confirmed, suspected source areas become known source areas. In some cases, areas of contamination are discovered during field sampling even though there is no reason to suspect contamination based on the background information. Discovery of such areas may warrant additional review of background information and/or field sampling to investigate whether the area is isolated or related to other suspected or known source areas.

There may also be contamination that is migrating from a suspected off-site source. If such sources are suspected, a reasonable attempt should be made to identify the locations of these sources based on visual observation or a review of documents such as aerial photographs and Sanborn fire insurance maps. Provide *Source Location Maps* that show the locations of known and suspected on-site source areas and potential off-site sources. These maps should indicate areas of relatively high contaminant concentrations, or “hot spots.” The presence of a hot spot may indicate a former operation area, waste disposal location, or other activity that contributed to contamination. Refer to these maps in the narrative of the report.

The following example is based on a hypothetical site where three groundwater plumes were discovered. Each plume is attributable to a different source area: an on-site source discovered during historical records review and confirmed during sampling, an area of contamination discovered during field sampling that is not attributable to any known current or historical site activity, and a suspected off-site source.

“During the course of the investigation at the site, three groundwater contaminant plumes were identified. The first groundwater plume consists of chlorinated volatile organic compounds, TCE, 1,1,1-TCA and 1,1-DCE. This plume is located on-site under the former drum storage area (figure 5-7) and is attributable to spills of the chemicals stored in the drums.”

“The second groundwater plume is located near the north side of the site (figure 5-8) and consists of relatively low concentrations (less than 5 ppb) of several pesticides, atrazine, cyanazine, and metolachlor. A search of the available records for this site did not provide any indication of the source of these chemicals. City directories dating back to 1935, Sanborn maps dating back to 1910 and aerial photographs dating back to 1954, do not provide any indication the site was ever used as a pesticide formulation plant or distributor.”

“The third plume is located at the up-gradient (west) edge of the site (figure 5-9) and consists of benzene, ethyl benzene, toluene, and xylenes. This plume appears to be attributable to an off-site source: the gasoline station located immediately west, across



the street from the site.”

2.2.4.2 Air

Most sites in the VCP will not have an ongoing source of air contaminants. In some cases, however, contaminated soils can release vapors and particulates into the air. To address such situations, two exposure pathways – air inhalation and intrusion of vapors into underground structures – are factored into the VCP lookup tables (Attachment 2-6). However, if it is determined that an on-going source of air contamination (such as an off-gassing lagoon) does exist, you should notify NDEQ to discuss potential air sampling requirements, including sample location, number, and method. Such sites will be dealt with on a case-by-case basis. If air sampling is performed, report the sample results.

2.2.4.3 Surface Water and Sediments

Surface water and sediment sample results should be reported. This includes field screening results, target compounds, and concentrations of compounds detected. Discuss these results in the narrative and refer to specific data in tables or figures included in the report.

2.2.4.4 Soils and Vadose Zone

Discuss the nature and extent of contamination in soils and the vadose zone. Refer to cross sections and maps that illustrate the spatial distribution of these contaminants, and include tables that contain field screening results, target compounds, and concentrations of compounds detected in soils and soil gas.

2.2.4.5 Groundwater

In this section, you should discuss the nature and extent of groundwater contamination at the site. You should draw general conclusions from the results of the investigation and refer to figures and tables containing data to support these conclusions. For example:

“The VOC plume extends off-site for a distance of 3,000 feet (figure 4-1). TCE concentrations vary from 5,000 µg/l near the source area on-site, to 5 µg/l at the distal end of the plume off-site (figure 4-1, table 4-1). The VOC plume occurs at a depth interval from 15 feet to 25 feet below ground surface on-site, to a depth of 35 feet to 50 feet below ground surface at the distal end of the plume off-site (figure 4-2).”

The report should include tables containing field-screening results, target compounds, and concentrations of compounds detected. It should also include cross sections and maps to illustrate the spatial distribution of contaminants in the groundwater. The following figures should be included:

- *Isoconcentration maps* should be provided to illustrate the general horizontal extent of groundwater contamination. Concentration contours and control points should be clearly labeled and superimposed on the site layout map. It may be necessary to prepare several isoconcentration maps showing different areas of contamination or different suites of contaminants
- *Isoconcentration cross-sections* should be provided to show the vertical extent of groundwater contamination in relation to the site geology. Concentration contours, sample points, and screened intervals should be superimposed on geologic cross-sections. If source areas can be determined, they should be shown on the cross sections as well



- *Free product isopach maps and cross sections* should be included to show the extent and thickness, if any, of free product

2.2.5 Contaminant Fate and Transport

The two main aspects that determine contaminant fate and transport are contaminant characteristics and site characteristics. In the report, these two aspects should be discussed together under one or more headings titled according to the contaminant(s) of concern. The IR should provide a detailed analysis of the contaminant characteristics, occurrence, migration and exposure pathways that have been determined to be significant for the site. The analysis will include a discussion of the chemical and physical characteristics for each type of contaminant, the site-specific characteristics that will affect migration, such as organic carbon content of the soil, and the hazard posed by the migration or accumulation of the contaminant. For example:

“After the excavation of the underground storage tank, benzene was detected in the soil at a concentration of 10,000 ppm and in the soil gas at 5000 ppm. Although benzene has a strong tendency to adsorb to carbon, there is relatively little carbon in the soil at this site. Therefore, attenuation through adsorption is not expected to be a significant factor. Benzene is a toxic and combustible volatile organic compound, and is likely to migrate through the soil gas to any below grade structures. The potential for lateral migration of soil gas will be enhanced at this site by the presence of the parking lot, which will act as a cap to prevent upward migration of the soil gas to the open atmosphere. Therefore, there is a significant chance that benzene will migrate toward, and possibly accumulate in, the box culvert and elevator shaft on-site.”

Chemicals with similar properties may be grouped to facilitate a concise description. For example, the description provided above could have stated:

“Benzene, ethyl benzene, toluene, and xylenes were detected in the soil and soil gas on-site. These chemicals are all combustible, volatile organic compounds and are likely to migrate via the soil gas migration pathway.”

You will use this analysis, along with information about potential receptors (Section 2.2.6), to develop a conceptual site model (Section 2.2.7) and select an appropriate remedial action (Section 2.3).

2.2.5.1 Contaminant Characteristics

This section of the IR should provide a description of the contaminant characteristics that affect fate and transport. The following information should be provided.

Chemical and Physical Properties of Contaminants

This section should provide a table containing names of detected contaminants and the most relevant chemical and physical properties of each. Focus on the properties of each contaminant that are most likely to affect fate and transport, such as density, solubility, octanol/water partition coefficient, vapor pressure, volatility, and other relevant properties.

Contaminant Persistence

Describe the persistence of each contaminant that occurs in each of the major media: air, surface water and sediments, soils and vadose zone sediments, and groundwater. For example, some VOCs are easily



degraded by ultraviolet light in the atmosphere. Some of the constituents of gasoline degrade relatively quickly in the groundwater under oxidizing conditions, while the primary constituents of chlorinated solvents degrade much more slowly.

Transport and Partitioning

Provide a narrative that discusses the chemical and physical properties that affect how each contaminant is transported as well as the properties that facilitate or retard transport. Examples of properties that affect transport include solubility and density. Properties that effect partitioning include the octanol/water partition coefficient and the octanol/carbon partition coefficient.

Transformation and Degradation

Describe the likelihood that the contaminants will be transformed or degraded into other compounds. This discussion should place special emphasis on transformation or degradation compounds that are more toxic than the parent compound (e.g., vinyl chloride derived from the degradation of trichloroethylene). Describe the significance of each of the contaminant properties, and refer to tables containing data and contaminant characteristics to support this description.

The following is an example of language that might be used to describe the contaminant characteristics of a specific COC:

“Benzene is a volatile compound that will evaporate into the gas phase when encountered as a free-phase liquid or residual product trapped in soil. Benzene is fairly soluble in water compared to other hydrocarbons, binds easily with carbon, including any organic carbon in the soil, and degrades readily under aerobic conditions. See Table 7.4 for a summary of these properties.”

It is important that this description is thorough and complete because it will be used later in the report to support evaluation of the contaminant migration, and ultimately, to support selection of the appropriate remedy(s).

For sample language and a source for some of the information requested in this portion of the guidance refer to the following web site: www.atsdr.cdc.gov/toxpro2.html. This web site provides toxicological profiles for many of the contaminants commonly found in the environment. Each toxicological profile includes a table of chemical and physical properties as well as other information about the fate and transport of these contaminants. Although the information on this website is relatively comprehensive, other sources of information are also available and should be consulted as appropriate.

2.2.5.2 Site Characteristics

This section of the IR should provide a description of the site characteristics that affect contaminant fate and transport. Specifically, the IR should describe: the properties of the environmental media, migration pathways, presence of preferential flow paths, and exposure pathways.

Environmental Media

There are four environmental media: air, surface water (and associated sediments), soil and vadose zone sediments, and groundwater. For each of these environmental media there are different characteristics and migration pathways that can affect the fate and transport of contaminants.



The first part of this section should describe the media characteristics that might influence the fate and transport of contaminants at the surface, through the soil, and in the groundwater. Such factors may include total organic carbon content, porosity, permeability, pH, alkalinity, cation exchange capacity, hardness, alkalinity, and any observed heterogeneity associated with these properties. You should present an evaluation of the likely affect that the existing aqueous geochemical conditions will have on contaminant persistence, transport/partitioning, and transformation/degradation. For example, you might describe whether the aqueous geochemical conditions are conducive to reductive dechlorination of chlorinated solvents. If so, you would also describe the likelihood that vinyl chloride will be produced as an end product and include this as an analytical parameter for future monitoring.

Migration Pathways

This section of the IR should describe the migration pathways that exist at the site. Each environmental media can have one or more migration pathways. For example, air can migrate through the open atmosphere or through the soil as soil gas. Water can migrate via the surface water pathway or groundwater pathway. Contaminated soil can migrate as windblown dust or in surface water as sediment. Because of the interrelated nature of environmental media, contamination can be passed from one media to another media via these migration pathways. Therefore, it is important to identify and describe migration pathways that are specific to the site as well as the media involved in each.

Each migration pathway (and associated exposure pathways) will have somewhat different characteristics that may affect exposure assessment. These differences should be noted in the IR. For example, at a site with significant soil contamination, contaminant concentrations in the open air tend to be much lower than contaminant concentrations in the soil gas. In addition, soil gas contaminants tend to migrate much more slowly than contaminants in the open air. The slower migration and higher concentrations result in a greater likelihood that soil gas will pose a threat to human health. Similarly, water flows more quickly in a stream than in the groundwater. The higher flow rate and exposure to the open atmosphere in the stream results in greater dilution and loss of contaminant mass due to volatilization. Therefore, the water in the stream is not as likely to pose a significant threat to human health.

Preferential Flow Paths

One significant aspect of contaminant migration is the existence of preferential flow paths. This section of the IR should include a description of typical anthropogenic and natural preferential flow paths. Examples of anthropogenic pathways include: sewers, utility trenches, wells, basements, tunnels, and elevator shafts. It is important to note that most utilities are constructed in a trench that is backfilled with pea gravel to support the pipe or conduit. The pea gravel backfill can act as a preferential flow path for both water and soil gas. Contamination can migrate long distances along these flow paths even if monitoring of the sewer pipe or conduit indicates there isn't any contamination in the pipe. Examples of natural preferential pathways include sand lenses, paleo-channels, and fractures in bedrock.

This section of your IR should also provide a brief description of the rationale for omitting any pathways from further evaluation consideration. For example:

“Migration of soil vapor through utility trenches was not evaluated because all utilities have been routed around the area of soil contamination.”

Exposure Pathways

Each migration pathway can affect human health via one or more exposure pathways. For example, people can be exposed to the contaminants in groundwater by ingestion of the water or by inhalation of



the contaminant vapors released during bathing or showering. People can be exposed to contaminated soil via ingestion or dermal contact with contaminated soil or inhalation of wind blown dust, such as may occur during construction activities. People can be exposed to contaminated air in the form of vapors in the open atmosphere or through exposure to contaminated soil gas migrating into buildings through the basements.

This section should identify and describe potential exposure pathways that exist at the site. Exposure pathways can be grouped into the following categories:

- Ingestion of soil
- Inhalation of volatiles and particulates from soils
- Dermal contact with soils
- Ingestion of water
- Inhalation of volatiles from water during showering/bathing
- Inhalation of volatiles from vapor intrusion into indoor air

2.2.6 Potential Receptors

This section of the IR should identify both human and ecological receptors. Identify and quantify any human populations, sensitive environments, and natural resources (such as groundwater supplies or agricultural land) that may be affected by potential or actual contamination at the site.

2.2.6.1 Human Receptors

In this section of the IR, you should identify the human receptors that may be exposed via one of the exposure pathways identified and evaluated, as discussed in section 2.2.5.2. You should document the following information:

- Nearby population centers, including general demographic descriptions
- Nearby sensitive populations, such as child care centers, schools, hospitals, or nursing homes
- A land use survey of the area within 500 feet of the site
- A well survey of nearby wells that includes locations of drinking water (private, community, or municipal), irrigation, livestock supply, and industrial supply wells within 1 mile of the site. (This well survey should be all-inclusive and the applicant should not rely solely on a search of the Nebraska Department of Natural Resources [DNR] registered well database, as not all water wells will be registered. It may be necessary to talk with local utility officials, review aerial photographs or conduct door-to-door surveys.)
- If groundwater contamination is present on-site and drinking water supply wells exist within one mile of the site, several of the nearest down-gradient wells should be sampled



to determine whether the wells are contaminated. The results of this sampling should then be presented in the IR.

Refer to the checklist in Attachment 2-1 for additional information.

2.2.6.2 Ecological Receptors

You should document the following information regarding ecological receptors:

- Nearby sensitive environments, such as wetlands or state or federally designated threatened or endangered wildlife habitats
- Area natural resources, such as groundwater supplies or agricultural land
- A surface water survey that shows the location of the closest water body, the most susceptible water body, nearby drinking water intakes, and water bodies downgradient from the site
- Answers to the questions listed in Section 2.3 of the *Protocol for VCP Remediation Goals Lookup Tables*.

NDEQ will review this information to determine whether or not ecological receptors are likely to be exposed to contamination at the site. If so, a site-specific ecological risk assessment may need to be conducted. See the checklist in Attachment 2-1 and Section 2.3 of the *Protocol for VCP Remediation Goals Lookup Tables* for more information regarding this topic.

2.2.7 Conceptual Site Model

The IR should include a Conceptual Site Model. The conceptual site model will integrate all investigation results collected into a coherent representation of current site conditions. The model may be presented as a figure with explanatory text. It should provide a summary of how and where contaminants are expected to migrate and the affect that migration is expected to have on human health and the environment. Example Conceptual Site Models are included as Attachment 2-4.

In addition to describing current site conditions, the conceptual site model should illustrate intended land use at the site. This includes information about buildings and below-grade structures (i.e. basements, utility trenches, tunnels, elevator shafts, and tanks), landscaping features and decorative ponds, and any potentially sensitive environments. Any institutional controls that are in place or proposed for the site should also be described.

It is important that all potential contaminant exposure pathways are evaluated and represented in the conceptual site model. These pathways are listed under *Exposure Pathways* in Section 2.2.5.2.

Finally, the conceptual site model should demonstrate why contamination is a problem and remedial action is necessary in light of proposed land use.

The following is a hypothetical example of part of the explanatory text that might go along with a conceptual site model:

“The plume of VOC contaminated groundwater that is migrating from the drum storage area has contaminated five private drinking water wells down gradient from the site at



concentrations that exceed the MCLs for TCE and 1,1-DCE. The well owners were contacted in July 2003 and all have been connected to the municipal water supply. There are several homes located over the plume. During the investigation, the ACME XYZ Company evaluated the possibility for vapor migration from the site, and the possibility that VOCs would partition from the groundwater into the soil gas, and subsequently migrate into the homes. The soil gas investigation didn't reveal any evidence to suggest that VOCs are migrating via the soil gas beyond the property boundary. The concentration of TCE and 1,1-DCE in the shallow groundwater (5-25 feet below ground surface) is below the method detection limit of 1 ppb. Therefore, it does not appear that VOCs are migrating upward through the shallow groundwater into the soil gas."

2.2.8 Summary and Conclusions

This part of the IR should summarize your findings and conclusions based on the results of the investigation. All of the conclusions should be supported by data, consistent with the conceptual site model, and valid in all other aspects so that they can be used to plan and implement remedial actions. Since this is the last section before the Remedial Action Work Plan, the narrative should be written such that the reader is left with a good understanding of the site, the nature and extent of contamination, and the potential impacts to human health and the environment. This section should be no longer than 2-3 pages, depending on the number and complexity of issues at the site.

2.3 REMEDIAL ACTION WORK PLAN

The next element of the RAP is the Remedial Action Work Plan (RAWP). The following categories of information should be described in the RAWP:

- Interim remedial actions
- Remedial action objectives
- Proposed remedial action
- Performance monitoring
- Remediation waste management plan
- Permitting and regulatory involvement
- Proposed schedule of remedial actions

The RAWP should address each of these categories as described in Sections 2.3.1 through 2.3.7, in the order given in this guidance. The level of detail will depend on site-specific conditions. It is important that you include sufficient and appropriate information to support the proposed remedial action.

2.3.1 Interim Remedial Actions

Interim remedial actions are used to control, minimize, or eliminate contamination that poses an actual or potential threat to human health or the environment. Typically, interim actions are taken in advance of the final remedial action. In some circumstances, an interim remedial action may become the final remedial action. In other cases, an interim remedial action may not be consistent with the approach chosen to meet the final remedial action.



The RAWP should provide a complete description of any interim remedial actions for the site. This description should include information about the location, duration, and method of any interim remedial actions, as well as a justification for their uses. You should evaluate the interim remedial action to determine if it is compatible with the final remedial action or whether the interim action can be the final remedial action. The results of this evaluation should be included in this section. In the event that the interim measure is not consistent with the final remedial action, the RAWP should describe the process by which the interim measure will be decommissioned or incorporated into the final remedy.

2.3.2 Remedial Action Objectives

A primary focus of the Nebraska VCP is to provide an applicant with options in determining remedial action objectives and remediation goals that are appropriate for their site. Towards that end, the NDEQ has developed a protocol that utilizes a three-tiered approach to establish or select specific remediation goals for a site. This tiered approach is presented in a separate guidance document, *Protocol for VCP Remediation Goals Lookup Tables*, Section 3.0. The NDEQ recommends that applicants familiarize themselves with this protocol prior to determining the RAOs.

In this section of the RAWP you should define RAOs. RAOs are statements that define qualitative goals and quantitative levels of cleanup that you intend to achieve for each of the contaminants identified at the site. Your selection of RAOs will be based on the intended land use for the site and groundwater use in the area of the site. The RAOs should be specific for the following:

- Chemicals of concern
- Exposure pathways
- Potential receptors that will be addressed.
- Cleanup levels as determined by the lookup tables (see Attachment 2-6)
- Location(s) or point of compliance at which the cleanup levels will be achieved
- Timeframe for which remedial actions will be completed

This section should also summarize the rationale for deciding which contaminants will be remediated and the level to which they will be reduced.

Provided below are examples of RAOs based on a site with PAH contamination:

“Remove and dispose of PAH contaminated soils from the affected residences that are above the residential remediation goals (RGs) provided below.”

“Prevent ingestion, dermal, and/or inhalation exposures by current or potential future domestic water supply well users to PAH contaminants in groundwater at concentrations greater than the maximum contaminant levels (MCLs) or RGs.”

“Restore the aquifer to the MCLs or RGs within a reasonable time frame and prevent further degradation and contaminant migration in groundwater.”



2.3.2.1 Land Use

Land use is to be based on future use considerations, especially if the property is to be redeveloped. If the intended land use is residential, the RAOs will be more stringent than if the intended land use is industrial. NDEQ recognizes that future land use may be consistent with present or historical land use.

2.3.2.2 Groundwater Use

Where protection of groundwater is determined to be a RAO, attention should be paid to the requirements of Title 118 – *Ground Water Quality Standards and Use Classification*, Appendix A - Ground Water Remedial Action Protocol. Under Title 118, protection and cleanup of groundwater directly relates to the site-specific Remedial Action Class (RAC) established by NDEQ for a pollution event. A RAC is essentially a pollution ranking designation defined for categories of groundwater (and overlying soils) in Nebraska, with the specific RAC determined for a specific site dependent on the current or potential use of groundwater as drinking water. The extent of remedial action required for groundwater will differ depending, in part, on the RAC of the contaminated or threatened groundwater. It should be noted that the RAC designation is determined from the condition of the groundwater prior to the occurrence of pollution. There are three RAC categories, each discussed in more detail below.

RAC-1

This category includes sites where groundwater is currently being used or has been proposed to be used for a public drinking water source, a portion of groundwater currently used as a private drinking water source, and groundwater within a designated Wellhead Protection Area (WHPA). RAC-1 will also be assigned anytime a public or private drinking water supply well has been polluted. RAC-1 sites receive the most extensive remedial action measures, including cleanup of readily removable contaminants (i.e., free product) and cleanup of dissolved phase contaminants to MCLs. If additional cleanup is not required, the remaining contaminated groundwater will be managed and monitored to prevent further damage.

RAC-2

This category includes sites where groundwater has the potential to be used as a public or private drinking water source. Potential use exists if the groundwater is located in a highly populated area, is part of a regional, high-yielding aquifer, or is otherwise justified (e.g., the regional aquifer is low-yield but serves as the sole source of water). A RAC-2 designation would encompass the largest portion of groundwater in Nebraska. Remedial actions measures would include cleanup of readily removable contaminants (i.e., free product) and potential cleanup of dissolved phase contaminants to MCLs. If cleanup is not required, the remaining contaminated groundwater will be managed and monitored to prevent further damage.

RAC-3

This category includes sites where groundwater has little or no potential to be used as a public or private drinking water supply. Justification for assigning occurrences to RAC-3 is based on a combination of factors, including:

- Water is of such poor natural quality that it is unfit for human consumption
- Insufficient yield may limit or exclude groundwater being used for drinking water



- Historical contamination that occurred prior to the pollution event(s) currently being investigated that may have rendered groundwater unsuitable for drinking and uneconomical to treat
- Past and present intensive land use where groundwater is likely to be contaminated or will not be used as drinking water (e.g., areas of concentrated industrial development or densely populated areas)

Remedial action measures would generally be the least extensive for RAC-3 sites and would include cleanup of readily removable contaminants (i.e., free product). Monitoring may also be required.

A more extensive discussion and explanation of the RAC system may be found in Title 118, Appendix A, Step 8, pages A-4 – A-6. The applicant should be aware that drinking water criteria is not the only reason to perform additional cleanup of groundwater contamination and that other beneficial uses could necessitate such cleanup.

As stated previously, under Title 118 the RAC designation for a site is established by NDEQ. Knowledge of the probable RAC will be necessary for an applicant to determine appropriate remediation goals and evaluate potential cleanup technologies where groundwater contamination is a concern. However, such a determination by NDEQ under the VCP could likely hinder the intent of the VCP, namely to move sites along in as timely and efficient a manner as possible and allow the applicant to prepare an adequate Remedial Action Work Plan.

To allow a site to move as timely and efficiently through the VCP as possible, the NDEQ has developed a Preliminary RAC Determination Worksheet for use by a VCP applicant (see Attachment 2-5). The purpose of the worksheet is to allow an applicant to make a preliminary determination of the likely RAC designation that a contaminated site would receive from NDEQ, based on groundwater use within the area surrounding the facility. ***The conclusions reached by an applicant using this worksheet will be considered preliminary only and subject to a final, official RAC determination by NDEQ as part of its review of the VCP RAP.*** The applicant should include a completed worksheet as part of the RAWP.

2.3.2.3 Remediation Goals

The cleanup levels or Remediation Goals (RGs) for the site should be determined from the attached Remediation Goals Lookup Tables (Attachment 2-6). Chemical-specific RGs are provided for specific exposure pathways and land use categories. These RGs were developed based on accepted risk assessment principles. The policy decisions and risk assessment framework used to develop the RGs, as well as documentation for the calculation of the RGs, can be found in a separate NDEQ document, *Protocol for VCP Remediation Goals Lookup Tables*.

The RGs selected as cleanup levels should be included as a specific table (see also Section 2.4) in the RAWP. This table should include the selected RG for each COC, indicate whether the RG represents a residential or commercial exposure, and the rationale for that selection.

2.3.3 Proposed Remedial Action

As mentioned in Section 1.0, the VCP is a streamlined, results-based cleanup program. This approach minimizes the number of steps in the regulatory review process and involves setting goals. It provides VCP applicants with the responsibility and latitude to determine how to achieve these goals. You will use the conclusions from the investigation to develop adequate RAOs, including cleanup levels taken from



the lookup tables. You will also demonstrate how the proposed remedy meets the following remedy evaluation criteria:

- Protect human health and the environment
- Comply with Applicable or Relevant and Appropriate Requirements (ARAR)
- Provide short-term and long-term effectiveness
- Implementability
- Cost
- Achieve community acceptance

Nebraska's VCP program does not require a formal and extensive evaluation of numerous potential remediation technologies, as do more traditional programs such as CERCLA or RCRA. (However, VCP applicants who are also Brownfields Revolving Loan Fund grantees are required by EPA to perform a remedial alternatives evaluation consisting of at least two remedial alternatives other than the no action alternative.) With the results-based approach, NDEQ does not ordinarily second-guess the chosen remedial action. However, you should evaluate the proposed remedial action in terms of its effectiveness in achieving the RAOs and remedy evaluation criteria. Effectiveness in achieving the RAOs will be based on monitoring and sampling results. In this guidance, such monitoring and sampling is termed *performance monitoring* (see Section 2.3.4). If performance monitoring results show that the RAOs are not met in the proposed timeframe, additional remedial actions will likely be necessary.

Performance Monitoring

In this guidance document, the term *performance* in performance monitoring refers to the effectiveness of the remedial action in achieving the RAOs. It does **not** refer to operational performance, or the ability of an engineered system to meet certain performance criteria. Since the VCP is a result-based program, NDEQ does not evaluate the design and operation of the remediation system, but rather, focuses on evaluating whether the remedial action will achieve the RAOs and remedy evaluation criteria.

The following sections provide information on different types of remediation technologies that you may choose to select as your proposed remedial action. Each of these sections identifies the type of information that should be included in the RAWP for the remediation technology that you select.

2.3.3.1 Presumptive Remedies

One way to simplify and streamline the remedy selection process is to use presumptive remedies. Presumptive remedies are techniques that have been used at a wide variety of sites across the country. The widespread use of these technologies means that environmental professionals, regulators and consultants alike are familiar with the effectiveness and limitations of these technologies; therefore, it generally is not necessary to perform a lengthy evaluation of the technology. Instead, efforts can be focused on collecting the site-specific information necessary to determine whether to implement the remediation technology at the site. EPA's webpage provides a discussion of several presumptive remedies (<http://www.epa.gov/superfund/resources/presump/>). For more information about presumptive remedies, see the resources listed in the bibliography (Appendix B).



2.3.3.2 Innovative Technologies

NDEQ encourages the use of innovative technologies. In some cases, innovative technologies can achieve cleanups that are as effective, faster, and cost less than traditional remediation technologies. Some examples of innovative technologies and the type of information that should be provided in the RAWP include:

- *In-Situ Bioremediation of Groundwater* – Describe the type of biodegradation mechanism to be used. Include maps showing the locations of wells, diagrams illustrating well construction information, and cross sections, descriptions, and construction information for any reactive barriers or other systems used to introduce reactants into the subsurface.
- *Phytoremediation* – Descriptions of phytoremediation should include type of application and details of the process employed. Types of plants, root depths, locations, and other applicable construction information should be included.
- *Monitored Natural Attenuation* – Any proposal to use monitored natural attenuation should provide sufficient and appropriate information to support the proposal. Include the results of sampling and monitoring to verify that natural attenuation is occurring at a rate that makes it suitable as a remedy. It is important to note that the occurrence of degradation products alone is not sufficient to make this demonstration. EPA’s guidance, Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater provides a description of the information to demonstrate that monitored natural attenuation will be an appropriate remedy. This guidance is available at www.epa.gov/oerrpage/superfund/resources/gwdocs/protocol.htm. The methods to be used to monitor degradation should be described in detail in Section 2.3.4.
- *Other Technologies* – If another innovative technology is proposed, specify the type of technology and include maps, cross sections, and/or diagrams to illustrate the basic construction of the system.

2.3.3.3 Traditional Technologies

There are many different kinds of traditional remediation technologies available to clean up contaminated sites. Some of the more commonly used technologies are listed below. Included with each is a brief summary of the information that should be provided in the RAWP.

- *Soil Excavation and Removal* – Descriptions of soil excavation should include the extent and depth of soil to be excavated and plans for refilling and regrading excavated areas. Include maps and diagrams to illustrate the locations, sizes, and shapes of these areas.
- *In Situ Treatment of Soil* – Describe the type of in situ treatment to be used and the overall systems for injection or extraction. Include maps or cross-sections showing system components, treatment points, and radius of influence of the treatment system.
- *Groundwater Pump-and-Treat* – Describe and illustrate the basic treatment process and construction of the groundwater pump-and-treat system, including the number and locations of wells, well construction information, and capture zones. Include maps, cross sections, and diagrams as appropriate.



- *Air Sparging/Soil Vapor Extraction* – Descriptions of air sparging/soil vapor extraction systems should include maps of wells locations, well construction information, radius of influence of the system, and cross sections illustrating the relationship among wells, contaminated zones, water table, and stratigraphic features.

2.3.3.4 Engineering Controls

Engineering controls are physical barriers or other engineered measures that limit exposure to contamination or access to the site. Some common engineering controls include low-permeability barriers and containment structures (e.g., clay caps, parking lots, landfill caps) and physical access barriers (e.g., fences).

If an engineering control is the proposed remedial action, describe and illustrate the area to be addressed and the type of engineering control to be used.

- *Low-permeability barriers and containment structures* – describe and illustrate the type, thickness, and engineering properties of the cover material. Include grading plans for the site. Include maps, cross sections, and diagrams as appropriate. If a landfill cap is the proposed remedial action, contact NDEQ regarding other applicable guidance and checklists of information to submit.
- *Physical access barriers* – describe and illustrate the type of barrier, location, size, and other construction information. Include maps and diagrams as appropriate.

Although some engineering controls may effectively prevent direct contact with contamination, they may not always be appropriate for the site. For example, a clean soil cap may limit exposure to contaminated soil, but the cap will not always be sufficient to prevent ongoing contamination of the groundwater. Residual contamination from contaminated soil or waste may continue to leach into the groundwater. This is especially true if it is located at or below the water table. In other cases, construction of a low-permeability barrier may exacerbate an existing contamination problem. For example, if a low-permeability cap is constructed over soils that are contaminated with volatile organic compounds, the cap may enhance lateral migration of vapors, potentially toward buildings. In this case, it may be necessary to supplement the cap with a remedial technology such as a soil vapor extraction system.

The narrative of this section should include a discussion of why the engineering control is appropriate for the site. In general, an engineering control is appropriate if the following criteria are met:

- the remedy will be protective of human health and the environment
- the wastes and contaminated media can be reliably contained to limit exposure and prevent ongoing contamination of other media
- the remedy will not cause or enhance other related contamination problems
- the wastes and contaminated media pose relatively low long-term threats
- treatment is impracticable



2.3.3.5 Institutional Controls

One way to minimize the potential for human exposure to contamination and/or protect the integrity of a remedy is through the use of institutional controls. Institutional controls are legal or administrative measures that limit land or resource use. They are typically used when the chosen remedial action involves leaving the contaminants in place or when implementing long-term cleanup actions. Often, institutional controls are used in combination with engineering controls or long-term groundwater cleanup actions.

There are four categories of institutional controls:

- *Governmental controls* – these controls use the authority of an existing governmental unit to impose land or resource restrictions. Examples include zoning, building codes, drilling permit requirements, and State or local groundwater use regulations.
- *Proprietary controls* – these controls, such as covenants and easements, are based on real property law and use a variety of tools to prohibit activities that may compromise the effectiveness of the remedy or restrict activities or future uses of resources that may result in unacceptable risk to human health or the environment. An example of this type of control is an easement that grants property access rights to a site owner/operator or regulatory agency for routine inspection and monitoring.
- *Enforcement and permit tools with institutional control components* – these tools may be used to require and ensure long-term compliance with site use restrictions. Examples include remedy agreements, administrative orders, consent decrees, and permit conditions.
- *Informational devices* – these tools provide information or notification about whether a remedy is operating as designed and/or that residual or contained contamination may remain on-site. Examples include state registries, deed notices, and advisories.

The RAWP should list the category and type of each proposed institutional control. The narrative should describe how the institutional control will minimize the potential for human exposure to contamination and protect the integrity of the remedy.

Applicants may choose to use a restrictive covenant pursuant to the Nebraska Uniform Environmental Covenants Act (Attachment 2-7). Restrictive covenants established pursuant to the Act must include written documentation providing, among other things, the nature of the activity and use limitations, and information on where the administrative record documenting the remedial action may be found. A copy of the control must be recorded with the county where the property is located, as well as a copy provided to NDEQ.

2.3.4 Performance Monitoring

Performance monitoring is a key component of the VCP streamlined, results-based approach. Performance monitoring consists of periodic measurement of physical and/or chemical parameters to evaluate the progress of the remedial action in achieving the RAOs defined for the site. Performance monitoring can also be used to verify or adjust estimates of remediation timeframes or determine whether advances in remediation technologies or approaches could improve the ability to achieve the RAOs. Your approach to conducting performance monitoring will depend on which remedial action is chosen. For example, with remedial actions selected to control groundwater migration, both chemical analysis of



groundwater samples and hydrogeologic measurements of groundwater elevations should be performed. At sites where engineering controls and institutional controls are used, performance monitoring may be necessary to demonstrate that ongoing contamination of the groundwater is prevented, groundwater contamination is not spreading to uncontaminated areas, and potential receptors are being protected.

In this section you should prepare a performance monitoring plan that includes a description of the RAOs, locations, frequency, type and quality of samples, techniques, and measurements that will be used to assess the performance of the remedial action. The plan should include sampling and analysis and quality assurance procedures consistent with the procedures discussed earlier in Section 2.2.2.3. In addition, a schedule for submittal of periodic monitoring reports should be included in the plan. The plan should also include an operation and maintenance plan for the monitoring system. Finally, the plan should discuss the proposed remediation timeframe during which performance monitoring activities will be conducted.

Performance monitoring reports should be submitted to NDEQ on a periodic basis after approval of the RAP. These reports should include the following:

- Analytical results
- QA/QC results
- Chain of custody records
- Groundwater sampling and field data sheets
- Data tables containing groundwater elevations and well data
- Groundwater contour maps

The timeline for submittal of performance monitoring reports, in relation to approval of the RAP, submittal of the RAR, and issuance of the NFA, will vary from site to site. For sites with long-term remedies, the general sequence will be as follows: (1) approve RAP, (2) submit periodic monitoring reports, (3) submit RAR, and (4) issue NFA. The NFA will only be issued if the regulatory standard has been met in the specified long-term timeframe.

For sites where engineered controls/institutional controls are the remedy, the general sequence will be different: (1) approve RAP, (2) submit RAR, (3) issue NFA, and (4) submit periodic monitoring reports.

Startup Reports and Long-Term Remedies

If a long-term remedy is chosen as the cleanup approach, you may need to submit a startup report after the RAP is approved.

Startup reports are submitted once remedial actions have begun. They should include as-built diagrams illustrating the construction information of the remedial system. You should confer with NDEQ to determine whether a startup report will be necessary.

This section should include an operation and maintenance plan (O&M plan) for the performance monitoring system. This plan should be used to ensure that the monitoring system will continue to function properly and provide data of the appropriate quality and quantity to allow NDEQ to evaluate the performance of the remedial action. The O&M plan should include:

- A description of the inspection procedures and tasks to be completed as part of the routine operation and maintenance of the system.



- A general description of the contingencies that will be used in the event the performance monitoring system requires repair or modification beyond the scope of routine operation and maintenance.

Finally, this section should include an outline of the expected remediation timeframe. An acceptable timeframe for remediation will be the period of potential exposure to the contamination in the absence of any remediation or 20 years, whichever is less. A longer period of time may be allowed on a case-by-case basis, if adequately justified by the applicant.

2.3.5 Remediation Waste Management Plan

For all remediation approaches, you should describe procedures for managing and disposing of any Remediation Waste (RW) generated during remedial action. Due to the generation of RW, remedial actions can trigger RCRA requirements at a facility that is otherwise not regulated under RCRA. Carefully selecting and implementing appropriate remedies can avoid or minimize the regulations that apply. For example, designating an area of contamination (AOC), managing waste within the AOC, and selecting in-situ treatment methods whenever possible are ways to avoid triggering the RCRA land disposal restrictions. Please refer to the NDEQ guidance document in Attachment 2-3 for more information on developing a RW plan.

2.3.6 Permitting and Regulatory Involvement

Permits and regulatory requirements are commonly associated with remedial actions. For example, a RCRA permit, order, RCRA Remedial Action Plan (RAP), or other enforceable mechanism may be required when conducting ex-situ treatment or management of waste outside of an AOC, or when using corrective action management units (CAMUs), temporary units (TUs), and staging piles. A Nebraska Title 129 permit may be required when construction activities or remediation systems, such as air stripping towers, cause or create contaminated airborne dust and vapors. Therefore, it is important to work with federal, state, and local agencies to identify and address all applicable permitting and regulatory issues.

There are two important issues that should be considered when obtaining a permit. First, obtaining a permit and complying with its terms means that the project is no longer strictly voluntary. Second, you will need to allow sufficient time to complete the permit process. If the VCP project is operating according to a relatively tight schedule, the time required to obtain a permit can significantly affect the timeframe for startup and/or completion of certain parts of the project.

This section should identify all applicable local, state, and federal permitting or regulatory requirements. Some permitting or regulatory requirements typically needed for remedial action are those for:

- Air discharge
- Solid waste disposal
- Groundwater well permits
- Surface water appropriations
- Injection or re-injection activities



- Discharge to surface water or sanitary sewers
- Local building, plumbing, or electrical permits
- Easements for sampling on public property
- Access agreements

You do not need to include copies of permits in the RAWP, but you should demonstrate that the regulatory framework has been considered in the remediation design.

Finally, you should include a statement in the RAWP that a site-specific Health and Safety Plan will be used for field activities associated with the remedial action.

2.3.7 Proposed Schedule of Remedial Actions

This section should contain the proposed schedule of remedial activities. The schedule should be in tabular format and contain a brief description of the activity, date of initiation, date of completion, and other relevant information.

If the intent is to move forward with remedial action implementation at a fairly fast pace, there are several things that should be considered. First, NDEQ should be notified before the remedial action is implemented. Second, the schedule should allow time for NDEQ to issue a 30-day public notice. Third, fast-moving schedules may be difficult to implement because the VCP process includes some NDEQ oversight and guidance. You can expedite this process by submitting a thorough, high-quality RAP. Finally, the regulatory issues identified in Section 2.3.6 can have a significant impact on the timing and overall construction schedule. To expedite the project, you should identify concurrent tasks and get NDEQ involved very early in the planning stage of these tasks.

2.4 TABLES

This section should include all tables referred to in the narrative of the RAP. The tables should appear in the order that they are mentioned in the RAP. They should be clearly labeled and prepared with an appropriate font size so that they are easily legible and understandable. Several example tables have been included in Appendix A to demonstrate how to effectively communicate tabulated information.

2.5 FIGURES

This section should include appropriate maps, cross sections, and other figures. They should appear in the order that they are mentioned in the RAP. All maps should include standard map information, including a north arrow, scale, and map legend. Similarly, cross sections should include vertical and horizontal scale bars and legends. All figures should be shown at an appropriate scale such that text, labels, and patterns are clearly legible. Ideally, maps should be superimposed on the site layout map. Several example figures have been included in Appendix A.

2.6 APPENDICES

The RAP should include appendices containing information collected during the investigation. Only one document or “type” of information should be provided per appendix. For example, monitoring well construction logs should be placed in a different appendix than the soil boring logs. Another example would be copies of previous investigation information or reports related to the facility (e.g., a LUST

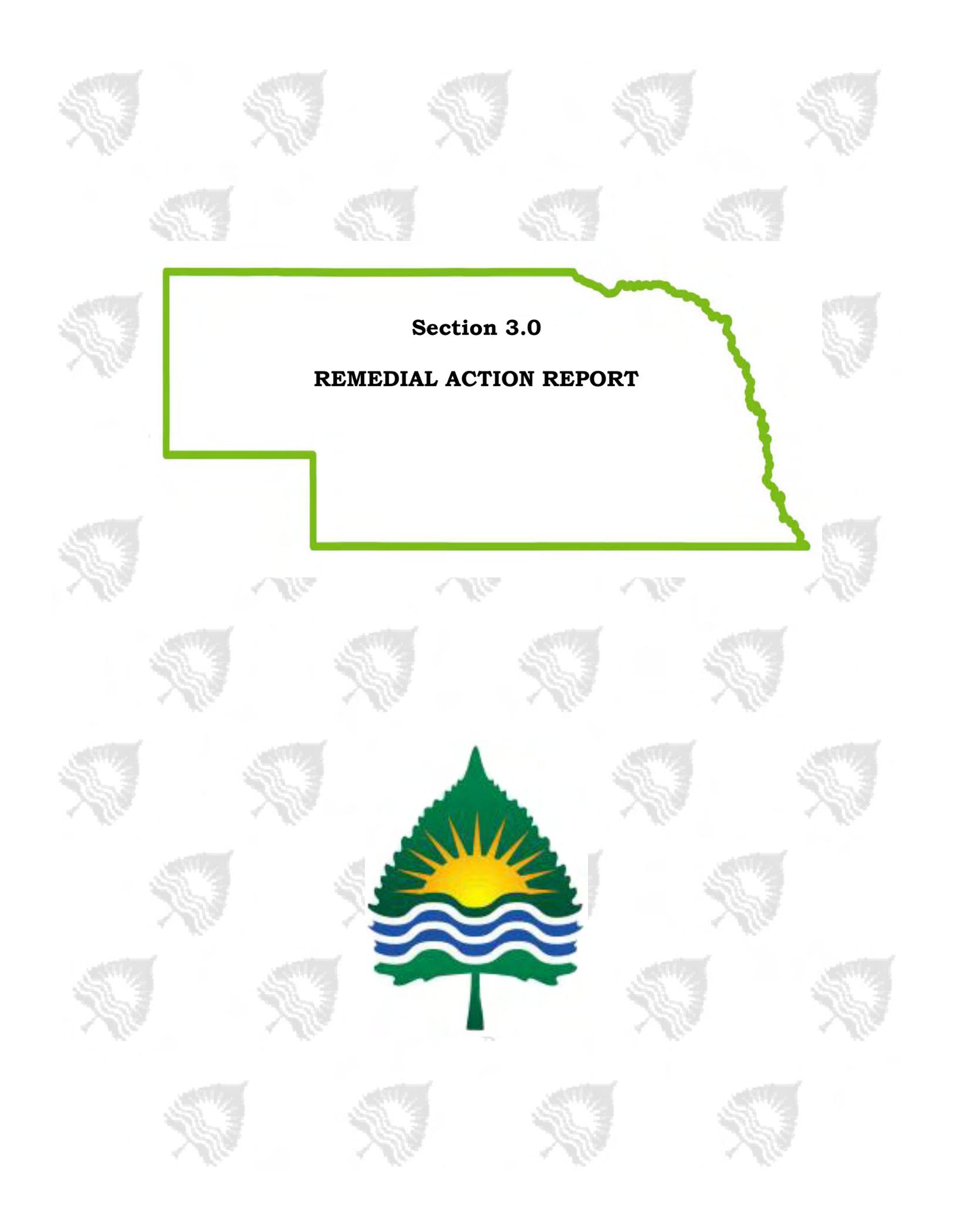




investigation report, Phase I or II environmental assessment report) placed into separate appendices. NDEQ recommends that numbered tab dividers be used between appendices for ease of review. The following material should be included, if applicable:

- Soil boring logs
- Monitoring well construction logs
- Complete results of field screening
- Analytical reports for all soil gas, groundwater, and soil data referred to in the report, including QA/QC results
- Data validation and usability summary
- Vadose zone or aquifer testing data and estimation calculations
- Flow modeling data, calculations, and results
- Photographic documentation of investigative activities
- Copies of log books, field sheets, chain-of-custody forms, or other supporting documentation for field sampling and analysis
- Copies of waste manifests, aerial photographs, and any other document used to identify suspected source areas or probable release areas at the site
- Copies of deeds and other property documentation
- Other applicable documentation of investigation findings
- QAPP used during the investigation





Section 3.0
REMEDIAL ACTION REPORT



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SECTION 3.0 REMEDIAL ACTION REPORT

INTRODUCTION

After remedial action is complete at the site, the applicant will submit a Remedial Action Report (RAR). The RAR is a stand-alone document that has three primary functions:

- 1) To document the remedial activities
- 2) To demonstrate that the Remedial Action Objectives (RAOs) described in the Remedial Action Plan (RAP) have been met
- 3) To identify any deviations from the RAP

This section of the guidance is designed to help facility owners and/or environmental consultants prepare a RAR to address these issues in a consistent and thorough manner. The RAR should include all of the information identified in sections 3.1 – 3.8 in the sequence listed in this guidance. At the end of the report, it should contain the appropriate figures, tables, and/or analytical results so that NDEQ and the public can understand and evaluate the conclusions of the RAR. The checklist at the end of this section should be used to make sure the RAR contains all the necessary information (see Attachment 3-1). The checklist should be completed and submitted as part of the RAR.

3.1 EXECUTIVE SUMMARY

The first part of the RAR should be an Executive Summary that presents an overview of the report. In this section you should do the following:

- State the RAOs
- Describe the remedial actions completed
- Explain any deviations from the remedial actions planned in the RAP
- Briefly demonstrate that the RAOs have been met
- Summarize the future land use plans and any institutional controls
- Describe any on-going performance monitoring that will continue at the site

The length of the executive summary will depend on the nature of contamination and the complexity of remedial actions at the site. However, a 2-3 page summary is generally recommended.

3.2 SITE SETTING, HISTORY, AND OPERATIONS

Since the RAR is meant to be a stand-alone document, it should include a brief summary of the setting, history, and operations of the site. Typically, you should include a 1-2 page summary of the following information:

- Identification of the property, the owner, and the consultants involved in developing the RAR



- Location, physical setting, and operational history of the site
- Findings of the investigation as reported in the RAP
- A brief summary of the site's VCP history, including the dates of application, submittal and approval of the RAP, and the beginning and ending of remedial actions

3.3 REMEDIAL ACTION OBJECTIVES

This section should state and explain the RAOs that were defined in the RAP. Refer to these RAOs in descriptions of remedial actions throughout the rest of the report.

3.4 OVERVIEW OF REMEDIAL ACTIONS

This section should contain an overview of the remedial actions conducted at the site. The overview should focus on important elements of the cleanup, including the remediation approach or approaches employed, the type(s) of remedial action(s) conducted, and the volumes of environmental media removed or treated.

The type of information to be provided in this section includes, but is not limited to:

- A table showing the chronology of events and remedial actions taken at the site
- A table providing the RGs selected as cleanup levels, including the RG for each COC, whether the RG represents a residential or commercial exposure, and the rationale for that selection.
- Extent, depth, and volume of soil excavated
- Total volume of soil treated and volumes of treatment chemicals used
- A figure showing areas of soil excavation or in-situ soil treatment
- Total volume of groundwater treated and volumes of treatment chemicals used
- Estimated volume of naturally attenuated contaminants
- Volume of remediation-derived waste generated, controlled, contained, transported, treated, and/or disposed
- Photographic logs of remedial activities
- Copies of relevant property deeds or other documentation of institutional controls implemented

The narrative should summarize the information and refer to the locations of the tables, figures, photos, and other documents in the RAR.



3.5 COMPLIANCE WITH RAOS

An important purpose of the RAR is to demonstrate that the RAOs described in the RAP have been achieved so that NDEQ can issue an NFA letter. To do this, you should present a summary of *all* environmental sampling and monitoring results collected during the time between approval of the RAP and submittal of the RAR. As part of the RAP, you should have developed a strategy for conducting these sampling and monitoring activities (see Section 2.3.3.7 of this guidance). These activities will vary from site-to-site. For example, if the monitoring strategy in the RAP included three years of quarterly sampling, all three years of data should be included in the RAR. In this section, provide a narrative to explain why the analytical results show that the RAOs have been achieved, and refer to the documents that contain this data. The analytical data should be documented at the same level of detail as data collected during the investigation. The following information should be included:

- Figures and maps showing sample locations and depths
- Summary of collection methods and dates and any supporting tables or figures
- Figures and maps showing post-remedial action conditions, such as groundwater potentiometric surface(s), remaining contamination, and/or remaining free-product
- Soil boring and monitoring well construction logs
- Table containing results of field screening
- Analytical results and reference to laboratory reports for soil or groundwater sampling, including target compounds and contaminant concentrations detected
- Summary of QA/QC results and reference to attached lab reports
- Table of data validation qualifiers
- Explanatory text and updated version of the CSM, with concentrations and locations of remaining contamination, if applicable. The CSM should demonstrate that all exposure pathways at the site have been eliminated.
- Previously submitted startup reports or monitoring reports
- Other information as appropriate for the implemented remedies to verify that RAOs have been achieved

The narrative should summarize the information and refer to the locations of supporting tables, figures, reports, and other documents in the RAR.

3.6 DEVIATIONS FROM RAP

If any deviations from the RAP are necessary after it has been approved, you should contact NDEQ as soon as possible. These deviations should be approved by NDEQ *prior* to submittal of the RAR. However, the review and approval of deviations will slow the overall process. You are encouraged to submit a complete and thorough RAP so that you can minimize the chance that you will need to request deviations later on.





If deviations from the RAP are approved by NDEQ, a revised RAP may be required and it may be necessary for NDEQ to reissue public notice of the changes. For example, if the deviation involves changing from a pump and treat cleanup system to chemically enhanced bioremediation, issuing a new public notice would likely be required. However, if the deviation was adding another groundwater extraction well to an existing pump and treat system, a new public notice would probably not be needed.

In this section of the RAR, you should include a summary of the timing and nature of deviations from the RAP. If changes to the proposed remedial action occurred, the following information should be included:

- Description and rationale for any changes to the proposed remedial action
- Copies of any correspondence with NDEQ concerning any of these changes

If there weren't any deviations to the remedial action, this section should state so.

3.7 DEVIATIONS IN PERFORMANCE MONITORING

For some sites, performance monitoring data will be collected and submitted in reports to NDEQ after the RAR has been approved and the NFA has been issued (see Section 2.3.4 of the RAP technical guidance). The monitoring plan will have been approved as part of the RAP; however, if changes to this plan are needed, these changes should be described in this section.

Update the monitoring strategy by including the following information:

- Explanation of new or modified sampling and monitoring objectives
- Explanation of new or modified sampling and monitoring methods
- Reference to maps showing new or modified monitoring and sampling locations
- Reference to cross sections and/or diagrams showing new or modified subsurface monitoring and sampling intervals
- Description of new or modified monitoring schedule
- Description of new or modified analytical parameters and reference to any supporting tables

If deviations from the RAP are approved by NDEQ, a revised RAP may be required and it may be necessary for NDEQ to reissue public notice of the changes. For example, a reduction in the number of wells sampled, the frequency of sampling, or a change in sampling parameters will likely require that a new public notice be published. However, a change in sampling methodology (e.g., changing from bailers to passive diffusion bag samplers) would likely not require a new public notice.

If there weren't any deviations to the monitoring strategy, this section should state so.



3.8 APPENDICES

Figures, tables, and other documents should be included in the appendices to support the description and documentation of remedial action. The tables should be clearly labeled and written so that they are easily legible and understandable. All maps should include standard map information, including a north arrow, graphical scale, and map legend. Cross sections should include vertical and horizontal scale bars and legends. All figures should be shown at an appropriate scale such that text, labels, and patterns are clearly legible. Only one document or “type” of information should be provided per appendix. NDEQ recommends that numbered tab dividers be used between appendices for ease of review.

The appendices should include:

- Analytical laboratory reports and chain-of-custody sheets
- Monitoring well construction information
- As-built diagrams of all remedial systems
- Maps of all site features such as ponds; parking lots; buildings; green space; and subsurface structures such as utilities, parking garages, basements, and tunnels
- Copies of any legal documents used for institutional controls
- Documentation of actions related to the disposal of water and/or soil waste generated as part of the remedial action



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ATTACHMENT 1-1

VOLUNTARY CLEANUP PROGRAM PROCESS FLOWCHART

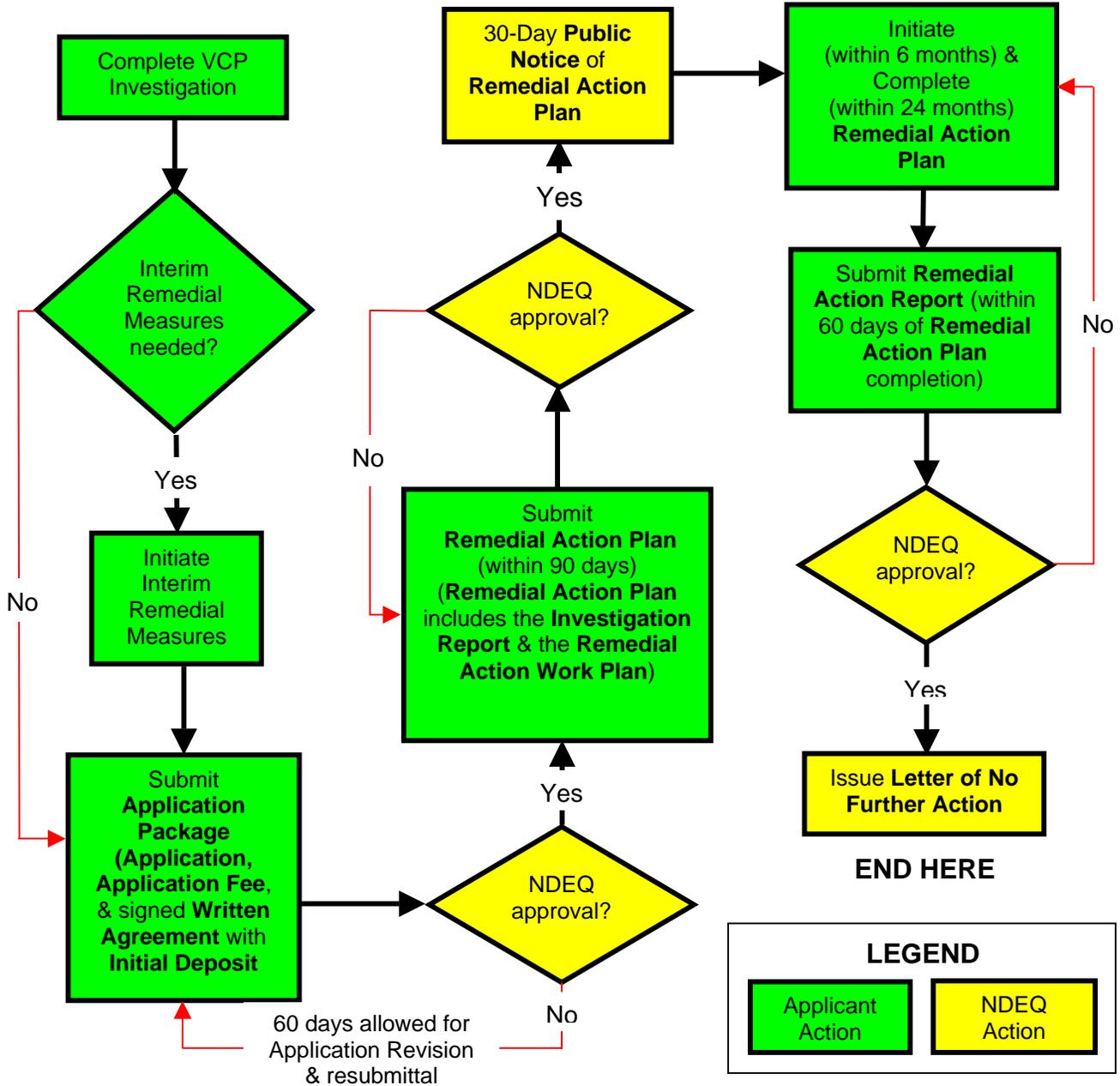
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Nebraska Department of Environmental Quality

Voluntary Cleanup Program (VCP) Process

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ATTACHMENT 1-2
APPLICATION FORM & INSTRUCTIONS

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Nebraska Department of Environmental Quality

Remedial Action Plan Monitoring Act Application Form and Instructions for Participation in the Voluntary Cleanup Program

INSTRUCTIONS

Please type or print legibly. Incomplete applications and/or applications not accompanied by the non-refundable \$5,000 application fee and the signed Written Agreement with the \$5,000 initial deposit, will be returned to the applicant. If any of the information requested is not applicable, enter "NA" in the blank provided.

More detailed instructions and a list of abbreviations follow the application form.

SECTION A – SITE INFORMATION

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

County: _____

Latitude: _____ Longitude: _____

Latitude/Longitude Source: _____

Latitude/Longitude Reference Location (e.g., center of property): _____

Quarter (10 acre) _____ Quarter (40 acre) _____ Quarter (160 acre) _____

Section _____ Township _____ Range _____

Lot or Subdivision (if applicable): _____

Property Size (acres): _____

Current Land Use: _____

Future Land Use: _____

Will this project protect human health and the environment? Yes No Please explain.

Will this project promote economic development? Yes No Please explain.

Will this project enable the creation or, preservation of, or addition to parks, greenways, undeveloped property, other recreational property, or other property used for nonprofit purposes? Yes No Please explain.



Attach a map or site diagram.

SECTION B – APPLICANT INFORMATION

Name: _____ Title: _____
 Organization: _____
 Address: _____
 City: _____ State: _____ Zip: _____
 Telephone: _____ Fax: _____
 E-mail: _____
 Applicant's Relationship to or Interest in the Site: _____

SECTION C – OWNER INFORMATION

If Applicant is Facility Owner, check box and skip to Land Owner subsection (below).

Facility Owner

Name: _____ Title: _____
 Organization: _____
 Address: _____
 City: _____ State: _____ Zip: _____
 Telephone: _____ Fax: _____
 E-mail: _____

If Applicant is Land Owner, check box and skip to Section D.

Land Owner

Name: _____ Title: _____
 Organization: _____
 Address: _____
 City: _____ State: _____ Zip: _____
 Telephone: _____ Fax: _____
 E-mail: _____

SECTION D – DESIGNATED POINT OF CONTACT

If Applicant is Designated Point of Contact, check box and skip to Section E.

Name: _____ Title: _____
 Organization: _____
 Address: _____
 City: _____ State: _____ Zip: _____
 Telephone: _____ Fax: _____
 E-mail: _____

SECTION E – NATURE OF POTENTIAL CONTAMINATION

Current and historical land use with corresponding years of operation and dates of known releases

Check all known or potential sources of contamination on site:

Feature and land use	Dates of operation
<input type="checkbox"/> Aboveground Storage Tank	_____
<input type="checkbox"/> Underground Storage Tank	_____
<input type="checkbox"/> Drum	_____
<input type="checkbox"/> Other Container	_____
<input type="checkbox"/> Aboveground Pipeline	_____
<input type="checkbox"/> Underground Pipeline	_____
<input type="checkbox"/> Lagoon or Pond	_____
<input type="checkbox"/> Seepage Pit or Dry Well	_____
<input type="checkbox"/> Septic Tank or Lateral Field	_____
<input type="checkbox"/> Surface Spill or Discharge	_____
<input type="checkbox"/> Adjacent Property	_____
<input type="checkbox"/> Drip Tank	_____
<input type="checkbox"/> Pit	_____
<input type="checkbox"/> Grain Storage Facility	_____
<input type="checkbox"/> Formerly Used Defense Site	_____
<input type="checkbox"/> Salvage Yard	_____
<input type="checkbox"/> Dry Cleaners	_____
<input type="checkbox"/> Landfill	_____
<input type="checkbox"/> Former Manufactured Gas Plant	_____
<input type="checkbox"/> Gas Station	_____
<input type="checkbox"/> Methamphetamine Laboratory	_____
<input type="checkbox"/> Mine Scarred Land	_____
<input type="checkbox"/> Source Unknown	_____
<input type="checkbox"/> Other	_____

Check all known chemical products, hazardous substances, pollutants or contaminants used, managed or released, on site:

<input type="checkbox"/> Acids/Bases	<input type="checkbox"/> Paint/Paint Wastes	<input type="checkbox"/> Sludge
<input type="checkbox"/> Fertilizers	<input type="checkbox"/> PCBs	<input type="checkbox"/> Solvents/Degreasers
<input type="checkbox"/> Inorganics	<input type="checkbox"/> Pesticides	<input type="checkbox"/> Fumigants
<input type="checkbox"/> Metals	<input type="checkbox"/> Petroleum Products	<input type="checkbox"/> Other _____

Check all known and potentially contaminated media on site:

Surface Soil (0-3')	<input type="checkbox"/> Confirmed	<input type="checkbox"/> Potential
Subsurface Soil	<input type="checkbox"/> Confirmed	<input type="checkbox"/> Potential
Surface Water	<input type="checkbox"/> Confirmed	<input type="checkbox"/> Potential
Sediment	<input type="checkbox"/> Confirmed	<input type="checkbox"/> Potential
Groundwater	<input type="checkbox"/> Confirmed	<input type="checkbox"/> Potential

Identify known contaminants, maximum concentration detected, and media impacted (attach additional pages as needed):

<i>Contaminant</i>	<i>Maximum Concentration</i>	<i>Units</i>	<i>Media</i>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

SECTION F – REGULATORY HISTORY

1. Does the property meet the following CERCLA §101(39) brownfield site definition? Yes No Unknown
 “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.”
2. Is or was the property, or any part thereof, a permitted or interim status hazardous waste management facility regulated under RCRA? If so, complete the permit information at the end of this section. Yes No Unknown
3. Has a CERCLA investigation (Preliminary Assessment and/or Site Inspection) been conducted at the property? If so, provide explanation at the end of this section. Yes No Unknown
4. Is the property subject to a planned, or ongoing CERCLA removal action? Has a CERCLA removal occurred at the site? If so, provide explanation at the end of this section Yes No Unknown
5. Is or was the property, or any part thereof, investigated for, proposed for, or listed on the Superfund National Priorities List, as established under CERCLA? If so, provide explanation at the end of this section. Yes No Unknown
6. Is or was the property, or any part thereof, subject to (enforcement action) a unilateral administrative order, court order, administrative order on consent, or consent decree under CERCLA? If so, provide explanation at the end of this section. Yes No Unknown
7. Is or was the property, or any part thereof, subject to (enforcement action) a unilateral administrative order, court order, administrative order on consent, consent decree, or permit under RCRA, CWA, TSCA or SWDA? If so, provide explanation at the end of this section. Yes No Unknown
8. Is or was the property, or any part thereof, subject to enforcement action under city, county, state, federal or other environmental laws? If so, provide explanation at the end of this section. Yes No Unknown
9. Is or was the property, or any part thereof, the subject to corrective action under RCRA 3004(u) or 3008(h) to which a corrective action permit or order has been issued or modified requiring the implementation of corrective measures? If so, provide explanation at the end of this section. Yes No Unknown

10. Is or was the property, or any part thereof, the subject of environmental orders or agreements with city, county, state, or federal environmental agencies? If so, provide explanation at the end of this section. Yes No Unknown
11. Is or was the property, or any part thereof, a land disposal unit(s) with closure notification submitted and closure plan or permit? If so, provide explanation at the end of this section. Yes No Unknown
12. Is or was the property, or any part thereof, subject to the jurisdiction, custody, or control of federal government? If so, provide explanation at the end of this section. Yes No Unknown
13. Does or did the property, or any part thereof, have PCB contamination subject to remediation under TSCA? If so, provide explanation at the end of this section. Yes No Unknown
14. Has the property owner received assistance from the EPA Leaking Underground Storage Tank program for a response activity on this property, or any part thereof? Yes No Unknown
15. Are or were activities conducted at the property, or any part thereof, requiring classification as a Nebraska or EPA Hazardous Waste Generator? If so, provide the hazardous waste generator identification number at the end of this section. Yes No Unknown
16. Has the property ever been a Nebraska Title 118 investigation site? Yes No Unknown

Use the following space for additional information related to the questions listed in Section F. Begin answers with the question number to which it relates. List any identification numbers and permits, with dates of permit issuance and expiration.:

SECTION G – INVESTIGATION/REMEDIAL ACTION STATUS

Identify the type of environmental investigations performed to date at the site.

Date	Title	Type of Investigation	Investigator

Does contamination at the site pose an immediate risk to human health or the environment? Yes No Unknown

Does contamination at the site impact or threaten to impact public or private drinking water supplies? Yes No Unknown

Identify and briefly describe any institutional controls that are already in place or proposed for the site.

Identify any other remedial actions already implemented at the site.

SECTION H – ACCESS

The undersigned certify that the applicant holds or can acquire title to all lands or Yes No has the necessary easements and right-of-way for the project and related lands.

Facility Owner Signature: _____ Date: _____

Land Owner Signature: _____ Date: _____

SECTION I – VERIFICATION

I verify that the foregoing information on this application and accompanying documents, estimates, and schedules is true and accurate to the best of my knowledge and belief. I understand that participation in the Voluntary Cleanup Program is voluntary, and I agree to comply with all state and federal standards and regulations.

I also verify that if additional funds beyond the fee submitted with this application are required to cover oversight costs for NDEQ, I will provide these additional funds.

Applicant
(signature required)

Date

SECTION J– APPLICATION SUBMITTAL

\$5,000 NON-REFUNDABLE APPLICATION FEE ATTACHED Yes No

SIGNED WRITTEN AGREEMENT ATTACHED Yes No

\$5,000 REFUNDABLE INITIAL DEPOSIT ATTACHED Yes No

Return completed application, application fee, written agreement and initial deposit, and any other attachments to:

**Nebraska Department of Environmental Quality
Suite 400, 1200 N Street, The Atrium
P.O. Box 98922
Lincoln, NE 68509-8922**

Attention: Remediation Section

If you have questions or need additional information, please call the VCP Coordinator at (402) 471-6411.

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Application Instructions

SECTION A – SITE INFORMATION

Name	Provide the site name. If the site is unnamed, provide a reference name based on the owner's name, current or historical operations, or the site location
Address	Provide the site location, including the site street address, city, state and zip code as well as county name. Provide latitude and longitude, source of lat./long. (7 1/2 min. Quad. Map, GPS coordinate, etc.) and reference location from which the lat./long. coordinate are taken (center of property, entrance, etc.). Provide the legal description along with subdivision and lot if applicable. Provide the approximate property acreage.
Current Land Use	Provide a summary of current business operations on site, with an emphasis on identifying possible contaminant source areas. If operations have ceased at the site, provide the date.
Future Land Use	Describe the intended future use of the property.
Health & Environment Protectiveness, Economic Development Promotion & Greenspace Creation	Explain if the project will be protective of human health and the environment, will promote economic development, and/or will enable the creation or, preservation of, or addition to park, greenways, undeveloped property, or other recreational property, or other property used for nonprofit purposes. This information is necessary to determine financial assistance eligibility on a site-by site basis to otherwise excluded CERCLA §101(39) brownfield sites.
Map	Attach a site map or diagram that includes the entire area to be addressed under the VCP and that clearly identifies site boundaries. Include a map that identifies known or suspected primary source areas, such as process and storage areas, and secondary source areas, such as contaminated soils.

SECTION B – APPLICANT INFORMATION

Name/Title	Provide the name of the individual completing the application to the VCP. Provide the applicant's title as representative.
Organization	Provide the name of the organization represented by the applicant.
Address/Telephone	Provide the applicant's mailing address and direct telephone number. Provide the applicant's fax number and e-mail address, if available.
Applicant's Relationship	Describe the applicant's relationship to or interest in the site. State whether the applicant is a current, past, or prospective owner of the site; is a current, past, or prospective facility operator on the site; has disposed of contaminants on the site; or has acquired the site by default, as through bankruptcy, tax delinquency, or abandonment.

SECTION C – OWNER INFORMATION

Owner Information If the applicant is not the owner of the land or facility, provide the owner contact information as described above under Section B.

SECTION D – DESIGNATED POINT OF CONTACT

Contact Information Provide contact information for the person who will be the designated point of contact for the site.

SECTION E – NATURE OF POTENTIAL CONTAMINATION

Current & Historic Land Use;
Sources of Contamination Provide a summary of current and historical business operations on site, with an emphasis on identifying possible contaminant source areas. Check the boxes identifying all known or suspected facility operations that could have been a sources of contamination on site. Provide the dates/years during which specific activities were conducted. Provide the dates of operation for each

Chemical Products Check the boxes indicating the general categories of chemical products or hazardous substances, pollutants or contaminants used, managed, stored, handled, released, or disposed on site. Check boxes for all categories applicable to the site, even if the chemical category is not known to be a source of contamination. If an applicable chemical category is not provided, check the “Other” box and list the applicable chemical products, hazardous substances, pollutants or contaminants.

Contaminated Media Check the boxes indicating the environmental media confirmed to be contaminated on site. If a medium is identified as potentially contaminated, check the box to indicate that the contamination is potentially present. Surface soils are defined as 0-3’ below ground surface.

Contaminants’ Information Identify all known contaminants, the maximum concentration of each contaminant detected (with measurement units), and the media impacted by each contaminant. Provide additional pages if necessary.

SECTION F – REGULATORY HISTORY & BROWNFIELD FUNDING ELIGIBILITY

Questions posed offer insight into the regulatory history of the property. They also help determine property eligibility for EPA Brownfield financial assistance. Extra space is provided at the end of this section for additional details; specify respective question numbers.

Brownfield Definition Check the box indicating whether the property meets the definition of a brownfield site as defined by CERCLA §101(39)

RCRA Check the box indicating whether the property has, or has ever had, a RCRA permit or RCRA interim status. If the answer is yes, please provide the following information at the end of the section: (1) the type of units; (2) the EPA identification number; (3) if applicable, the date the permit was issued; and (4) the permit expiration date.

CERCLA Investigation	Check the box indicating whether any investigations have been conducted relative to the property under CERCLA, also referred to as Superfund. EPA, the State of Nebraska, or their contractors typically conduct these Preliminary Assessments, Site Inspections, and Expanded Site Investigations.
CERCLA Removal	Check the box indicating whether any removal actions have been conducted, are planned or ongoing relative to the property under CERCLA. EPA typically conducts such removals.
NPL Listing	Check the box indicating whether the property, or any portion of the property, has ever been listed or proposed for listing on the NPL established under CERCLA. Contaminated sites that have been listed on the NPL are usually referred to as Superfund sites.
CERCLA Enforcement Action	Check the box indicating whether the property, or any part thereof, is currently or has previously been subject to an enforcement action pursuant to CERCLA. Enforcement actions may include unilateral administrative orders, court orders, administrative orders on consent, or consent decrees under CERCLA.
RCRA, CWA, TSCA or SWDA Enforcement Action	Check the box indicating whether the property, or any part thereof, is currently or has previously been subject to an enforcement action pursuant to RCRA, CWA, TSCA or SWDA. Enforcement actions may include unilateral administrative orders, court orders, administrative orders on consent, consent decrees or permits under these specific federal laws.
Environmental Enforcement Action	Check the box indicating whether the property, or any part thereof, is currently or has previously been subject to an enforcement action pursuant to city, county, state, or federal environmental laws (not previously mentioned). Enforcement actions include orders and civil lawsuits issued by government entities that require remedial action for non-compliance with environmental laws.
RCRA Corrective Action	Check the box indicating whether the property, or any part thereof, is currently or has previously been subject to a corrective action under RCRA 3004(u) or 3008(h) to which a corrective action permit or order has been issued or modified requiring the implementation of corrective measures.
Orders or Agreements	Check the box indicating whether the property, or any part thereof, is currently or has previously been subject of environmental orders or agreements with city, county, state, or federal environmental agencies.
Land Disposal	Check the box indicating whether the property, or any part thereof, is currently or has previously been, a land disposal unit(s) with closure notification submitted and closure plan or permit.
General	Check the box indicating whether the property, or any part thereof, is currently or has previously been subject to the jurisdiction, custody, or control of the federal government.
PCB	Check the box indicating whether the property, or any part thereof, has PCB contamination subject to remediation under TSCA.

LUST	Check the box indicating whether the property owner has received assistance from the EPA Leaking Underground Storage Tank program for a response activity relative to this property, or any part thereof.
Waste Generator	Check the box indicating whether any past or current activities conducted on site require classification as an EPA or Nebraska Hazardous Waste Generator. If the facility or operation on the site was or is classified as a hazardous waste generator, provide the identification number in the blank provided.
Title 118	Check the box indicating whether the site has ever been the subject of a Nebraska Title 118 groundwater investigation.
Orders or Agreements	Check the box indicating whether the site is currently subject to an environmental order or agreement with a city, county, state, or federal government agency. This question does not pertain to permits issued by governmental entities to conduct regulated activities at a site. Examples of agreements include consent, interim, and letter agreements.

SECTION G – INVESTIGATION/REMEDIAL ACTION STATUS

Investigations Performed	Identify the dates, titles, and types of investigations performed to date.
Risk to Health/Environment	Check the box indicating whether contamination at the site poses an immediate risk to human health or the environment.
Risk to Water Supply	Check the box indicating whether contamination at the site currently impacts or threatens to impact public or private drinking water supplies.
Institutional Controls	Identify and describe any institutional controls, already in place or proposed for the site. Institutional controls are intended to restrict land use or notify potential landowners of contamination or land use concerns. Institutional controls may include government controls (such as zoning laws and ordinances), legal controls (such as restrictive covenants and deed notices), and informational controls (such as public notices and warnings).
Remedial Actions	Identify and describe any remedial actions already implemented at the site. These may include interim remedial actions, removals, engineering controls and/or long term monitoring.

SECTION H – ACCESS AGREEMENT

Owner Signature	The owner of the site must sign the access agreement to certify that the applicant holds or can acquire title to the property in order to complete the project as required by the RAPMA statute, or has the necessary easements and right-of-way for the project and related lands. The facility owner's signature indicates that they have knowledge of the intended project and approve access for the purposes of completing the project.
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ATTACHMENT 1-3

EXAMPLE WRITTEN AGREEMENT

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BEFORE THE NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY

IN THE MATTER OF) **RAPMA**
ABC BROWNFIELD SITE) **Project Number**
AND XYZ COMPANY) **36-336-49XX**

MEMORANDUM OF AGREEMENT

This Memorandum of Agreement (Agreement) is entered into voluntarily by X-Ray Yankee Zulu Company (XYZ Co.) pursuant to the authority vested in the Department of Environmental Quality (DEQ) by the Remedial Action Plan Monitoring Act (RAPMA), Neb. Rev. Stat. § 81-15,181 et seq. (Reissue 2000), the Nebraska Environmental Protection Act (NEPA), Neb. Rev. Stat. § 81-1501 et seq. (Reissue 1999, Cum. Supp. 2002), and all rules and regulations promulgated thereunder.

FINDINGS

1. The DEQ is the agency of the State of Nebraska authorized pursuant to Neb. Rev. Stat. § 81-1504(1) to exercise exclusive general supervision, administration, and enforcement of NEPA, and all rules, regulations, and orders promulgated thereunder, including the issuance of orders requiring the adoption of remedial action to prevent, control, or abate land and water pollution, and to encourage voluntary cooperation by persons to achieve the purposes of NEPA. The DEQ is further authorized pursuant to Neb. Rev. Stat. §§ 81-15,183 through 81-15,185 to administer RAPMA.
2. XYZ Co., a Nebraska Corporation, with principal offices at 1234 Main Street, Suite 100, Omaha, Nebraska, is the party executing this Agreement. XYZ Co. is a "person" within the meaning of Neb. Rev. Stat. § 81-1502(10).
3. The property that is the subject of this Agreement is located at 5678 East Oak Street, in Lincoln, Lancaster County, Nebraska, and is part of the Southwest Quarter of the Northeast Quarter of Section 15, Township 10 North, Range 6 East, more particularly described as, Lots 1 through 8, Block 7 (the Site). The Site encompasses one city block, approximately 3.2 acres.
4. XYZ Co. has conducted an environmental investigation of the Site and has submitted information to the DEQ that evidences that "land pollution," as defined by Neb. Rev. Stat. § 81-15,182(1), and "water pollution," as defined by Neb. Rev. Stat. § 81-15,182(2), exists at the Site.
5. Pursuant to Neb. Rev. Stat. § 81-15,184, XYZ Co. has submitted to the DEQ an application for oversight of the remedial action it plans to conduct at the Site, as well as a nonrefundable application fee of \$5,000. In addition, XYZ Co. has posted an initial deposit of \$5,000 to be used by the DEQ to cover the DEQ's direct and indirect costs related to technical review, oversight, guidance, and other activities associated with remedial action at the Site. The DEQ shall review and approve or deny the application and notify XYZ Co. in writing. If the application is denied, the notification will state the reason for the denial. If the DEQ determines that an application does not contain adequate information, the DEQ shall return the application to XYZ Co. XYZ Co. will have sixty (60) days to resubmit the required information or the application will be deemed denied.

AGREEMENT

6. The intent of this Agreement is to allow XYZ Co. to voluntarily conduct remedial action in accordance with RAPMA and to seek a determination from the DEQ that no further remedial action is required at the Site pursuant to Paragraph 23 of this Agreement.
7. XYZ Co. agrees to perform all remedial action at the Site in accordance with NEPA and all rules and regulations promulgated thereunder. XYZ Co. shall be responsible for obtaining any necessary permits, licenses, access and other authorizations required under this Agreement. Nothing in this Agreement shall be deemed to impose any additional liabilities or obligations on XYZ Co., other than those specifically stated herein. Nothing shall relieve XYZ Co. from complying with all other applicable federal, state and local laws, rules and regulations.
8. XYZ Co. agrees to maintain insurance coverage, including self-insurance, sufficient to cover any potential risks to XYZ Co.'s employees, agents, and contractors, performing the actions under this Agreement.
9. Nothing in this Agreement, including any document the DEQ issues as agreed to herein, shall be interpreted to constitute a release or waiver of liability for any of the conditions which existed at the Site before, during, or after execution of this Agreement nor limit the DEQ's authority to respond to such conditions. DEQ shall have the authority to respond to such conditions in addition to requiring further remedial action from XYZ Co. under the circumstances described in Paragraph 23 of this Agreement. XYZ Co. reserves the right to raise any and all defenses, to any action brought by DEQ for conditions that existed on the Site prior to acquisition by XYZ Co.
10. XYZ Co. neither admits nor denies that it caused land or water pollution at the Site in violation of Neb. Rev. Stat. § 81-1506(1)(a), but agrees that DEQ may file an action against XYZ Co. if it fails to comply with or terminates this Agreement. XYZ Co. waives any affirmative defenses regarding jurisdiction. However, nothing in this Agreement shall constitute a waiver of XYZ Co.'s right to contest the authority of the DEQ to take any enforcement action against XYZ Co., other than an action to enforce this Agreement.
11. Remedial Action Plan. Within ninety days of approval of the application, XYZ Co. shall provide to DEQ a complete Remedial Action Plan (RAP) for the proposed project that conforms to all federal and state environmental standards and substantive requirements and that is subject to review and approval of the DEQ. DEQ approval shall be void upon failure to comply with the approved RAP or willful submission of false, inaccurate, or misleading information by XYZ Co. DEQ shall not commence technical review, oversight, guidance, or other activities associated with the RAP until this Agreement is executed and XYZ Co. has submitted a complete RAP to the DEQ.

The RAP shall, at a minimum, include the following:

- a. Documentation regarding the investigation of land pollution or water pollution including, when appropriate, information indicating that XYZ Co. holds or can acquire title to all lands or has the necessary easements and rights-of-way for the project and related lands;
- b. A Remedial Action Work Plan which describes the remedial action measures to be taken to address the land or water pollution; and

- c. Project monitoring reports, appropriate engineering, scientific, and financial feasibility data, and other data and information as may be required by the DEQ.

New information about the presence of land pollution or water pollution at the Site may require additional action. Therefore, XYZ Co. shall submit any subsequent work plans on a schedule agreed to by XYZ Co. and the DEQ.

12. If XYZ Co. believes any such data or information is protected by a privilege, it will retain the data and information and notify the DEQ of the nature of the document and the privilege claimed. XYZ Co. may also request that the DEQ keep data or information contained in any submission confidential, pursuant to Title 115 - Rules of Practice and Procedure.
13. Upon receipt of the RAP, the DEQ shall review and approve or disapprove the RAP and notify XYZ Co. of its decision in writing. If the RAP is disapproved, the notification shall state the reason for disapproval. DEQ will provide XYZ Co. an opportunity to resubmit the RAP.

If the DEQ intends to approve the RAP, DEQ shall issue a public notice of its intent pursuant to § 81-15,185 in a local newspaper of general circulation in the area affected and make the RAP available to the public. The public shall have thirty days from the date of publication during which any person may submit written comments to the DEQ regarding the proposed remedial action. Such person may also request or petition the Director of Environmental Quality, in writing, for a hearing and state the nature of the issues to be raised. The Director shall hold a public hearing if the comments, request, or petition raise legal, policy, or discretionary questions of general application and significant public interest exists.

Within six (6) months after the RAP is approved by the DEQ, XYZ Co. shall begin implementation of the RAP. The RAP shall be completed within twenty-four (24) months of approval by the DEQ, excluding long-term operation, maintenance, and monitoring activity, unless the DEQ grants an extension of time. An approved RAP is not enforceable unless the DEQ can demonstrate that the applicant has failed to fully implement the approved RAP. The DEQ may require further action if such action is authorized by other state statutes administered by the DEQ.

14. The DEQ and its authorized representatives and contractors shall have access at all reasonable times to the Site and any related lands, to the extent access is controlled by or granted to XYZ Co. for the purpose of conducting technical review, oversight, guidance, or other activities associated with remedial action at the Site.
15. XYZ Co. shall notify the DEQ at least ten (10) days before any scheduled well drilling, installation of equipment, or sampling for the purpose of affording the DEQ the opportunity to collect split samples. If either party is collecting samples, the other party or its authorized representative shall be allowed to take split samples of all samples collected.
16. In addition to any other obligation required by law, XYZ Co. shall notify the DEQ immediately upon knowledge of any condition posing an immediate threat to human health and welfare or the environment. In the event that any action or occurrence under this Agreement causes or threatens an emergency situation or presents an imminent threat to human health or welfare or the environment, XYZ Co. shall promptly take all appropriate action to prevent, abate, or minimize such emergency or imminent threat in accordance with applicable law. Nothing in this paragraph shall be deemed to limit the authority of the DEQ or State of Nebraska to take, direct, or order all

appropriate action to protect human health and the environment or to prevent, abate, respond to, or minimize an actual or threatened release from the Site.

17. Unless otherwise directed by the DEQ, XYZ Co. shall submit two copies of all documents required by this Agreement to the person identified below, who shall be DEQ's contact for the Site and for all matters concerning this Agreement:

Steve Kemp
Nebraska Department of Environmental Quality
P.O. Box 98922
1200 "N" Street, Suite 400
Lincoln, NE 68509-8922
Phone: (402) 471-6411
Fax: (402) 471-2909
E-mail: steve.kemp@ndeq.state.ne.us

18. Unless otherwise directed, the contact for XYZ Co. for all matters concerning this Agreement shall be:

John Doe
XYZ Company
1234 Main Street, Suite 100
Omaha, NE 68123-0100
Phone: (402) 123-4567
Fax: (402) 123-9876
E-mail: jdoe@xyzco.com

19. If the costs incurred by DEQ exceed the initial deposit, an additional amount agreed upon by the DEQ and XYZ Co. may be required prior to proceeding. The DEQ shall prepare a summary of all costs and submit an invoice to XYZ Co. Within thirty (30) days of receiving the invoice, XYZ Co. shall submit to the DEQ a check payable to the "Department of Environmental Quality, State of Nebraska" for the amount of the invoice. XYZ Co. will not be released from their obligations under this Agreement until all DEQ costs are paid. Any balance of funds remaining after the mutual termination of this Agreement shall be refunded to XYZ Co. by the DEQ.

20. XYZ Co. may terminate this Agreement provided XYZ Co.:

- a. Notifies the DEQ in writing of its intention to terminate this Agreement;
- b. Submits to the DEQ full payment of any outstanding costs incurred by the DEQ pursuant to this Agreement; and
- c. Leaves the property in no worse condition, from a human health and environment perspective, than when XYZ Co. initiated this Agreement.

21. The DEQ will cease review of any submittals under this Agreement on the date it receives XYZ Co.'s written notice of intent to terminate. The DEQ will then prepare a summary of all costs and provide it to XYZ Co. Once the DEQ determines that XYZ Co. has fully complied with all the requirements set forth in (a) through (c) above, the Agreement shall be deemed terminated. The DEQ reserves the right to unilaterally terminate this Agreement if XYZ Co.:

- a. Violates any terms or conditions or fails to fulfill any obligations of the RAP, including submission of an acceptable RAP within a reasonable period of time;
- b. Fails to address an imminent and significant harm to public health and welfare or the environment in a timely and effective manner;
- c. Fails to initiate the RAP within six (6) months after approval by the DEQ;
- d. Fails to complete the RAP within twenty-four (24) months after approval by the DEQ, excluding long-term operation, maintenance, and monitoring activity, unless the DEQ grants an extension of time; and
- e. Violates any terms or conditions of this Agreement.

The DEQ shall notify XYZ Co. in writing of its intention to terminate this Agreement and include the reason for termination. The DEQ will also include a summary of all outstanding costs owed to the DEQ. The DEQ reserves the right to suspend this Agreement for any reason. The DEQ will not consider any of the unapproved work performed during any suspension to be eligible for consideration under RAPMA.

22. Within sixty (60) days after completion of the RAP, XYZ Co. shall schedule and conduct a pre-certification inspection to be attended by XYZ Co. and the DEQ. If the pre-certification inspection is satisfactory, XYZ Co. shall submit to the DEQ a Final Remedial Action Report within thirty (30) days, including certification by a registered professional engineer that the RAP has been completed in material satisfaction of the requirements of this Agreement.. If the pre-certification inspection is unsatisfactory, the DEQ shall, acting reasonably, identify any additional remedial actions necessary to satisfy this Agreement. XYZ Co. shall perform any additional remedial actions identified by DEQ prior to the submission of the Final Remedial Action Report.
23. Provided that XYZ Co.: (1) completes the remedial action in accordance with the RAP; (2) is in compliance with all provisions of this Agreement; (3) is in compliance with all state and federal laws, rules and regulations; (4) agrees to impose and enforce any institutional controls the parties mutually deem appropriate and necessary at the Site; and (5) has remitted all outstanding costs to the DEQ, the DEQ may issue a letter to XYZ Co. a letter stating that no further action need be taken at the Site related to any land pollution or water pollution for which remedial action has been taken in accordance with the RAP. Such letter shall provide that the DEQ may require XYZ Co. to conduct additional remedial action in the event that any monitoring conducted at or near the Site or other circumstance indicates that (a) contamination is reoccurring, (b) additional contamination is present which was not previously identified under RAPMA, or (c) additional contamination is present for which remedial action was not taken according to the RAP. As a condition of issuance of the no further action letter, the DEQ may require payment of ongoing direct and indirect costs of oversight of any ongoing long-term operation, maintenance, and monitoring at the Site.
24. This Agreement shall not be construed as an acceptance of liability by the State of Nebraska for activities conducted pursuant to RAPMA. XYZ Co., who is proceeding under RAPMA shall indemnify and hold harmless the State of Nebraska for any further action required by the federal Environmental Protection Agency relating to land pollution or water pollution by XYZ Co. for the remedial action.

25. This Agreement shall be governed and interpreted under the laws of the State of Nebraska. The powers conferred by the RAPMA shall be independent of and in addition and supplemental to any other provisions of the laws of the State of Nebraska with reference to the matters covered hereby, and the act shall be considered as a complete and independent act and not as amendatory of or limited by any other provision of the laws of the State of Nebraska.
26. This Agreement shall be binding on each party, its successors and assignees subject to the right of termination in Paragraphs 20 and 21. No change in the ownership or corporate or business status of any party, or of the Site shall alter any signatory's responsibilities under this Agreement.
27. By entering into this Agreement, XYZ Co. certifies that, to the best of its knowledge and belief, it has fully and accurately disclosed to the DEQ all information known to XYZ Co. and to the best of its knowledge and belief, disclosed information in the possession or control of its officers, employees, contractors and agents which relates in any way to any existing land or water pollution or any past or potential future release of hazardous substances, pollutants or contaminants at or from the Site. This Agreement shall be null and void upon willful submission of false, inaccurate, or misleading information by XYZ Co.
28. This Agreement shall become effective upon execution by both parties and may only be modified or amended by an agreement in writing signed by both parties.
29. Signatures. The undersigned representatives of the parties certify that they are fully authorized to enter into the terms and conditions of this Agreement.

NEBRASKA DEPARTMENT OF
ENVIRONMENTAL QUALITY

Date: _____ By: _____

(PERSON)

Date: _____ By: _____

Title

ATTACHMENT 1-4
EXAMPLE PUBLIC NOTICE & FACT SHEET

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Notice of a Public Comment for Formal Approval for the Remedial Action Plan

For the XYZ Company Site at 5678 Oak Street – Hometown, NE

Beginning March 1, 2005 and Ending March 30, 2005

In accordance with Chapter 11 of Title 118, the Nebraska Department of Environmental Quality (NDEQ) requests public comment on the Remedial Action Plan (RAP) for the remediation of the XYZ Company Site located at 5678 Oak Street in Hometown, Nebraska. This RAP was received by the NDEQ on January 17, 2005 and will be available for review at the locations provided below from March 1, 2005 to March 30, 2005.

Soil and groundwater at the Site are contaminated with a grain fumigant (carbon tetrachloride) and a common industrial solvent (trichloroethylene). The RAP proposes:

1. To use soil vapor extraction to cleanup the soil to a level of 0.064 mg/kg of carbon tetrachloride.
2. To use soil vapor extraction to cleanup the soil to a level of 0.058 mg/kg of trichloroethylene.
3. To use air sparging and pump & treat systems to cleanup the groundwater to a level of 0.005 mg/L of carbon tetrachloride.
4. To use air sparging and pump & treat systems to cleanup the groundwater to a level of 0.005 mg/L of trichloroethylene.
5. Upon remediation the groundwater at this location will be classified as Class GA. A classification of GA corresponds to use of groundwater as a public or private drinking water supply.
6. Upon remediation site soils will be cleaned up to levels protective of groundwater and groundwater will be cleaned up to federally promulgated Maximum Contaminant Levels (MCLs).

The NDEQ has deemed the groundwater at this location to be given a Remedial Action Classification (RAC) Number of 1. RAC Numbers are used to prioritize groundwater contamination events with (1) being of highest priority and (3) being of lowest priority.

Written comments will be accepted during the public comment period that runs from March 1, 2005 to March 30, 2005. Please send written comments to:

Director
Department of Environmental Quality
The Atrium, 1200 N Street, Suite 400, P.O. Box 98922
Lincoln, Nebraska 68509-8922
Phone: (402)471-2186
TDD users please call 711 and ask the operator to call (402) 471-2186

During the public comment period, any interested person may submit to the Director of the NDEQ, written comments on the proposed action or event and may request or petition for a hearing, in writing, stating the nature of the issues to be raised at the hearing.

One may review the RAP and other site-related documents at the following locations:

NDEQ Main Office
1200 "N" Street, Suite 400
Lincoln, Nebraska
(402)471-2186

NDEQ Northeast Field Office
214 N. 7th Street, Suite 4
Norfolk, Nebraska
(402)370-0000

At the close of the public comment period, NDEQ will carefully consider all public comments received and make a final decision on whether to approve the RAP. The public information repositories will contain a copy of the final RAP as well as all comments received and the responses to those comments. All those who submitted comments will be notified of the decision and will receive a copy of the responses to comments.

Additional information regarding this site may be requested by contacting Mike Felix, NDEQ Remediation Section, at (402)471-6411.

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XYZ COMPANY SITE FACT SHEET

The Nebraska Department of Environmental Quality (NDEQ) is providing public notice of the following actions for the XYZ Company Site located in Hometown, Nebraska:

- The proposed establishment of preliminary cleanup levels and remedial action requirements,
- The proposed approval of the Remedial Action Plan (RAP), and
- The proposed use of the property continues as industrial use.

This fact sheet provides background information on the site, a summary of the nature and extent of contamination, a description of the proposed remedial action requirements and remedial action plan, a description of the public participation procedures, and the Department contact person.

Background: The XYZ Company site is located at 5678 Oak Street in Hometown, NE. This area is approximately 2 acres. A legal description of the site is lot 11 of the Smith subdivision, Hometown, NE.

From 1978 to present, the XYZ Company used the site as a parts cleaning facility. Prior to the ownership of the XYZ Company, the site was operated as a grain storage facility by the ACME Corporation.

The XYZ Company has submitted a RAP for the Site under the NDEQ's Voluntary Cleanup Program (VCP). The RAP includes information on environmental investigations of soil and groundwater contamination that have been conducted at the site. These investigations included analysis of soil and groundwater samples for a number of chlorinated solvents commonly associated with the past land uses. The RAP also proposes remedial activities to address the contamination found at the site.

Soil Contamination: The primary contaminants found in soil were carbon tetrachloride (CTC) and trichloroethylene (TCE). Other contaminants were present below health-based remediation goals (RGs). The RGs for soils protective of groundwater were exceeded in five soil samples for CTC and three for TCE.

Soil Remediation: The XYZ Company has proposed to cleanup site soils to RGs protective of groundwater using a soil vapor extraction system. The XYZ Company is proposing cleanup of soils to levels protective of groundwater based on groundwater use in the area of the Site. Soil vapor extraction is a remedial technology wherein volatile contaminants (such as CTC and TCE) are removed from the subsurface by placing a vacuum on the soil vapor, and collecting and treating the recovered contaminants. The proposed RGs for CTC and TCE are as follows: CTC – 0.064 mg/kg and TCE – 0.058 mg/kg.

Ground Water Contamination: The primary contaminants detected in the groundwater were CTC and TCE. No other contaminants were detected in groundwater. Ten groundwater samples exceeded the RG for CTC and eight for TCE.

Ground Water Remediation: The NDEQ assigns Remedial Action Classifications (RACs) to ground water as a way of designating the importance of cleaning up the ground water. This designation is based, in part, on how the ground water is used. Ground water that is being used as a drinking water supply is assigned the highest remedial action classification of RAC-1. NDEQ typically requires extensive cleanup of ground water that is classified as RAC-1. When the ground water at a site is not used as drinking water, the ground water is assigned a remedial action classification of RAC-2 or RAC-3. Generally, ground water cleanup will be less extensive for these classifications because the risk to human health is lower.

The groundwater in the area of the Site is presently used as a private drinking water source. Therefore, the ground water at the Site has been assigned a RAC-1 designation.

The XYZ Company has proposed to cleanup groundwater to federally promulgated Maximum Contaminant Levels (MCLs) using a combination of air sparging and pump & treat systems. The MCLs for CTC and TCE are as follows: CTC – 0.005 mg/L and TCE – 0.005 mg/L. Air sparging is a remedial technology wherein air is introduced within the contaminated groundwater plume to remove the volatile contaminants dissolved in the groundwater. The contaminants in vapor form are collected and treated using vapor extraction. Pump & treat is a remedial technology wherein contaminated groundwater is pumped from the ground and treated to remove volatile contaminants.

Public Participation Procedures: You may receive additional information, submit written comments regarding the proposed actions, or request a hearing, in writing, on or before March 30, 2005. If you request a hearing, you must clearly state the nature of the issues to be raised and present your arguments and facts to support your position in writing to NDEQ. If the Director grants a public hearing, the hearing will be advertised by public notice at least 30 days prior to its occurrence. Comments and requests should be mailed to the Director, Nebraska Department of Environmental Quality, 1200 N Street, Suite 400, The Atrium, PO Box 98922, Lincoln, NE 68509-8922.

Contact: The proposed RAP and supporting materials pertaining to the XYZ Company site are available for inspection at the office of the Nebraska Department of Environmental Quality, 1200 N Street, Suite 400, The Atrium, Lincoln, NE 68509-8922. These materials are also located at the NDEQ Northeast Regional Office, 214 North 7th St., Norfolk, NE. Further information may be obtained from Mike Felix, Remediation Section, Nebraska Department of Environmental Quality, Suite 400, the Atrium, 1200 'N' Street, P.O. Box 98922, Lincoln, Nebraska 69509-8922, phone (402) 471-6411.

ATTACHMENT 1-5

REMEDIAL ACTION PLAN MONITORING ACT STATUTE

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Remedial Action Plan Monitoring Act

81-15,181. Act, how cited.

Sections 81-15,181 to 81-15,188 shall be known and may be cited as the Remedial Action Plan Monitoring Act.

Source: Laws 1994, LB 1349, § 1; Laws 2004, LB 449, § 4. Effective date July 16, 2004.

81-15,182 Terms, defined.

For purposes of the Remedial Action Plan Monitoring Act:

1. Land pollution means the presence upon or within the land resources of the state of one or more contaminants or combinations of contaminants, including, but not limited to, solid waste, hazardous waste, petroleum, or hazardous substances, in such quantities and of such quality as will or are likely to (a) create a nuisance, (b) be harmful, detrimental, or injurious to public health, safety, or welfare, (c) be injurious to plant and animal life and property, or (d) be detrimental to the economic and social development, the scenic beauty, or the enjoyment of the natural attractions of the state; and
2. Water pollution means the manmade or man-induced alteration of the chemical, physical, biological, or radiological integrity of water.

Source: Laws 1994, LB 1349, § 2; Laws 2004, LB 449, § 5. Effective date July 16, 2004.

81-15,183. Remedial Action Plan Monitoring Fund; created; use; investment.

1. The Remedial Action Plan Monitoring Fund is created. The fund shall be administered by the Department of Environmental Quality. Revenue from the following sources shall be credited to the fund:
 - (a) Application fees collected under the Remedial Action Plan Monitoring Act;
 - (b) Deposits for costs associated with administration of the act, including review, oversight, and guidance;
 - (c) Gifts, grants, reimbursements, or appropriations from any source intended to be used for purposes of the act; and
 - (d) Investment interest attributable to the fund.
2. The fund shall be used by the department to:
 - (a) Review applications and provide technical review, oversight, guidance, and other activities associated with remedial action plans for land pollution or water pollution;
 - (b) Fund activities performed by the department to address immediate or emergency threats to human health and the environment related to property under the act; and
 - (c) Administer and enforce the act.
3. Any money in the fund available for investment shall be invested by the state investment officer pursuant to the Nebraska Capital Expansion Act and the Nebraska State Funds Investment Act.

Source: Laws 1994, LB 1349, § 3; Laws 1995, LB 7, § 130; Laws 2004, LB 449, § 6. Effective date July 16, 2004.

Cross References: Nebraska Capital Expansion Act, see section 72-1269. Nebraska State Funds Investment Act, see section 72-1260.

81-15,184. Remedial action plan; application for monitoring; requirements; fees; department; duties.

1. Any entity which voluntarily chooses to make application for monitoring of remedial action plans for property where land pollution or water pollution exists shall:
 - (a) Submit an application on a form approved by the Department of Environmental Quality;
 - (b) Provide the department with a nonrefundable application fee of five thousand dollars; and
 - (c) Execute a written agreement to provide reimbursement of all department direct and indirect costs related to technical review, oversight, guidance, and other activities associated with the remedial action plan. As part of the voluntary agreement, the department shall require the applicant to post a deposit of five thousand dollars to be used by the department to cover all costs. The department shall not commence technical review, oversight, guidance, or other activities associated with the remedial action plan until the voluntary agreement is executed and a complete remedial action plan has been submitted. If the costs of the department exceed the initial deposit, an additional amount agreed upon by the department and the applicant may be required prior to proceeding. After the mutual termination of the voluntary agreement, any balance of funds paid under this subdivision shall be refunded.
2. The department shall review and approve or deny all applications and notify the applicant in writing. If the application is denied, the notification shall state the reason for the denial. If the department determines that an application does not contain adequate information, the department shall return the application to the applicant. The applicant has sixty days to resubmit the required information or the application will be deemed denied.
3. Within ninety days of approval of the application, the applicant shall provide a complete remedial action plan for the proposed project that conforms to all federal and state environmental standards and substantive requirements, including:
 - (a) Documentation regarding the investigation of land pollution or water pollution including, when appropriate, information indicating that the applicant holds or can acquire title to all lands or has the necessary easements and rights-of-way for the project and related lands;
 - (b) A remedial action work plan which describes the remedial action measures to be taken to address the land or water pollution; and
 - (c) Project monitoring reports, appropriate engineering, scientific, and financial feasibility data, and other data and information as may be required by the department.

Source: Laws 1994, LB 1349, § 4; Laws 2004, LB 449, § 8. Effective date July 16, 2004.

81-15,185. Department of Environmental Quality; remedial action plan; approval or disapproval; notification.

Upon receipt of a voluntary remedial action plan for land pollution or water pollution pursuant to section 81-15,184, the Department of Environmental Quality shall review and approve or disapprove the plan and notify the applicant in writing. If the plan is disapproved, the notification shall state the reason for the disapproval and provide a reasonable opportunity to resubmit the plan.

Source: Laws 1994, LB 1349, § 5; Laws 2004, LB 449, § 9. Effective date July 16, 2004.

81-15,185.01. Remedial action plan; notice; hearing.

The Department of Environmental Quality shall issue public notice of its intent to approve a voluntary remedial action plan pursuant to section 81-15,185 in a local newspaper of general circulation in the area affected and make the remedial action plan available to the public. The public shall have thirty days from the date of publication during which any person may submit written comments to the department regarding the proposed remedial action. Such person may also request or petition the Director of Environmental Quality, in writing, for a hearing and state the nature of the issues to be raised. The director shall hold a public hearing if the comments, request, or petition raise legal, policy, or discretionary questions of general application and significant public interest exists.

Source: Laws 2004, LB 449, § 10. Effective date July 16, 2004.

81-15,185.02. Remedial action plan; termination; notification.

1. The applicant may unilaterally terminate a voluntary remedial action plan approved pursuant to section 81-15,185 prior to completion of investigative and remedial activities if the applicant leaves the property in no worse condition, from a human health and environment perspective, than when the applicant initiated voluntary remedial action and the applicant reimburses the Department of Environmental Quality for all outstanding costs.
2. The department may terminate a voluntary remedial action plan if the applicant:
 - (a) Violates any terms or conditions of the plan or fails to fulfill any obligations of the plan, including submission of an acceptable remedial action plan within a reasonable period of time;
 - (b) Fails to address an immediate and significant risk of harm to public health and the environment in a timely and effective manner; or
 - (c) Fails to initiate the plan within six months after approval by the department or to complete the plan within twenty-four months after approval by the department, excluding long-term operation, maintenance, and monitoring, unless the department grants an extension of time.
3. The department shall notify the applicant in writing of the intention to terminate the voluntary remedial action plan and include the reason for the termination and a summary of any unreimbursed costs of the department that are due.

Source: Laws 2004, LB 449, § 11. Effective date July 16, 2004.

81-15,185.03. Remedial action plan; completion; duties; enforceability.

1. Within sixty days after completion of a voluntary remedial action plan approved pursuant to section 81-15,185, the applicant shall provide the Department of Environmental Quality with a final remedial action report and assurance that the plan has been fully implemented. Department approval of a voluntary remedial action plan shall be void upon failure to comply with the approved plan or willful submission of false, inaccurate, or misleading information by the applicant.
2. Voluntary remedial action plans approved under section 81-15,185 are not enforceable unless the department can demonstrate that the applicant has failed to fully implement the approved plan. The department may require further action if such action is authorized by other state statutes administered by the department.

Source: Laws 2004, LB 449, § 12. Effective date July 16, 2004.

81-15,186. Department of Environmental Quality; issuance of letter; contents.

If the requirements of the Remedial Action Plan Monitoring Act are met and the applicant has remitted all applicable fees, the Department of Environmental Quality may issue to the applicant a letter stating that no further action need be taken at the site related to any contamination for which remedial action has been taken in accordance with the approved remedial action plan. Such letter shall provide that the department may require the person to conduct additional remedial action in the event that any monitoring conducted at or near the real property or other circumstances indicate that (1) contamination is reoccurring, (2) additional contamination is present which was not identified pursuant to section 81-15,184, or (3) additional contamination is present for which remedial action was not taken according to the remedial action plan. As a condition of issuance, the department may require payment of ongoing direct and indirect costs of oversight of any ongoing long-term operation, maintenance, and monitoring.

Source: Laws 1994, LB 1349, § 6; Laws 2004, LB 449, § 13. Effective date July 16, 2004.

81-15,186.01. Rules and regulations.

The Environmental Quality Council may adopt and promulgate rules and regulations necessary to administer and enforce the provisions of the Remedial Action Plan Monitoring Act.

Source: Laws 2004, LB 449, § 7. Effective date July 16, 2004.

81-15,187. Act, how construed; indemnification.

The Remedial Action Plan Monitoring Act shall not be construed as an acceptance of liability by the State of Nebraska for activities conducted pursuant to such act. Entities proceeding under such act shall indemnify and hold harmless the State of Nebraska for any further action required by the federal Environmental Protection Agency relating to land pollution or water pollution by an entity.

Source: Laws 1994, LB 1349, § 7.

81-15,188. Act; supplemental to other laws; how construed.

The powers conferred by the Remedial Action Plan Monitoring Act shall be independent of and in addition and supplemental to any other provisions of the laws of the State of Nebraska with reference to the matters covered hereby, and the act shall be considered as a complete and independent act and not as amendatory of or limited by any other provision of the laws of the State of Nebraska.

Source: Laws 1994, LB 1349, § 8.

ATTACHMENT 2-1
REMEDIAL ACTION PLAN CHECKLIST

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Nebraska Department of Environmental Quality

Remedial Action Plan Checklist

This checklist should be used when preparing a Remedial Action Plan (RAP). It serves two purposes: First, it helps the applicant develop an appropriate RAP, both in terms of content and format. Second, it supports NDEQ's review of the RAP after the application is received.

This checklist is not an all-inclusive list of the information that may be necessary to develop an appropriate RAP. It is intended as an aid to assist in developing the RAP. NDEQ may request additional information, and some categories of information may not be applicable to every RAP.

Please specify in the boxes opposite each item whether the information is present (Y), absent (N), or not applicable (NA). Indicate the page number within the RAP where the information is included. Specific information for individual elements of the RAP are indicated. Additional general information for the RAP, including specific formats for tables and figures, are included at the end of the checklist. All acronyms are defined at the end of the checklist.

Applicant Name _____

Site or Property Name _____

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
2.1 EXECUTIVE SUMMARY		
➤ Summary and conclusions of the completed investigation		
➤ Identification of potential receptors		
➤ Overview of the conceptual site model		
➤ Interim remedial measures completed to date		
➤ Future land use plans		
➤ Remedial Action Objectives (RAOs) and proposed remediation goals (from the Remediation Goals Lookup Tables)		
➤ Description of anticipated remedial actions		
• Conceptual approach		
• Rationale used to support selection of remedial action and how it meets the five remedy evaluation criteria and RAOs developed		
➤ Any other site-specific issues that should be considered during completion of remedial actions		
2.2 INVESTIGATION REPORT		
2.2.1 Compilation and Analysis of Background Information		
2.2.1.1 Site Information		
➤ Site name		
➤ Site type		
➤ Standard Industrial Classification code		
➤ Facility status (active/inactive, etc.)		
➤ Street address		
➤ Directions to site relative to nearest intersection of major highways		
➤ Nearest city or town and county		
➤ Legal description (¼, ¼, ¼, section, township, range)		
➤ Latitude and longitude in decimal degrees (linked to NAD 83)		
➤ Location map based on a USGS 7.5-minute quadrangle, with a reference to the quadrangle name and date		
➤ Applicant, owner, or designated point of contact with contact information		
➤ Contractors or consultants to the applicant or owner, with contact information		
➤ Documentation indicating that the applicant holds or can acquire title to all lands or has the necessary easements and rights-of-way for the remedial actions		
2.2.1.2 Physical Setting		
Surface features		
➤ Site layout map showing natural and man-made (current or former) features within 2,000 feet of site		
• Property boundary		
• Primary surface and subsurface structures		
• Roads, fences, other man-made boundaries		
• Streams, lakes, wooded areas, etc.		
• Onsite and nearby utility lines and conduits		
Climate and meteorology		
➤ Sources of information		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> • National Oceanic and Atmospheric Administration – National Climatic Data Center (NOAA-NCDC) 		
<ul style="list-style-type: none"> • University of Nebraska-Lincoln – High Plains Regional Climate Center (UNL – HPRCC) 		
<ul style="list-style-type: none"> • Natural Resources Conservation Service – National Water and Climate Center (NRCS – NWCC) 		
➤ Mean annual rainfall		
➤ Mean seasonal temperatures		
➤ Mean wind velocity and direction		
<ul style="list-style-type: none"> • Wind rose 		
➤ Daily mean variances in atmospheric parameters		
Vegetation		
➤ Sources of information		
<ul style="list-style-type: none"> • Natural Resources Conservation Service – National Plant Data Center (NRCS – NPDC) 		
<ul style="list-style-type: none"> • University of Nebraska-Lincoln – Institute of Agriculture and Natural Resources (UNL – IANR) 		
➤ Type of plant cover		
➤ Density of plant cover		
➤ Sensitive environments – locally and regionally		
Topography and hydrology		
➤ Source of information		
<ul style="list-style-type: none"> • United States Geologic Survey (USGS) 		
<ul style="list-style-type: none"> • University of Nebraska-Lincoln – Conservation and Survey Division (UNL – CSD) 		
<ul style="list-style-type: none"> • Nebraska Department of Natural Resources (NDNR) 		
➤ Descriptions and map(s) of		
<ul style="list-style-type: none"> • Topography 		
<ul style="list-style-type: none"> • Drainage direction and routes 		
<ul style="list-style-type: none"> • On- and off-site surface water bodies 		
<ul style="list-style-type: none"> • Flood plains 		
<ul style="list-style-type: none"> • Wetlands 		
➤ Graphs/data indicating recurrence interval of floods on and near the site		
Soils and Geology		
➤ Source of information for soils		
<ul style="list-style-type: none"> • USDA - NRCS County Soil Survey (online or published) 		
<ul style="list-style-type: none"> • Personal communication with specific county NRCS personnel (surveys not available or being revised) 		
➤ Description of soils typical to site		
<ul style="list-style-type: none"> • Topographic setting (<i>i.e.</i>, upland slope or alluvial valley) 		
<ul style="list-style-type: none"> • Probable parent material 		
<ul style="list-style-type: none"> • Total organic content 		
<ul style="list-style-type: none"> • Porosity and permeability 		
➤ Soil map(s)		
➤ Source of information for geology		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> • United States Geologic Survey (USGS) 		
<ul style="list-style-type: none"> • University of Nebraska-Lincoln – Conservation and Survey Division (UNL – CSD) 		
<ul style="list-style-type: none"> • Nebraska Department of Natural Resources (NDNR) 		
<ul style="list-style-type: none"> ➤ Generalized stratigraphic section showing regional geologic formations, formal names and ages of units, lithologies, and unconformities 		
<ul style="list-style-type: none"> ➤ Map(s) showing regional structural features 		
<ul style="list-style-type: none"> ➤ Map(s) showing important surficial deposits and/or other geologic features 		
<ul style="list-style-type: none"> ➤ Regional and local geologic cross-sections with control points, emphasizing: <ul style="list-style-type: none"> • Relict channels • Paleosols • Impermeable layers or boundaries • Potential preferential pathways • Geometry of complex geologic strata • Other important geologic features 		
<p>Hydrogeology</p>		
<ul style="list-style-type: none"> ➤ Source of information <ul style="list-style-type: none"> • United States Geologic Survey (USGS) • University of Nebraska-Lincoln – Conservation and Survey Division (UNL – CSD) • Nebraska Department of Natural Resources (NDNR) 		
<ul style="list-style-type: none"> ➤ Approximate depth to groundwater 		
<ul style="list-style-type: none"> ➤ Approximate depth to bedrock 		
<ul style="list-style-type: none"> ➤ Primary, surficial, and/or perched aquifer characteristics <ul style="list-style-type: none"> • Hydraulic conductivity and porosity • Thickness • aquifer material • Description of aquifer usage • Potentiometric surface maps or water table maps with control points • Approximate groundwater flow direction and rate 		
<ul style="list-style-type: none"> ➤ Confining zone or aquitard characteristics 		
<ul style="list-style-type: none"> ➤ Nearby pumping wells that influence groundwater flow <ul style="list-style-type: none"> • Well depth and completion zone • Pump level and pumping rate and frequency pumped • Radius of influence of drawdown cone • Capture zone 		
<p>2.2.1.3 Historical Operations and Site Conditions</p>		
<ul style="list-style-type: none"> ➤ A list of the previous owners and their ownership dates (provide copies of deeds or other county records in an appendix) 		
<ul style="list-style-type: none"> ➤ Any historical or alternative facility names 		
<ul style="list-style-type: none"> ➤ Discussion of historical site use, previous business operations, and periods of operation 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> • Sources of information 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Nebraska Department of Natural Resources (NDNR) 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Nebraska Department of Roads (NDOR) 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ University of Nebraska-Lincoln – Conservation and Survey Division (UNL – CSD) 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ United States Department of Agriculture (USDA) – Farm Service Agency 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ United States Department of Agriculture – Natural Resources Conservation Service (USDA – NRCS) 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Environmental Protection Agency (EPA) Environmental Monitoring Systems Laboratory 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Department of Defense (DOD) 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ United States Geological Survey USGS – Earth Resources Observation Systems 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ County government 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ City government 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Local library historical collections 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Local newspaper archives 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Private historical collection 		
<ul style="list-style-type: none"> • Dates that the site was active 		
<ul style="list-style-type: none"> • Site map showing historical operation areas 		
<ul style="list-style-type: none"> • Historical aerial photographs 		
<ul style="list-style-type: none"> • Topographic maps 		
<ul style="list-style-type: none"> • Sanborn or other fire insurance maps 		
<ul style="list-style-type: none"> • Local historical collections, or city directories that illustrate site use and periods of operation 		
<ul style="list-style-type: none"> • Types of historical operations 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Landfill 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Grain storage facility 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Former manufactured gas plant 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Dry cleaners 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Salvage yard 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Formerly Used Defense Site (FUDS) 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Gas station 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Drum storage 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Pesticide formulation 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Agricultural chemical distribution or cooperative 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Explosive or fireworks manufacturing 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Ammunition production or disposal 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Battery-breaking operation 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Mining operation, including mills and smelters 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Solvent recycler 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Waste oil recycler 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Metals plating operation 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Other industrial, manufacturing, or potentially hazardous waste generation, treatment, storage or disposal operation at the site. 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> ▪ Previous site uses believed to be nonhazardous 		
<ul style="list-style-type: none"> ➤ Possible contaminant sources 		
<ul style="list-style-type: none"> • Aboveground storage tank 		
<ul style="list-style-type: none"> • Underground storage tank 		
<ul style="list-style-type: none"> • Drum 		
<ul style="list-style-type: none"> • Other container 		
<ul style="list-style-type: none"> • Aboveground pipeline 		
<ul style="list-style-type: none"> • Underground pipeline 		
<ul style="list-style-type: none"> • Lagoon or pond 		
<ul style="list-style-type: none"> • Seepage pit or dry well 		
<ul style="list-style-type: none"> • Septic tank or lateral field 		
<ul style="list-style-type: none"> • Surface spill or discharge 		
<ul style="list-style-type: none"> • Pit 		
<ul style="list-style-type: none"> • Drip tank 		
<ul style="list-style-type: none"> • Adjacent property 		
<ul style="list-style-type: none"> ➤ Detailed description of information regarding historical non-hazardous solid waste generated or managed at the site 		
<ul style="list-style-type: none"> ➤ Detailed description of information regarding historical hazardous wastes generated, received, disposed of, or managed at the site 		
<ul style="list-style-type: none"> • Types of hazardous wastes 		
<ul style="list-style-type: none"> • Quantities and rates of hazardous wastes generated, received, disposed of, or managed 		
<ul style="list-style-type: none"> • Discussion of historical waste management practices 		
<ul style="list-style-type: none"> • Source of information <ul style="list-style-type: none"> ▪ Load or waste manifests ▪ MSDSs ▪ Bills of lading ▪ Historical sources regarding facility production 		
<ul style="list-style-type: none"> ➤ Detailed description of processing or storage locations 		
<ul style="list-style-type: none"> • Transformer shear area 		
<ul style="list-style-type: none"> • Chemical storage/ formulation areas 		
<ul style="list-style-type: none"> • Battery storage area 		
<ul style="list-style-type: none"> ➤ Detailed description of information regarding historical environmental incidents, spills, or releases of hazardous constituents, for all previous businesses 		
<ul style="list-style-type: none"> • Source of information <ul style="list-style-type: none"> ▪ NDEQ Petroleum Remediation files ▪ NDEQ National Pollutant Discharge Elimination System files ▪ NDEQ Integrated Waste Management files ▪ NDEQ environmental assessment files ▪ NDEQ release assessment files ▪ NDEQ Superfund files ▪ NDEQ RCRA files ▪ NDEQ RAPMA files ▪ EPA CERCLIS ▪ EPA RCRA INFO 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
▪ EPA TRIS		
▪ USDA		
▪ DOD – FUDS		
▪ County health department		
▪ Other sources (i.e., interviews, newspaper accounts, internet)		
2.2.1.4 Current Operations and Site Conditions		
➤ Discussion and illustration of current site use and business operations		
• Aerial photographs		
• Topographic maps		
• City directories		
• Types of operations		
▪ Landfill		
▪ Grain storage facility		
▪ Former manufactured gas plant		
▪ Dry cleaner		
▪ Salvage yard		
▪ Formerly Used Defense Site (FUDS)		
▪ Gas station		
▪ Drum storage		
▪ Pesticide formulation		
▪ Agricultural chemical distribution or cooperative		
▪ Explosive or fireworks manufacturing		
▪ Ammunition production or disposal		
▪ Battery-breaking operation		
▪ Mining operation, including mills and smelters		
▪ Solvent recycler		
▪ Waste oil recycler		
▪ Metals plating operation		
▪ Other industrial, manufacturing, or potentially hazardous waste generation, treatment, storage or disposal operation at the site.		
▪ Previous site uses believed to be nonhazardous		
➤ Possible contaminant sources		
• Aboveground storage tank		
• Underground storage tank		
• Drum		
• Other container		
• Aboveground pipeline		
• Underground pipeline		
• Lagoon or pond		
• Seepage pit or dry well		
• Septic tank or lateral field		
• Surface spill or discharge		
• Pit		
• Drip tank		
• Adjacent property		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ A detailed description of information regarding current hazardous wastes generated, received, disposed, or managed at the site		
• Types of hazardous wastes		
• Quantities and rates of hazardous wastes generated, received, disposed, or managed		
• Discussion of current waste management practices		
• Source of information		
▪ Load or waste manifests		
▪ Landfill invoices		
▪ MSDSs		
▪ Bills of lading		
• Generation rates of hazardous constituents		
➤ A detailed description of information regarding current releases of hazardous constituents		
➤ Descriptions of all storage or disposal vessels, above and below ground, including the following information:		
• Location		
• Number		
• Type		
• Size		
• Age		
• Condition		
• Labels present		
• Contents, past or current		
• Any conduits or disposal systems associated with the vessels		
• Any piping, particularly below ground, to or from vessel		
➤ Existing institutional controls affecting the site		
• Description of institutional controls		
• Name and contact information for person(s) responsible for implementing, monitoring, and enforcing institutional controls		
➤ List of current environmental permits		
➤ Descriptions of any ongoing interim remedial actions		
➤ Descriptions of any ongoing investigations, remediation, or monitoring activities		
➤ Results of searching the following databases for the site or property adjacent to the site:		
• Federal National Priorities List		
• Federal CERCLIS		
• Federal RCRA treatment, storage, or disposal facilities (RCRIS)		
• Federal RCRA generators		
• Federal Emergency Response Notification System list		
• NDEQ's Integrated Information System (IIS)		
▪ State hazardous waste sites		
▪ State landfills		
▪ State Leaking Underground Storage Tanks		
• State Fire Marshal registered underground storage tanks		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> • EPA TRIS database 		
<ul style="list-style-type: none"> • Other database or source identifying relevant information 		
<ul style="list-style-type: none"> ➤ Results of interviews with the site owner, administrator, or former employees with attached questionnaire 		
2.2.1.5 Previously Reported Investigations		
Summary of previous reports		
<ul style="list-style-type: none"> ➤ Summary and chronology of previous reports with reference to location of attached report in RAP 		
<ul style="list-style-type: none"> ➤ Summary of any relevant correspondence from NDEQ, EPA, or private entities (such as consulting firms) regarding previous environmental reports, with copies of correspondence provided in an appendix 		
<ul style="list-style-type: none"> ➤ Summary of findings, conclusions, and recommendations of previously reported investigations 		
Data Quality and Temporal Variability		
<ul style="list-style-type: none"> ➤ Were appropriate QA/QC standards and procedures in-place during the collection of these data? Explain. 		
<ul style="list-style-type: none"> ➤ Did the results of QA/QC samples indicate any potential problems with the data? Explain. 		
<ul style="list-style-type: none"> ➤ Were laboratory methods, detection limits, and holding times adequate for the intended use of the data (i.e. if data is to be used for defining nature and extent of contamination at MCLs, were detection limits below currently established MCLs)? Explain. 		
<ul style="list-style-type: none"> ➤ Is any of the data variable temporally (i.e. are conditions likely to have changed significantly since the data was last collected)? Explain. 		
2.2.1.6 Potential Chemicals of Concern		
<ul style="list-style-type: none"> ➤ Bulleted list of potential chemicals of concern based on review of all existing historical data and previous investigations 		
<ul style="list-style-type: none"> ➤ Discussion of the relationship between each type of material received or processed on site and each of the chemicals of concern 		
2.2.1.7 Data Gaps		
<ul style="list-style-type: none"> ➤ Bulleted list of data gaps and/or deficiencies identified based on review of all existing historical data and previous investigations (see sections 2.2.1.2 – 2.2.1.5 of the guidance and this checklist) 		
<ul style="list-style-type: none"> ➤ Some commonly encountered data gaps are: <ul style="list-style-type: none"> • Physical site characteristics <ul style="list-style-type: none"> ▪ Geology, hydrogeology, soils, etc. • Nature and extent of contamination <ul style="list-style-type: none"> ▪ Source areas and sources ▪ Lateral and vertical extent of contamination ▪ Magnitude of contamination ▪ Highest concentrations detected • Geologic and hydrogeologic characteristics affecting fate and transport <ul style="list-style-type: none"> ▪ Carbon content of soils ▪ Cation exchange capacity of soils ▪ dissolved oxygen concentration ▪ oxidation-reduction potential 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> • Potential receptors 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Water supply wells within 1 mile 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Sensitive populations: daycares, schools, nursing homes 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Sensitive habitats 		
<ul style="list-style-type: none"> ➤ For additional information that may help you identify data gaps, see sections 2.2.3 – 2.2.6 of the guidance and this checklist 		
2.2.2 Field Investigation		
2.2.2.1 Investigation Objectives		
<ul style="list-style-type: none"> ➤ Bulleted list of objectives for investigation 		
<ul style="list-style-type: none"> ➤ Rationale for selection of each objective 		
2.2.2.2 Data Quality Objectives		
<ul style="list-style-type: none"> ➤ Bulleted list of objectives for data quality, organized by media 		
<ul style="list-style-type: none"> ➤ Rationale to support selection of each objective 		
2.2.2.3 Sampling and Analysis Procedures		
Field Sampling Procedures		
<ul style="list-style-type: none"> ➤ Sample (i.e. soil boring, direct-push well) locations 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Descriptions of locations (latitude/longitude coordinates referenced to NAD 83) 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Map showing sampling locations 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Description of location survey method (Global Positioning System – GPS – preferred) 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Explanation of methods for locating future follow-up samples (e.g. property may be redeveloped and site layout may change) 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Location and number of background samples 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Rationale to support selection of sampling locations 		
<ul style="list-style-type: none"> ➤ Sampling intervals 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Descriptions of intervals 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Table, diagram, or cross section indicating intervals for each sampling point 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Rationale to support selection of sampling intervals 		
<ul style="list-style-type: none"> ➤ Sample types 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Sampling information for each medium sampled 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Sampling methods, with justification for method 		
<ul style="list-style-type: none"> ➤ Sample collection 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Collection methods for soil sampling 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Were grab or composite soil samples taken? 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Drilling method (hollow stem, direct push, mud rotary) 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Auger size 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Sampler type (split spoon, continuous, etc.) 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Center bit type 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> • Collection methods for groundwater sampling 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Sampling methods (traditional, low-flow purging, passive-diffusive bags, etc.) 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Purging rate and volume 		
<ul style="list-style-type: none"> <ul style="list-style-type: none"> <ul style="list-style-type: none"> ▪ Measured stabilization parameters – dissolved oxygen, oxidation-reduction potential, pH, specific conductance, etc. 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
• Total number of samples taken		
• Description of sample labeling/identification system		
• Order of sample collection with regards to volatilization and expected contamination levels		
➤ Field screening methods		
➤ Sampling equipment		
• Equipment used		
• Cleaning procedures		
• Was calibration of instruments performed?		
➤ Table or list of analytical parameters		
➤ Analytical methods		
• Analytical laboratory, with contact information		
• Holding times for all samples analyzed		
• Practical Quantitation Limits (PQLs) for each media:		
▪ For groundwater, PQLs must be less than the applicable regulatory limit – MCLs, PRGs, 1 x 10 ⁻⁶ excess cancer risk levels, VCP lookup tables, or site specific risk based cleanup levels		
▪ For soil, PQLs must be less than the applicable regulatory limit – PRGs, 1 x 10 ⁻⁶ excess cancer risk levels, VCP lookup tables, or site specific risk based cleanup levels		
▪ For surface water, PQLs must be less than the applicable regulatory limit		
• Description and table of analytical laboratory methods used for each parameter and media		
▪ Standard method for VOCs: 8260b		
▪ Standards method for SVOCs: 8270		
▪ Various methods for metals		
▪ Methods for Dioxins 8280 or 8290 depending on detection limit needed.		
▪ Phenols: 8270 or 8310. 8310 will be necessary for most groundwater analysis because the detection limit for 8270 is above the MCL for some contaminants.		
• Description of any alternative laboratory methods used, including explanation of why the methods were appropriate		
➤ Well purging data		
• Purging technique		
• Purging dates		
• Volumes purged		
• Rate of purging		
• Temporal variations in parameter values, such as pH, temperature, conductivity, redox, turbidity, or dissolved oxygen		
• Detection of immiscible layers		
Quality Assurance/Quality Control		
➤ Description (i.e. number and location) of QA/QC samples		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> • Trip blanks – one per every cooler used to transport and store samples 		
<ul style="list-style-type: none"> • Field blanks – minimum of 10% (i.e. 1 field blank for every 10 samples) 		
<ul style="list-style-type: none"> • Equipment rinsate blanks – minimum of 10% (i.e. 1 rinsate blank for every 10 samples) 		
<ul style="list-style-type: none"> • Field split samples 		
<ul style="list-style-type: none"> • Field duplicate samples – minimum of 10% (i.e. 1 duplicate for every 10 samples) 		
<ul style="list-style-type: none"> • Matrix spike and matrix spike duplicates 		
2.2.2.4 Health and Safety		
<ul style="list-style-type: none"> ➤ Brief statement that a health and safety plan was prepared and used during the investigation 		
2.2.2.5 Investigation-Derived Waste		
<ul style="list-style-type: none"> ➤ Source of information: NDEQ Investigation-Derived Waste (IDW) Environmental Guidance - Draft 		
<ul style="list-style-type: none"> ➤ Description of strategy for managing and disposing of investigation-derived waste 		
<ul style="list-style-type: none"> • Procedures for segregation of hazardous and non-hazardous waste 		
<ul style="list-style-type: none"> • Description of how hazardous waste sent off-site was managed <ul style="list-style-type: none"> ▪ Location(s) of disposal site ▪ Supporting documentation such as load manifests or disposal receipts 		
<ul style="list-style-type: none"> ➤ Description of procedures used to ensure compliance with federal and state rules 		
<ul style="list-style-type: none"> • Analyze total metals first, then TCLP for any samples that exceed 20X the TCLP limit 		
2.2.3 Physical Site Characterization		
2.2.3.1 Surface Water		
<ul style="list-style-type: none"> ➤ Description of physical aspects of surface water bodies, including lakes, rivers, and impoundments 		
<ul style="list-style-type: none"> ➤ Maps, diagrams, or tables containing flow rates, channel dimensions and elevations, river stages, and historical flooding characteristics 		
<ul style="list-style-type: none"> ➤ Maps and diagrams illustrating surface water/groundwater relationships 		
<ul style="list-style-type: none"> ➤ Topographic maps 		
2.2.3.2 Soils and Geology		
<ul style="list-style-type: none"> ➤ Sampling location maps 		
<ul style="list-style-type: none"> • Locations of soil borings, direct-push sampling, or other investigation points used to characterize soils and geology 		
<ul style="list-style-type: none"> ➤ Geologic cross-sections 		
<ul style="list-style-type: none"> • Cross section showing geologic strata and water table, oriented parallel to groundwater flow direction 		
<ul style="list-style-type: none"> • Cross section showing geologic strata and water table, oriented perpendicular to groundwater flow direction 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> • Cross section(s) showing other geologic or man-made features that might influence the transport of contaminants in the subsurface, such as fractures zones, highly permeable channels, and/or utility conduits 		
2.2.3.3 Hydrogeology		
➤ Sampling location maps		
<ul style="list-style-type: none"> • Locations of monitoring wells, piezometers, direct-push sampling locations, or other investigation points used to characterize hydrogeology 		
➤ Potentiometric surface and/or water table maps		
<ul style="list-style-type: none"> • Control points at which the static water level is measured • Water-level elevations at control points • Contour interval appropriate for gradient across site • Arrow indicating groundwater flow direction • Additional maps depicting seasonal and/or long-term changes in water table elevation and groundwater flow direction 		
➤ Aquifer characteristics		
<ul style="list-style-type: none"> • Hydraulic conductivity • Storativity • Transmissivity • Specific yield 		
➤ Well completion information		
<ul style="list-style-type: none"> • Well identification numbers and coordinates in decimal degrees, linked to NAD 83 • Elevations of ground surface, top of well casing, relative to mean sea level • Static water level • Screen length • Screened interval, in depth below ground surface and estimated elevation above mean sea level • Dates of well completion and water level measurements 		
2.2.4 Nature and Extent of Contamination		
2.2.4.1 Sources		
➤ Discussion of known and suspected on-site sources, 'hot spots,' and potential sources of contamination migrating from off-site		
➤ Source location maps		
<ul style="list-style-type: none"> • Tanks, lagoons, pits, or other potential or known source areas • Areas of contaminated soil identified based on historical information or sampling and analysis • 'Hot spots' • Potential sources of contamination migrating from off-site 		
2.2.4.2 Air		
➤ Descriptions of each source of airborne contaminants (e.g. contaminated soils, off-gassing lagoon, etc.)		
➤ Other appropriate information that can be used to determine the extent and direction of migration		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ Notify NDEQ if it is determined that an on-going source of air contamination exists at the site		
<ul style="list-style-type: none"> • Information gathered as a result of discussions with NDEQ, including sampling locations, methods, and analytical results in tabular form 		
2.2.4.3 Surface water and sediments		
➤ Discussion of nature and extent of contamination in surface water and sediments		
➤ Sample location maps		
➤ Table(s) containing sample information and laboratory analytical results		
<ul style="list-style-type: none"> • Sample identification • Sample collection method • Sampling date • Sample location (linked to NAD 83) • Target compounds • Results from field screening • Concentrations of contaminants detected (values exceeding applicable regulatory limits should be highlighted) • Analytical method and detection limits for each compound • Appropriate data validation qualifiers • QA/QC sample results 		
➤ Maps showing the distribution of contamination in surface water and sediment		
2.2.4.4 Soils and vadose zone		
➤ Discussion of nature and extent of contamination in soils and vadose zone		
➤ Lateral and vertical extent of contamination defined to most conservative RGs (from RG Lookup Tables)		
➤ Table(s) containing sample information and laboratory analytical results		
<ul style="list-style-type: none"> • Sample identification • Sample collection method • Sampling date • Sample location (linked to NAD 83) and depth • Target compounds • Results from field screening • Concentrations of contaminants detected (values exceeding applicable regulatory limits should be highlighted) • Analytical method and detection limits for each compound • Appropriate data validation qualifiers • QA/QC sample results 		
➤ Sample location maps		
➤ Maps illustrating the horizontal distribution of soil contamination		
➤ At least two (2) cross sections oriented perpendicular to each other showing the vertical distribution of soil contamination		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
2.2.4.5 Groundwater		
➤ Discussion of nature and extent of contamination in groundwater		
➤ Lateral and vertical extent of contamination defined to MCLs		
➤ Table(s) containing sample information and laboratory analytical results		
• Well identification		
• Sample collection method		
• Sampling date		
• Sample location (linked to NAD 83) and depth		
• Target compounds		
• Results from field screening		
• Concentrations of contaminants detected (values exceeding applicable regulatory limits should be highlighted)		
• Analytical method and detection limits for each compound		
• Appropriate data validation qualifiers		
• QA/QC sample results		
➤ Sample location maps		
➤ Isoconcentration maps showing horizontal distribution of contamination in groundwater		
➤ At least two (2) isoconcentration cross-sections, oriented parallel and perpendicular to groundwater flow direction, showing vertical distribution of contamination in groundwater		
➤ Isopach maps and cross sections showing locations, horizontal extent, and thickness of free product		
2.2.5 Contaminant Fate and Transport		
2.2.5.1 Contaminant characteristics		
➤ Narrative description of each contaminant's characteristics affecting fate and transport		
Chemical and physical properties of contaminants		
➤ Table of contaminant properties		
➤ Name of contaminant		
➤ Density		
➤ Solubility		
➤ Octanol/water partition coefficient		
➤ Vapor pressure, volatility		
➤ Other relevant properties		
Contaminant persistence		
➤ Description of each contaminant's persistence in air		
➤ Description of each contaminant's persistence in surface water and sediments		
➤ Description of each contaminant's persistence in soil and vadose zone sediments		
➤ Description of each contaminant's persistence in groundwater		
Transport and Partitioning		
➤ Description of the chemical and physical properties of each contaminant that affect transport (i.e. solubility, density)		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ Description of the chemical and physical properties of each contaminant that affect partitioning (i.e. octanol/water partition coefficient, octanol/carbon coefficient)		
Transformation and Degradation		
➤ Discussion of the likelihood that contaminants will be transformed or degraded into other compounds		
➤ Table listing each contaminant and its transformation and/or degradation products		
➤ Description of the chemical characteristics affecting fate and transport of transformation and/or degradation products		
2.2.5.2 Site characteristics		
Environmental media		
➤ Description of media characteristics that might influence contaminant fate and transport		
• Evaluation of the potential affect of existing aqueous geochemical conditions on contaminant fate and transport		
• total organic carbon content		
• porosity		
• permeability		
• pH		
• alkalinity		
• cation exchange capacity		
• hardness		
• alkalinity		
• any observed heterogeneity associated with the media characteristics		
Migration pathways		
➤ Description of migration pathways that exist at the site		
• Groundwater		
• Surface water		
• Soil in surface water as sediment		
• Air in soil as soil gas		
• Soil in air as windblown dust		
Preferential flow paths		
➤ Anthropogenic		
• Sewers		
• Utility trenches		
• Wells		
• Basements		
• Tunnels		
• Elevator shafts		
➤ Natural		
• Sand/gravel lenses		
• Paleo-channels		
• Fractures in bedrock		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ Rationale used to omit any preferential flow paths from further evaluation		
Exposure pathways		
➤ Ingestion of soil		
➤ Inhalation of volatiles and particulates from soils (e.g. windblown dust)		
➤ Dermal contact with soils		
➤ Ingestion of water		
➤ Inhalation of volatiles from water during showering/bathing		
➤ Inhalation of vapors from vapor intrusion into indoor air (e.g., through foundations, floor drains, etc.)		
2.2.6 Potential Receptors		
2.2.6.1 Human receptors		
➤ Description of nearby population centers, including general demographic description		
➤ Present and planned sensitive populations within 2,000 feet of the site		
• Daycare or businesses with daycare facilities		
• Schools		
• Nursing homes and retirement communities		
• Hospitals and rehabilitation facilities		
➤ Land use survey of the area within 500 feet of site, including information about		
• General demographics		
• Zoning		
• Land usage at site and at adjacent properties (e.g., commercial, residential)		
• Table of adjacent landowners, with contact information		
• Any current institutional controls affecting the site		
➤ List of all water supply wells within 1 mile of site, including wells constructed before 1990s		
• Sources of information used in survey		
• Location (latitude/longitude coordinates referenced to NAD 83)		
• Well use – irrigation, private drinking water supply, industrial, etc.		
• Diameter		
• Depth		
• Screened interval		
• Capacity		
• Static and pumping water levels		
• Well head elevation		
• Owner		
• Location of the closest water supply well		
• Location and description of most susceptible water supply well		
• Location and description of any impacted water supply wells		
• Proof of notification of offsite impacted land owner		
• List of any water supply wells downgradient from the site within 5 miles		
• Map of any wellhead protection areas near the site		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ If groundwater contamination is present, include analytical results of samples from down-gradient drinking water supply wells (results should be presented in section 2.2.4.5)		
2.2.6.2 Ecological Receptors		
➤ Location and description of sensitive environments within 2,000 feet of the site		
• Wetlands or wildlife habitats		
• Threatened or endangered species known or suspected to live on the site		
➤ Location and description of area natural resources		
• Groundwater use(s)		
• Agricultural use(s)		
• Other natural resources		
➤ Surface water survey		
• Location of closest surface water body		
• Location and description of the most susceptible surface water body		
• Location and description of any impacted surface water bodies		
• List of any surface water bodies downgradient from site within 1,000 feet		
• Surface water survey map		
➤ Answers to the questions listed in Section 2.2 of the <i>Protocol for VCP Remediation Goal Lookup Tables</i> document		
2.2.7 Conceptual Site Model		
➤ Summary of how and where contaminants are expected to move		
➤ Potential impacts to human health and the environment based on predicted movement of contaminants		
➤ Depiction of intended land use		
• Location and use of buildings		
• Location and depth of below-grade structures		
▪ basements		
▪ utility trenches		
▪ tunnels		
▪ elevator shafts		
▪ tanks		
• Description of landscaping features or decorative ponds		
• Description of any potential sensitive populations		
• Description of any current or proposed institutional controls		
➤ Potential contaminant exposure pathways		
• Ingestion of soil		
• Inhalation of volatiles and particulates from soils (e.g. windblown dust)		
• Dermal contact with soils		
• Ingestion of water		
• Inhalation of volatiles from water during showering/bathing		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> • Inhalation of vapors from vapor intrusion into indoor air (e.g., through foundations, floor drains, etc.) 		
<ul style="list-style-type: none"> ➤ Illustration of why contamination is a problem and why remediation is needed, in light of proposed land use 		
2.2.8 Summary and Conclusions		
<ul style="list-style-type: none"> ➤ Summary of significant findings of investigation 		
<ul style="list-style-type: none"> ➤ Conclusions regarding the full nature and extent of contamination 		
<ul style="list-style-type: none"> • Source areas or 'hot spots' of contamination in soil, groundwater, and/or surface water 		
<ul style="list-style-type: none"> • Horizontal and vertical extent of contamination in each media 		
<ul style="list-style-type: none"> ➤ Potential contamination migration routes for each media 		
<ul style="list-style-type: none"> ➤ Potential impacts of contamination to human health and the environment 		
2.3 REMEDIAL ACTION WORK PLAN		
2.3.1 Interim Remedial Actions		
<ul style="list-style-type: none"> ➤ Detailed description of any interim remedial actions for the site 		
<ul style="list-style-type: none"> • Locations 		
<ul style="list-style-type: none"> • Duration 		
<ul style="list-style-type: none"> • Methods 		
<ul style="list-style-type: none"> ➤ Justification of the implementation of interim remedial actions 		
<ul style="list-style-type: none"> ➤ Evaluation of whether interim remedial actions are compatible with the final remedy 		
<ul style="list-style-type: none"> ➤ Evaluation of whether interim remedial actions can be the final remedy 		
<ul style="list-style-type: none"> ➤ Description of the process by which the interim remedial actions will be decommissioned or incorporated into the final remedy 		
2.3.2 Remedial Action Objectives		
<ul style="list-style-type: none"> ➤ Bulleted list of RAOs 		
<ul style="list-style-type: none"> • Contaminant(s) of concern 		
<ul style="list-style-type: none"> • Cleanup levels for each contaminant 		
<ul style="list-style-type: none"> • Locations at which cleanup levels will be achieved 		
<ul style="list-style-type: none"> • Timeframe according to which remedial actions will be completed 		
<ul style="list-style-type: none"> • Exposure routes to be addressed 		
<ul style="list-style-type: none"> • Potential receptors to be addressed 		
<ul style="list-style-type: none"> ➤ Rationale for deciding which contaminants will be remediated and the level to which they will be reduced 		
<ul style="list-style-type: none"> ➤ Preliminary RAC Determination worksheet provided 		
2.3.3 Proposed Remedial Action		
<ul style="list-style-type: none"> ➤ Briefly describe the selected remedial action and explain how it will achieve the following environmental results (you do not have to describe the step-by-step evaluation in the report): 		
<ul style="list-style-type: none"> • Overall ability to protect human health and the environment 		
<ul style="list-style-type: none"> • Compliance with Applicable or Relevant and Appropriate Requirements (ARARS) 		
<ul style="list-style-type: none"> • Long-and short-term effectiveness and permanence 		
<ul style="list-style-type: none"> • Reduction of toxicity, mobility, or volume through treatment 		
<ul style="list-style-type: none"> • Community acceptance 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ Description of selected remedial action, including the information described in relevant sections below		
2.3.3.1 Presumptive Remedies		
➤ Description and justification for use of presumptive remedies, if applicable		
2.3.3.2 Innovative Technologies		
➤ In-situ bioremediation of groundwater		
• Type of biodegradation mechanism		
• Maps showing the locations of injectate wells		
• Well construction information		
• Maps, cross sections, and construction information for reactive barriers or other systems used to introduce reactants into the subsurface		
➤ Phytoremediation		
• Type of application and details of process employed		
• Plant types, root depths, locations, and other information		
➤ Passive groundwater remediation (i.e., monitored natural attenuation)		
• Methods for verifying that contaminants are degrading, rather than being diluted		
• Methods for verifying that contaminants are degrading at a rate that makes it suitable as a remedy		
• See section 2.3.3.5 for additional information regarding groundwater monitoring		
➤ Other innovative technology		
• Brief description of the technology		
• Maps, cross sections, and/or diagrams to illustrate planned remedial system		
2.3.3.3 Traditional Technologies		
➤ Soil excavation and removal		
• Extent and depth of soil to be excavated		
• Plans for refilling and regrading excavated areas		
• Maps and diagrams to illustrate locations, sizes, and shapes of these areas		
➤ In situ treatment of soil		
• Describe type of <i>in situ</i> treatment to be used		
• Overall systems for injection or extraction		
• Maps of cross-sections showing treatment points or radius of influence of the treatment system		
➤ Groundwater pump-and-treat		
• Describe basic treatment process		
• Maps showing locations of wells		
• Well construction information		
• Capture zone information		
• Other appropriate maps, cross sections, and diagrams		
➤ Air sparging/Soil vapor extraction		
• Maps of well locations		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
• Well construction information		
• Radius of influence of the system		
• Cross sections illustrating relationship among wells, contaminated zones, water table, and stratigraphic features		
2.3.3.4 Engineering Controls		
➤ Low-permeability barriers and containment structures		
• Describe type of engineering control		
• Thickness and engineering properties of cover material		
• Grading plans for the site		
• Maps, cross sections, and diagrams as appropriate		
• For landfill caps, contact NDEQ regarding information about other applicable guidance and checklists of information to submit		
➤ Physical access barriers		
• Describe type of barrier		
• Maps, diagrams, and cross sections to illustrate location, size, and other construction information		
➤ Discussion of why the engineering control is appropriate for the site		
2.3.3.5 Institutional Controls		
➤ Descriptions of planned institutional controls, including category and type:		
• Governmental controls		
▪ Zoning		
▪ Building codes		
▪ Drilling permit requirements		
▪ State or local groundwater use regulations		
• Proprietary controls		
▪ Covenants		
▪ Easements		
• Enforcement and permit tools with institutional control components		
▪ Remedy agreements		
▪ Administrative orders		
▪ Consent decrees		
▪ Permit conditions		
• Informational devices		
▪ State registries		
▪ Deed notices		
▪ Advisories		
➤ Discussion of how the institutional control will minimize the potential for human exposure to contamination and protect the integrity of the remedy		
2.3.4 Performance monitoring		
➤ Strategy for conducting performance monitoring		
• Monitoring or sampling objectives		
• Planned or existing monitoring locations		
• Monitoring schedule		
• Analytical parameters		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ Timeline for submittal of periodic performance monitoring reports. Reports should include:		
• Analytical results		
• QA/QC results		
• Chain of custody records		
• Groundwater sampling and field data sheets		
• Data tables containing groundwater elevations and well data		
• Groundwater contour maps		
➤ Operation and maintenance plan for		
• Inspection procedures and tasks to be completed as part of the routine operation and maintenance of the system		
• General description of the contingencies that will be used in the event the performance monitoring system requires repair or modification beyond the scope of routine operation and maintenance		
➤ Statement that you contacted NDEQ to determine whether a startup reports will be needed		
➤ Expected remediation timeframe (an acceptable timeframe will be the period of potential exposure to contamination in the absence of any remediation or 20 years, whichever is less)		
2.3.5 Remediation Waste Management Plan		
➤ Procedures for managing and disposing of remediation-derived waste		
➤ Facilities or methods for on-site treatment		
➤ Other information as outlined in Attachment 2-3		
2.3.6 Permitting and Regulatory Involvement		
➤ Description of applicable permits and regulations		
• Air discharge permit		
• Solid waste disposal permit		
• Groundwater well permits		
• Surface water appropriations permit		
• Injection or reinjection permit		
• Discharge to surface water permit		
• Discharge to sanitary sewers permit		
• Local building, plumbing, and electrical permits		
• Necessary easements or variances		
• Access agreements		
➤ Statement that a site-specific Health and Safety Plan will be used for field activities associated with the remedial action		
2.3.7 Proposed Schedule of Remedial Activities		
➤ Table containing:		
• Description of activity		
• Date of planned initiation		
• Date of planned completion		
• Other relevant information		
2.4 TABLES		
➤ All tables are numbered and titled		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
➤ All tables are easily legible and understandable		
➤ All abbreviations used in the table or table title are spelled out in table footnotes		
2.5 FIGURES		
➤ Horizontal and vertical scales bars on cross-sections		
➤ Horizontal scale bars on maps		
➤ Legend		
➤ Orientation labels (i.e., north arrow) on maps		
➤ Date, title, and source of base maps		
➤ Cross-section control points shown on an associated map, with reference to map on cross-section		
➤ Date(s) data was collected indicated on map		
➤ All features on maps clearly labeled		
➤ Site boundaries clearly labeled		
➤ Photographs scanned and printed at high resolution (300 dpi scanned, 600 dpi printed), preferably in color, including aerial photographs		
2.6 APPENDICES		
➤ Borehole logs		
• Facility name		
• Borehole identification		
• Borehole location, linked to NAD 83		
• Drilling method		
• Soil/bedrock lithological description (soil or rock type)		
• Soil/bedrock texture, fractures, and secondary porosity features		
• Color (Munsell soil color or Geological Society of America rock color chart identification)		
• Degree of saturation		
• Depths to water and bottom		
• Drilling rate or blow counts		
• Start and stop times and dates for drilling		
• Sampling equipment used		
• Percent sample recovered		
• Organic vapor field screening readings		
• Sample depth, number, and type		
➤ Well construction logs		
• Facility name		
• Well identification		
• Well location		
• Borehole diameter, total depth, plug back depth		
• Casing and screen material		
• Casing and screen diameter		
• Screen length and interval		
• Screen slot size		
• Sump length		
• Filter pack size and interval		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
• Spacing between casing and borehole wall		
• Placement and construction of seal and grout		
• Protective casing and surface structures		
➤ Complete results of field screening		
➤ Analytical reports for soil gas, groundwater, or soil samples, including QA/QC results		
➤ Data validation and usability summary		
➤ Vadose zone or aquifer testing data and estimation calculations		
➤ Flow modeling data, calculations, and results		
➤ Photographic documentation of investigative activities		
➤ Copies of log books, field sheets, chain-of-custody forms, or other relevant supporting documentation.		
➤ Copies of waste manifests, aerial photographs, and other documents used to characterize the site		
➤ Copies of relevant property deeds		
➤ Quality Assurance Project Plan (QAPP)		
➤ If QAPP has been modified for RAWP, include new document here		

ACRONYMS/ABBREVIATIONS

CERCLIS	= Comprehensive Environmental Response, Compensation, and Liability Act Information System
CSD	= Conservation and Survey Division
DOD	= Department of Defense (U.S.)
Dpi	= dots per inch
EPA	= Environmental Protection Agency (U.S.)
FUDS	= Formerly used defense sites
MCL	= Maximum Contaminant Level
MSDS	= Manufacturer's safety data sheet
N	= Not included/absent
NA	= Not applicable
NAD 83	= North American Datum 1983
NDEQ	= Nebraska Department of Environmental Quality
NDNR	= Nebraska Department of Natural Resources
NRCS	= Natural Resources Conservation Service
PQL	= Practical quantitation limit
PRG	= Preliminary remediation goal
QA	= Quality assurance
QC	= Quality control
RAC	= Remedial action class
RAO	= Remedial action objective
RAP	= Remedial Action Plan
RAPMA	= Remedial Action Plan Monitoring Act
RAWP	= Remedial action work plan
RCRA	= Resource Conservation and Recovery Act
RCRIS	= RCRA Information System
RG	= Remediation goal
SVOC	= Semi-volatile organic compound
TCLP	= Toxicity Characteristic Leaching Procedure
TRIS	= Toxics Release Inventory System
UNL	= University of Nebraska - Lincoln
USDA	= U.S. Department of Agriculture
USGS	= U.S. Geological Survey
VCP	= Voluntary Cleanup Program
VOC	= Volatile organic compound
Y	= Yes/present

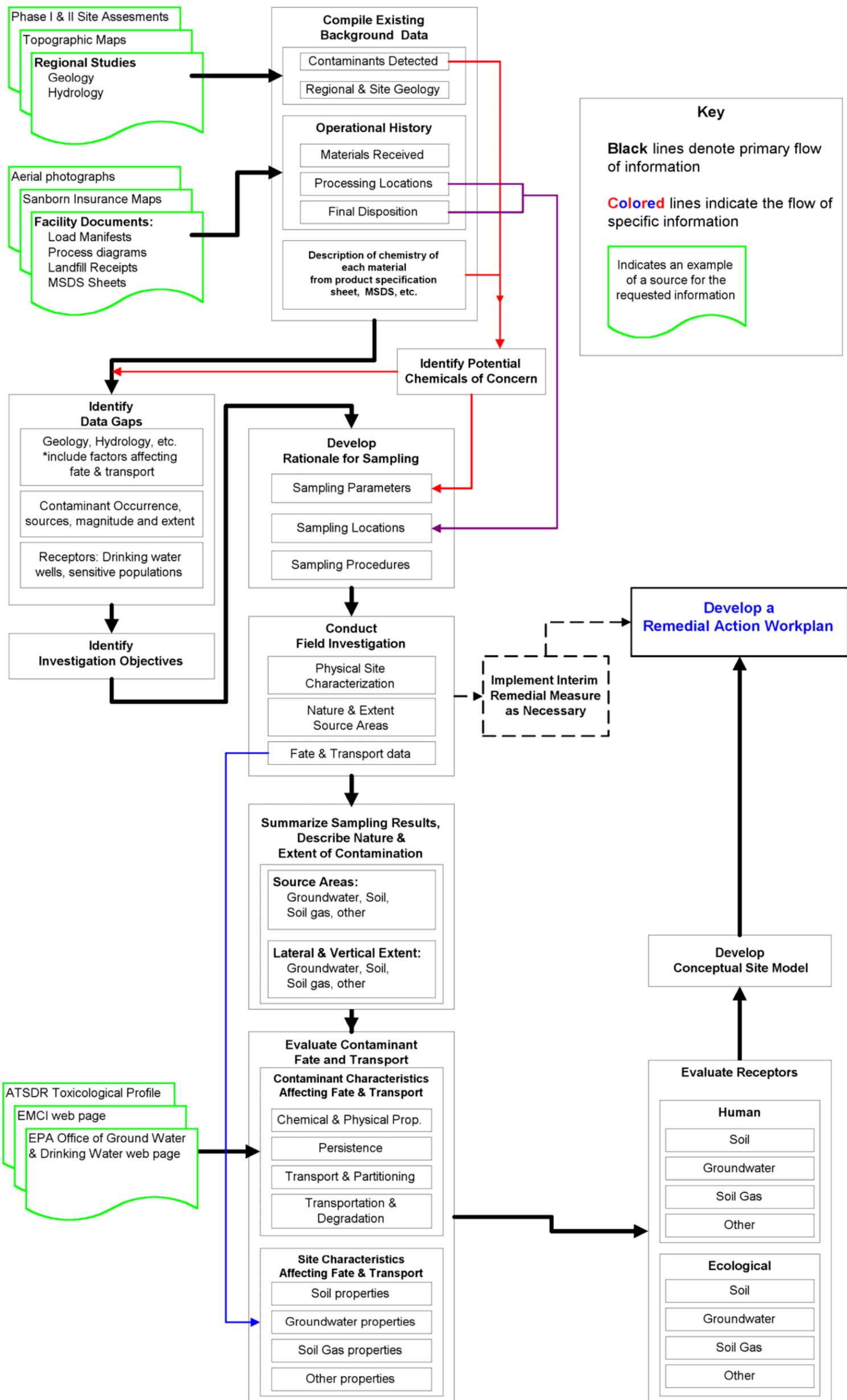
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ATTACHMENT 2-2
INVESTIGATION PROCESS FLOWCHART

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Nebraska's Voluntary Cleanup Program

Investigation Process Flowchart



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ATTACHMENT 2-3
INVESTIGATION-DERIVED WASTE (IDW)
ENVIRONMENTAL GUIDANCE

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NEBRASKA DEPARTMENT OF ENVIRONMENTAL QUALITY

ENVIRONMENTAL GUIDANCE DOCUMENT

05-161

March 2005

Investigation-Derived Waste (IDW) & Remediation Waste Considerations

Scope of This Guidance Document

The objective of this document is to facilitate consistency throughout the state in managing IDW and remediation environmental media and debris potentially contaminated with hazardous waste. While this guidance is applicable to locations that do not come under the “area of contamination” (AOC) policy or have not had an AOC designated, AOC considerations are discussed in this document to better clarify the full range of options available when considering investigation and remediation questions should an AOC be appropriate. AOC considerations are at page 6. This document is not meant for use to develop cleanup criteria. This document was written for environmental investigation and remediation professionals.

What is Investigation-Derived Waste (IDW)?

IDW is a subset of remediation wastes. IDW is waste that is generated in the process of investigating or examining an actual or potentially contaminated site. It includes solid and hazardous waste, media (including groundwater, surface water, soils, and sediments) and debris that contain *listed* hazardous wastes or exhibit a characteristic of a hazardous waste. It includes media and debris that is not hazardous but is contaminated with hazardous constituents. Not all IDW is hazardous waste.

IDW includes wastes that are generated from field investigation activities, typically approved and overseen by the Nebraska Department of Environmental Quality (NDEQ) or the U. S. Environmental Protection Agency (EPA), that are specifically designed to determine the nature and extent of contamination. IDW will normally be generated during the site assessment or remedial investigation and feasibility study stage of a cleanup project. IDW is the waste generated from an activity related to determining the nature and extent of contamination as well as the preparation or examination of the site for future remediation. Such wastes can include, but are not limited to: drilling mud, cuttings, and purge water from test borings and well installation;

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purge water, soil and other materials from collection of samples; contaminated personal protective equipment (PPE), and solutions used to decontaminate non-disposable protective clothing and sampling equipment; and equipment used during field investigation activities. IDW does not include wastes that are generated from the removal or displacement of environmental media or debris as a result of other related remediation activities (these would be remediation wastes) or activities not related to remediation such as geotechnical investigation for building construction. The generator can usually dispose of non-hazardous IDW, depending on its physical state and health-based characteristics, as any other solid waste. However, federal, state, and local waste, air, and water regulations apply. For example, most non-hazardous media cannot be disposed by open burning. As another example, land application of contaminated media is regulated in Nebraska and is usually not allowed except to permitted municipal solid waste landfills.

Remediation wastes are wastes generated from all types of remediation activities.

Is The Waste Hazardous?

Environmental media is not, of itself, a waste. It can, however, contain *listed* hazardous wastes or enough hazardous constituents that it exhibits a characteristic of a hazardous waste. If the media will be actively managed and it contains *listed* hazardous waste or is a characteristic hazardous waste, it must be managed as a hazardous waste.

There may be circumstances where pre-existing sampling data may be used to make a hazardous waste determination. Factors such as the age of the extant sampling data, potential for changed conditions, and whether the sampling data used is representative of the IDW in question must be considered. For further information regarding hazardous waste determinations see the department's Environmental Guidance Document # 00-066, Waste Determinations & Hazardous Waste Testing.

Active Management and Point of Generation

The concept of “active management” as applied to IDW or remediation waste is associated with environmental media or debris. *If media or debris is being displaced on a site due to activities related to contamination investigation or remediation, the NDEQ considers such activities as active management under the waste regulations.* Activity not related to investigation or remediation is not considered “active management” under the waste regulations. For example, routine trench or foundation excavation spoils that are generated at a site that is not a remediation or investigation activity site or are not related to remediation or investigation activities are not considered a waste unless it is intended for disposal. Such spoils could normally be replaced in the excavation. In investigation or remediation activities, the point of

generation (POG) of waste is where or when the media or debris is excavated or investigation or remediation related wastes are either created or rendered spent. For example, for PPE the POG is generally the location where the equipment is determined to be no longer usable. Sampling gloves are routinely rendered “spent” between sampling events. These gloves are waste when they are removed.

Pre-Characterized Sites.

When a site can be adequately pre-characterized as not contaminated with *listed* or characteristic hazardous wastes, IDW from this site does not require management as hazardous waste.

Examples of this type of IDW include: cuttings and purge water from wells or piezometers located a significant distance from known contamination that are being drilled to fully determine hydrologic conditions or gradient, cuttings from an uncontaminated and unsaturated zone above suspected groundwater contamination; etc. However, if the pre-characterization is proven to be wrong by subsequent investigation, incorrect management of the IDW may result in an expansion of the scope of the cleanup or remediation, since contamination may have been spread. This could result in an enforcement action. To avoid this possibility, the department recommends that IDW be containerized and managed according to this guidance, pending the completed hazardous waste determination for any portion of a site with limited or poor historical data.

How to Manage IDW or Remediation Waste.

Often, once IDW or remediation waste is generated it needs appropriate management before a hazardous waste determination is completed (usually due to the laboratory turnaround time for analysis of field samples). Unless the area where the IDW or remediation waste was generated is pre-characterized as not containing hazardous waste, the waste should be managed as follows:

Disposable Personal Protective and Sampling Equipment: Containerize when generated. This waste is a solid waste and could, therefore, be a hazardous waste. Personal protective and sampling equipment becomes a hazardous waste at the time it is disposed if it is contaminated with any *listed* hazardous waste. According to the “Mixture Rule” (See Title 128- Nebraska Hazardous Waste Regulations, Chapter 2, §005.02), any mixture of solid waste and *listed* hazardous waste becomes a *listed* hazardous waste. Although unlikely, this waste may also be a hazardous waste if it has become contaminated with enough hazardous constituents to exhibit a *characteristic* of a hazardous waste. (Spent filters are examples of IDW or remediation waste that are often characteristic for toxicity.)

Drill Cuttings/Soil/Sediment (including composite/grab sample waste from surface soils) and Test Pit Spoils: Containerize when generated pending characterization. If the solid media contains a *listed* waste, you must obtain a determination by the department’s Waste Management Division that the waste no longer “contains” *listed* waste before it can be considered a non-hazardous waste and disposed of as such. (See the EPA’s “contained-in” policy.) The department recognizes that circumstances will vary from site to site.

Generally speaking, drill cuttings/soil/sediment may be returned to the site of original removal if the media is a non-hazardous waste and is below the EPA Region 9 Preliminary Remediation Goal (PRG) or the Nebraska Voluntary Cleanup Program (VCP) Lookup Table values* for all constituents of concern. IDW or remediation waste drill cuttings/soil/sediment must not be allowed to be used as fill on other areas of the site or off site unless the media is not mixed with other solid wastes and does not have the potential to cause contamination that may threaten human health or the environment. Merely being below appropriate PRG or VCP Lookup Table values* does not necessarily mean the media won't have the potential to cause contamination that may threaten human health or the environment. There might also be situations where "landfarming" of some types of contaminated soils is appropriate. For example, media contaminated solely with petroleum fuels can often be landfarmed successfully and safely. Contact the NDEQ Waste Management Section for more information.

If you have questions about how to implement this section for your particular situation, contact the department for clarification and assistance. (*Note: Test pits might be the most convenient sampling methodology, but they generate a great deal of material that must be managed and should be used as a last resort and only after the depth to ground water has been established.*)

Purge and Development/Decontamination Water: Containerize when generated. If the water is a *listed* or a characteristic hazardous waste it may not be discharged to the ground or back to the well. If analysis of the water determines that it is not hazardous waste and it meets ground water standards found in Title 118 – Nebraska Ground Water Quality Standards and Use Classifications, VCP Lookup Table values*, or health based standards, the water may be poured on the ground at or near the point of generation, but not back to the well. If the water contains a *listed* waste, you must obtain a determination by the department that the waste no longer "contains" *listed* waste before it can be disposed of as a non-hazardous waste. (See the EPA's "contained-in" policy.)

Discharges to surface water or drainages should be avoided because of stringent aquatic life water quality standards.

Where there is prior approval by the affected Publicly Owned Treatment Works (POTW) (Municipal Wastewater Treatment Plant) Facility, discharges directly through an on-site sanitary sewer system to a POTW may be allowed. (*Note: The water cannot be transported to a Nebraska POTW if it is a listed or characteristic hazardous waste. Nor can listed or characteristic hazardous waste water be transported to another site that has a sanitary sewer connection to a Nebraska POTW.*)

The department understands that there may be a large amount of decontamination water to containerize for analysis and characterization; therefore we recommend the initial generation of decontamination water be minimized.

Water generated from *dewatering IDW* must be managed as a separate waste. Containerize the water upon generation. A separate waste determination is required. If analysis of the water determines that it is not hazardous waste and it meets ground water

standards found in Title 118 – Nebraska Ground Water Quality Standards and Use Classifications, VCP Lookup Table values*, or health based standards, the water may be poured on the ground at or near the point of generation. If the water contains a *listed* waste, you must obtain a determination by the department that the waste no longer “contains” *listed* waste before it can be disposed of as a non-hazardous waste.

Miscellaneous Waste Issues: The disposal of waste in *unpermitted* landfills is prohibited. In other words, you can’t put waste in or on the ground *or put it back in or on the ground* if it’s not a permitted landfill. There may be times during investigation or remediation activities when excavation uncovers materials that might have been improperly disposed. In addition to excavating items that were improperly disposed, there may be times when random non-media items are excavated that had a legitimate reason for being in the ground. **Generally speaking, if waste-like items are excavated, they must not be placed back in the ground.** These items should be sent to a municipal solid waste landfill if determined to be a non-hazardous waste and can pass the “paint filter” test. Examples: 1) If you excavate an abandoned pipe or cable section, you should not re-bury that piece. *There is no need to remove the remaining pipe or cable that was not excavated.* 2) If you come upon a dumpsite and determine the waste was placed after October 1, 1993 (when the solid waste regulations became effective in Nebraska), all the waste might need to be removed to a properly permitted landfill. If the landfill site was closed prior to October 1, 1993, then only the waste items removed during excavation need to be sent to a properly permitted solid waste landfill. 3) If you come upon “free-product” material, you should consider this material to be a waste. It should not be left on site. Waste determination and proper waste management would be required.

Beneficial Use: Title 132, Chapter 1, §041 defines “fill” as solid waste that consists only of one or more of the following: sand, gravel, stone, soil, rock, brick, concrete rubble, asphalt rubble, or similar material. If excavation uncovers buried material that appears to meet the above definition, the NDEQ would normally allow such material to be replaced in the excavation if it is not otherwise hazardous. If the “fill” were mixed with other types of wastes not mentioned above it would not meet the above definition. This would be evidence that the location might be a former landfill. In some cases, excavation spoils might be able to be used elsewhere on site or at another site. Title 132, Chapter 2, §002.01 and §002.01A allow the use of fill for certain land improvement purposes provided the wastes used in these activities are not mixed with other wastes **and** do not have the potential to cause contamination that might threaten human health or the environment.

Hazardous IDW or Remediation Waste Placed on the Ground. Hazardous IDW or remediation waste placed on the ground creates a regulated unit and constitutes a solid waste management unit (SWMU) that might be subject to RCRA permitting or closure requirements. Placement on the ground occurs even when the IDW or remediation waste is placed on plastic sheets or concrete pads. Note that the Area of Contamination Policy can change this assessment, but only when and where an AOC has been formally declared.

Storage In Containers

Hazardous waste storage in containers must meet the requirements of Title 128 - Nebraska Hazardous Waste Regulations, Chapter 9 or 10 (whichever applies), or, if applicable, a RCRA hazardous waste storage permit.¹ Hazardous IDW or remediation waste must be stored and managed as a hazardous waste because returning it to a SWMU might exacerbate the contamination cleanup regulatory issues. Facilities accumulating hazardous IDW or remediation waste for longer than

- 90 days for Large Quantity Generators (LQGs) (See Title 128, Chapter 10), or
- 180/270 days for Small Quantity Generators (SQGs) (See Title 128, Chapter 9)

after generation will need a hazardous waste storage permit. Hazardous waste accumulation is limited to the generator's accumulation timeframe. However, a special one-time 30-day extension approval may be obtained from the department, if the generator can justify that an additional 30 days is essential. This request must be made in writing, within the generator's accumulation timeframe. Already permitted facilities may need to modify their current RCRA permit to store the waste. If a remedy is chosen to treat the waste in tanks or containers and that remedy cannot effectively treat the hazardous IDW, it must be properly disposed of within the generator's accumulation timeframe or as delineated in a RCRA permit.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) sites meet applicable or relevant and appropriate requirements (ARARs) relative to on-site treatment of remediation waste.

IDW or Remediation Waste Disposal

Hazardous IDW or Remediation Waste. If only conditionally exempt small quantity generator amounts are involved, then the waste may be disposed to a permitted municipal solid waste landfill with prior approval by the landfill. In this case, no more than 43 pounds of the CESQG waste may be sent to the landfill on any one day. Such wastes must be able to pass the "paint-filter" test.

Certain liquid wastes may be sent to a publicly owned treatment works (POTW) via an on site sanitary sewer with prior approval by the POTW.

The generator of IDW or remediation waste must meet all SQG or LQG generator requirements as appropriate.

Non-hazardous IDW. Options follow:

Keep IDW media on-site if uncontaminated.

Keep contaminated IDW media on-site if it meets EPA Region 9 PRG or Nebraska VCP Lookup Table* values. Return to the point of excavation. Return water media to the ground at/near generation point if it meets certain criteria as explained above. Site specifics must be considered. Non-media IDW or remediation waste must be disposed off-site to a proper facility.

Remediation waste, by its very nature, is not supposed to be left on site. Therefore, non-hazardous environmental media should be disposed to a permitted landfill or properly treated on or off site. Liquid remediation wastes can be treated on or off site or disposed to an appropriate Clean Water Act facility.

Area of Contamination Policy Considerations

As stated previously, this guidance document generally applies to non-AOC sites. **This section is meant as additional information should conditions warrant application of the AOC policy.** AOCs are certain discrete areas of generally dispersed contamination that can be equated to a RCRA landfill and that movement of hazardous wastes within those areas would not be considered land disposal and would not trigger the RCRA land disposal restrictions. The AOC policy generally involves the concept of “placement.” “Placement” of hazardous waste into or on a landfill or other land-based unit is considered land disposal, which triggers the land disposal restrictions and might trigger other RCRA requirements including permitting, closure, and post-closure. Generally, “placement” *does not* occur when waste is consolidated **within** an AOC, when it is treated in situ, or when it is left in place. “Placement” *does* occur if wastes are moved from one AOC to another (e.g., for consolidation) or when waste is actively managed (e.g., ex situ treatment) within or outside the AOC and returned to land.

AOC Factors. Only the EPA or NDEQ can formally designate an AOC in Nebraska. The lateral extent of an AOC must be limited to the actual area of contiguous, but not necessarily homogenous, contamination. Hazardous waste placed outside an AOC would be considered land disposal and might be subject to RCRA corrective action. AOCs do not include adjacent areas used to implement response activities. The AOC policy does not include contaminated ground water or surface water that may be associated with the land-based source of hazardous waste.

AOC Designation. The department can designate an AOC upon a formal request based on: 1) actual data presented to the department, 2) *discrete* areas of contamination or suspected contamination, 3) approval of an adequate, comprehensive sampling plan, 4) a workplan describing hazardous waste activities to be performed in the AOC, and 5) any other pertinent factors particular to the site.

Glossary of Terms

Area of Contamination Policy: See EPA Document EPA530-F-98-026, Management of Remediation Waste Under RCRA. In Nebraska only the EPA or NDEQ can designate an AOC.

Debris: Material exceeding 60 mm particle size that is intended for disposal and that is a manufactured object, or plant or animal matter or natural geologic material. (Approximately the size of a tennis ball.) See Title 128, Chapter 20, §011.

Environmental Media: Naturally occurring material indigenous to the environment including ground water, surface water, surface and subsurface soils, rocks, bedrock and gravel.

Fill: Solid waste that consists only of one or more of the following: sand, gravel, stone, soil, rock, brick, concrete rubble, asphalt rubble, or similar material.

LQG (Large Quantity Generator): A generator of 2,200 lbs or more of hazardous waste or 2.2 lbs of acutely hazardous waste in a calendar month.

Regulated Unit: Regulated units are defined in 40 CFR 264.90 as surface impoundments, waste piles, land treatment units, and landfills that received hazardous waste after July 26, 1982. RCRA regulated units are a subset of the universe of solid waste management units.

SQG (Small Quantity Generator): A generator of greater than 220 lbs of hazardous waste or less than 2,200 lbs per month of hazardous waste in a calendar month.

SWMU (Solid Waste Management Unit): Any discernible unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. This includes any area at a facility where solid wastes have been routinely and systematically released and may include contiguous property where releases have migrated beyond the facility boundaries.

Miscellaneous Resources

Useful Websites:

NDEQ Home page – <http://www.deq.state.ne.us/>

EPA Office of Solid Waste – <http://www.epa.gov/osw/>

Contacts:

NDEQ Waste Compliance Assistance

(402) 471-8308

NDEQ Waste Management Section

(402) 471-4210

NDEQ Toll Free Number

(877) 253-2603

NDEQ Publications²:

Title 128 – Nebraska Hazardous Waste Regulations

Title 132 – Integrated Solid Waste Management Regulations

Environmental Fact Sheet – Hazardous Waste Generator Comparison (00-055)

Environmental Guidance Document – Waste Determinations & Hazardous Waste Testing (00-066)

Nebraska Voluntary Cleanup Program (VCP) Guidance*

1. Refer to the Land Disposal Restriction Rule found in Title 128 – Nebraska Hazardous Waste Regulations, Chapter 20, to determine if the hazardous debris or alternate soil treatment standards can apply to the IDW.

2. These are available on the NDEQ website or may be requested by calling the NDEQ Waste Management Section.

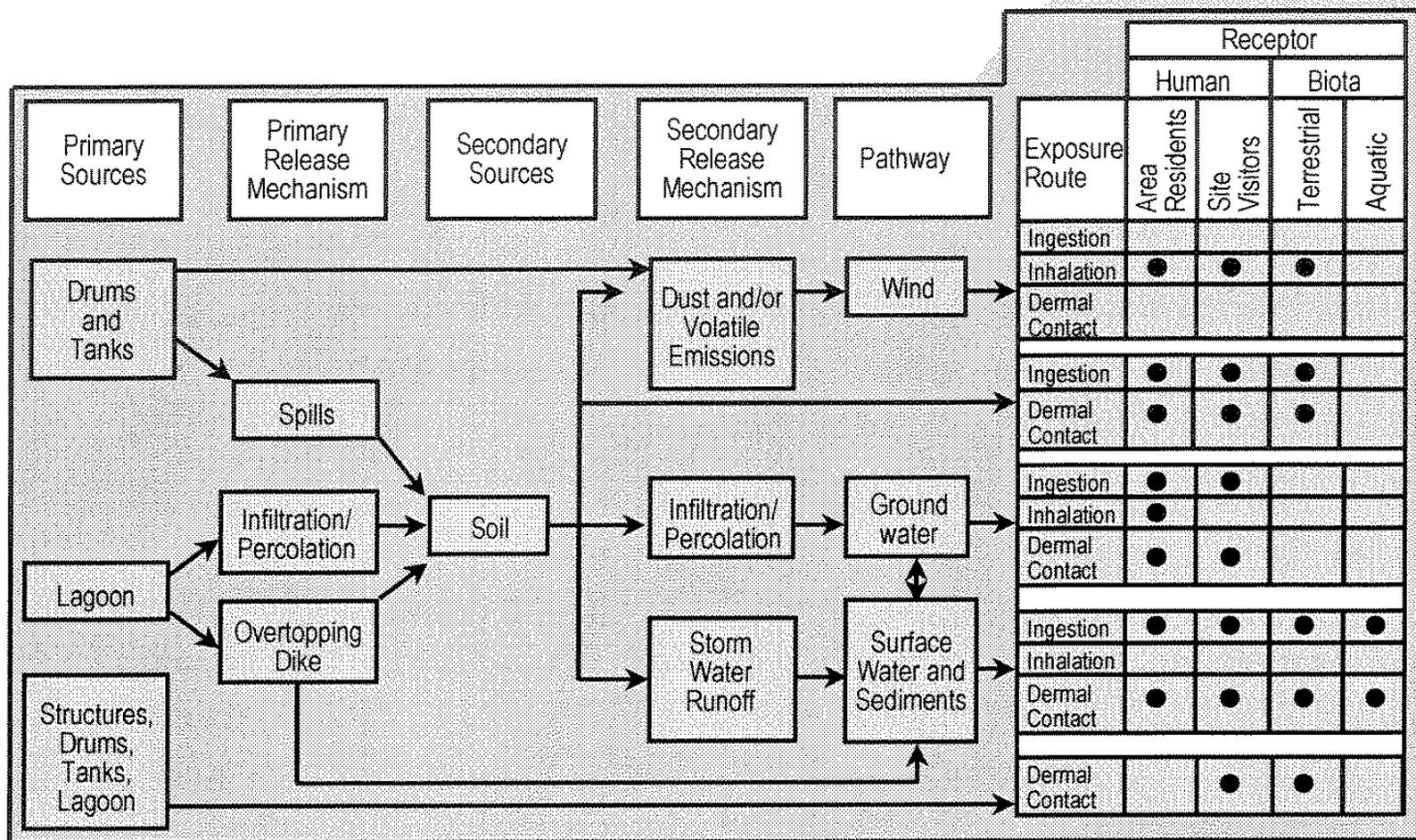
**The Nebraska Voluntary Cleanup Program (VCP) Guidance with the VCP Lookup Tables was in draft at the time of publication of this guidance. Use the most current version. Contact the NDEQ Remediation Section at (402) 471-2214 if you have questions on the VCP Guidance currency. The VCP Guidance may be found on the NDEQ web site.*

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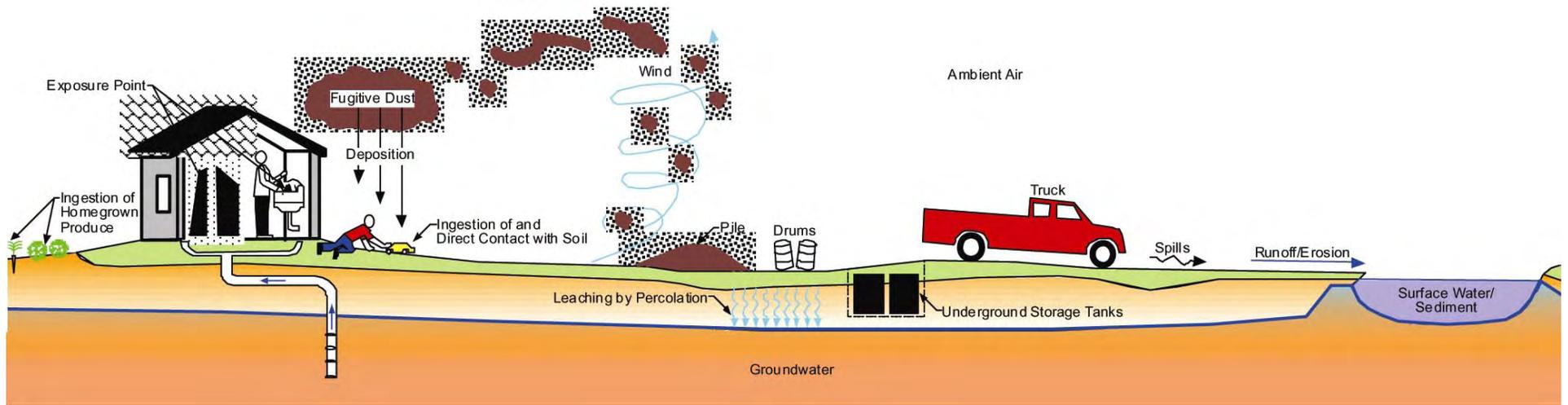
ATTACHMENT 2-4
EXAMPLE CONCEPTUAL SITE MODELS

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CONCEPTUAL SITE MODEL – TABULAR FORMAT



CONCEPTUAL SITE MODEL – GRAPHICAL FORMAT



ATTACHMENT 2-5

PRELIMINARY RAC DETERMINATION WORKSHEET

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Nebraska Department of Environmental Quality

Preliminary RAC Determination Worksheet for VCP Sites

Note: The purpose of this worksheet is to aid a user of the NDEQ VCP Guidance Document in the preliminary determination of the likely Remedial Action Class (RAC) designation a contaminated site would receive from NDEQ, based on groundwater use within the area surrounding the facility. Knowledge of the probable RAC will be necessary for a user to determine appropriate remediation goals and evaluate potential cleanup technologies where groundwater contamination is a concern. **The conclusions reached by a user of this worksheet are to be considered preliminary only and subject to a final, official RAC determination by the NDEQ as part of its review of the VCP Remedial Action Plan.** Detailed information regarding RACs may be found in Nebraska Title 118 – Ground Water Quality Standards and Use Classification, Appendix A, Step 8, pages A-4 – A-6.

Has a public or private drinking water supply well been impacted by contamination from the VCP site?		
Is the groundwater contaminant plume within 1000 feet of a public drinking water supply well?		
Is the groundwater contaminant plume within 500 feet of a private drinking water supply well?		
Has groundwater in the area around the contaminant plume been zoned or purchased by a local government for the purpose of developing a public drinking water supply well or well field?		
Is the groundwater contaminant plume within a designated wellhead protection area, as defined by the NDEQ through the Nebraska Wellhead Protection Program?		

If any of the questions above have been answered "Yes," the release is classified as RAC-1.

RAC-3 Determination

	Yes	No
Is groundwater within the area of the contaminant plume of poor natural or background quality compared to the numerical standards of Title 118, Chapter 4?		
Is groundwater in the area of the contaminant plume found under hydrogeologic conditions that make development of a public or private drinking water supply unlikely?		

If either of the previous two questions have been answered "Yes," the release may be considered RAC-3.

RAC-2 Determination

If all of the above questions have been answered "No," then the release will likely be considered RAC-2.

PRELIMINARY RAC DETERMINATION

For the purpose of preparing the VCP site Remedial Action Plan, the groundwater contaminant plume associated with the facility under consideration is preliminarily assigned the following RAC designation (circle one):

RAC-1

RAC-2

RAC-3

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ATTACHMENT 2-6
REMEDIATION GOALS LOOKUP TABLES

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VCP REMEDIATION GOALS

Key : SFo = Oral Slope Factor; RfDo = Oral Reference Dose; IUR = Inhalation Unit Risk; RfC = Inhalation Reference Concentration; i = IRIS; h = HEAST; n = NCEA; x = Withdrawn (reference for value provided); o = Other EPA Source (reference for value provided); p = NCEA PPRTV; R3 = EPA Region 3 RBC Table; R6 = EPA Region 6 MSSL Table; R9 = EPA Region 9 PRG Table; ca = Cancer VCP RG; nc = Noncancer VCP RG; m = MCL-based; s = solubility; sat = Soil Saturation; max = Ceiling limit; DAF = Dilution Attenuation Factor; CAS = Chemical Abstract Services; +++ = Non-Standard Method Applied; see Notes section at bottom of table and Appendix A, Protocol for VCP Remediation Goal Lookup Tables, Nebraska Voluntary Cleanup Program for more information

CONTAMINANT	TOXICITY INFORMATION ¹											VCP REMEDIATION GOALS (RGs)									
	CAS No.	SFo (mg/kg-d) ⁻¹	RfDo (mg/kg-d)	IUR (µg/m ³) ⁻¹	RfC (mg/m ³)	V		ABS _d (unitless)	ABS _{GI} (unitless)	Direct Contact Exposure Pathways			Migration to Ground Water								
						O	S			Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ground Water (µg/l)	DAF 20 (mg/kg)								
														C	solid						
Acephate	30560-19-1	8.7E-03	i	4.0E-03	i				0.10	1	5.6E+01	ca	2.0E+03	ca	7.7E+00	ca					
Acetaldehyde	75-07-0			2.2E-06	i				9.0E-03	i	0		1.6E+01	ca	1.9E+02	nc	2.2E+00	ca	1.0E-02	ca	
Acetochlor	34256-82-1			2.0E-02	i				0.10	1	0		3.1E+02	nc	1.2E+04	nc	1.8E+02	nc			
Acetone	67-64-1			9.0E-01	i					1	1		1.8E+04	nc	1.0E+05	max	8.2E+03	nc	3.3E+01	nc	
Acetone cyanohydrin	75-86-5			8.0E-04	h				1.0E-02	h	0		1.2E+01	nc	4.9E+02	nc	7.3E+00	nc			
Acetonitrile	75-05-8								6.0E-02	i	1		4.3E+02	nc	2.4E+03	nc	3.1E+01	nc	1.4E-01	nc	
Acrolein	107-02-8			5.0E-04	i				2.0E-05	i	1		7.0E-02	nc	3.9E-01	nc	1.0E-02	nc	5.1E-05	nc	
Acrylamide	79-06-1	4.5E+00	i	2.0E-04	i	1.3E-03	i		0.10	1	0		1.1E-01	ca	3.8E+00	ca	1.5E-02	ca			
Acrylic acid	79-10-7			5.0E-01	i				0.10	1	0		7.5E+03	nc	1.0E+05	max	4.6E+03	nc			
Acrylonitrile	107-13-1	5.4E-01	i	1.0E-03	h	6.8E-05	i		2.0E-03	i	1		2.9E-01	ca	5.7E+00	ca	4.5E-02	ca	1.8E-04	ca	
Alachlor	15972-60-8	8.0E-02	h	1.0E-02	i					0	S	0.10	1	6.1E+00	ca	2.2E+02	ca	2.0E+00	m		
Alar	1596-84-5			1.5E-01	i				0.10	1	0		2.3E+03	nc	9.2E+04	nc	1.4E+03	nc			
Aldicarb	116-06-3			1.0E-03	i				0.10	1	0	S	1.5E+01	nc	6.2E+02	nc	9.1E+00	nc			
Aldicarb sulfone	1646-88-4			1.0E-03	i				0.10	1	0	S	1.5E+01	nc	6.2E+02	nc	9.1E+00	nc			
Aldrin	309-00-2	1.7E+01	i	3.0E-05	i	4.9E-03	i		0.10	1	S	0.10	1	2.9E-02	ca	1.0E+00	ca	7.9E-04	ca	7.8E-02	ca
Allyl	74223-64-6			2.5E-01	i				0.10	1	0		3.8E+03	nc	1.0E+05	max	2.3E+03	nc			
Allyl alcohol	107-18-6			5.0E-03	i				0.10	1	0		7.6E+01	nc	3.1E+03	nc	4.6E+01	nc			
Allyl chloride	107-05-1			5.0E-02	R9				0.10	1	0		7.6E+02	nc	3.0E+04	nc	4.6E+02	nc			
Aluminum	7429-90-5			1.0E+00	p				5.0E-03	p	0		1.9E+04	nc	1.0E+05	max	5.0E+01	m			
Aluminum phosphide	20859-73-8			4.0E-04	i					0			7.8E+00	nc	4.1E+02	nc	3.7E+00	nc			
Amdro	67485-29-4			3.0E-04	i				0.10	1	0		4.6E+00	nc	1.8E+02	nc	2.7E+00	nc			
Ametryn	834-12-8			9.0E-03	i				0.10	1	0		1.4E+02	nc	5.5E+03	nc	8.2E+01	nc			
m-Aminophenol	591-27-5			7.0E-02	h				0.10	1	0		1.1E+03	nc	4.3E+04	nc	6.4E+02	nc			
4-Aminopyridine	504-24-5			2.0E-05	h				0.10	1	0	S	3.1E-01	nc	1.2E+01	nc	1.8E-01	nc			
Amitraz	33089-61-1			2.5E-03	i				0.10	1	0		3.8E+01	nc	1.5E+03	nc	2.3E+01	nc			
Ammonia	7664-41-7								1.0E-01	i	n/a		1								
Ammonium sulfamate	7773-06-0			2.0E-01	i				0.10	1	0		3.1E+03	nc	1.0E+05	max	1.8E+03	nc			
Aniline	62-53-3	5.7E-03	i	7.0E-03	p				1.0E-03	i	0		8.5E+01	ca	3.0E+03	ca	1.2E+01	ca			
Antimony and compounds	7440-36-0			4.0E-04	i					0		0.15	7.8E+00	nc	4.1E+02	nc	6.0E+00	m			
Antimony pentoxide	1314-60-9			5.0E-04	h					0		0.15	9.8E+00	nc	5.1E+02	nc	6.0E+00	m			
Antimony potassium tartrate	28300-74-5			9.0E-04	h					0		0.15	1.8E+01	nc	9.2E+02	nc	6.0E+00	m			
Antimony tetroxide	1332-81-6			4.0E-04	h					0		0.15	7.8E+00	nc	4.1E+02	nc	6.0E+00	m			
Antimony trioxide	1309-64-4			4.0E-04	h				2.0E-04	i	0		7.8E+00	nc	4.1E+02	nc	6.0E+00	m			
Apollo	74115-24-5			1.3E-02	i				0.10	1	0		2.0E+02	nc	8.0E+03	nc	1.2E+02	nc			
Aramite	140-57-8	2.5E-02	i	5.0E-02	h	7.1E-06	i		0.10	1	0		1.9E+01	ca	6.9E+02	ca	2.7E+00	ca			
Arsenic (noncancer endpoint)	7440-38-2			3.0E-04	i				0.03	1	0		5.4E+00	nc	2.6E+02	nc	5.0E+01	m	2.9E+01	m	
Arsenic (cancer endpoint)	7440-38-2	1.5E+00	i	3.0E-04	i	4.5E-03	i		0.03	1	0		3.9E-01	ca	1.6E+01	ca	5.0E+01	m	2.9E+01	m	
Arsine	7784-42-1								5.0E-05	i	n/a		1								
Assure	76578-12-6			9.0E-03	i				0.10	1	0		1.4E+02	nc	5.5E+03	nc	8.2E+01	nc			
Asulam	3337-71-1			5.0E-02	i				0.10	1	0		7.6E+02	nc	3.1E+04	nc	4.6E+02	nc			
Atrazine	1912-24-9	2.2E-01	h	3.5E-02	i				0.10	1	0	S	2.2E+00	ca	7.8E+01	ca	3.0E+00	m			
Avermectin B1	71751-41-2			4.0E-04	i				0.10	1	0		6.1E+00	nc	2.5E+02	nc	3.7E+00	nc			
Azobenzene	103-33-3	1.1E-01	i			3.1E-05	i		0.10	1	0		4.4E+00	ca	1.6E+02	ca	6.1E-01	ca			
Barium and compounds	7440-39-3			7.0E-02	i					0		0.07	1.4E+03	nc	6.6E+04	nc	2.0E+03	m	1.6E+03	m	
Baygon	114-26-1			4.0E-03	i				0.10	1	0		6.1E+01	nc	2.5E+03	nc	3.7E+01	nc			
Bayleton	43121-43-3			3.0E-02	i				0.10	1	0		4.6E+02	nc	1.8E+04	nc	2.7E+02	nc			
Baythroid	68359-37-5			2.5E-02	i				0.10	1	0		3.8E+02	nc	1.5E+04	nc	2.3E+02	nc			
Benefin	1861-40-1			3.0E-01	i				0.10	1	0		4.6E+03	nc	1.0E+05	max	2.7E+03	nc			
Benomyl	17804-35-2			5.0E-02	i				0.10	1	0		7.6E+02	nc	3.1E+04	nc	4.6E+02	nc			
Bentazon	25057-89-0			3.0E-02	i				0.10	1	0		4.6E+02	nc	1.8E+04	nc	2.7E+02	nc			
Benzaldehyde	100-52-7			1.0E-01	i				0.10	1	0		1.5E+03	nc	6.2E+04	nc	9.1E+02	nc			

VCP REMEDIATION GOALS

Key : SFo = Oral Slope Factor; RfDo = Oral Reference Dose; IUR = Inhalation Unit Risk; RfC = Inhalation Reference Concentration; i = IRIS; h = HEAST; n = NCEA; x = Withdrawn (reference for value provided); o = Other EPA Source (reference for value provided); p = NCEA PPRTV; R3 = EPA Region 3 RBC Table; R6 = EPA Region 6 MSSL Table; R9 = EPA Region 9 PRG Table; ca = Cancer VCP RG; nc = Noncancer VCP RG; m = MCL-based; s = solubility; sat = Soil Saturation; max = Ceiling limit; DAF = Dilution Attenuation Factor; CAS = Chemical Abstract Services; +++ = Non-Standard Method Applied; see Notes section at bottom of table and Appendix A, Protocol for VCP Remediation Goal Lookup Tables, Nebraska Voluntary Cleanup Program for more information

CONTAMINANT	TOXICITY INFORMATION ¹											VCP REMEDIATION GOALS (RGs)									
	CAS No.	SFo (mg/kg-d) ⁻¹	RfDo (mg/kg-d)	IUR (µg/m ³) ⁻¹	RfC (mg/m ³)	V		ABS _d (unitless)	ABS _{GI} (unitless)	Direct Contact Exposure Pathways			Migration to Ground Water								
						O	S			Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ground Water (µg/l)	DAF 20 (mg/kg)								
Benzene	71-43-2	5.5E-02	i	4.0E-03	i	7.8E-06	i	3.0E-02	i	1			9.2E-01	ca	1.6E+01	ca	5.0E+00	m	3.4E-02	m	
Benzidine	92-87-5	2.3E+02	i	3.0E-03	i	6.7E-02	i			0	0.10	1	2.1E-03	ca	7.5E-02	ca	2.9E-04	ca			
Benzoic acid	65-85-0			4.0E+00	i					0	S	0.10	1	6.1E+04	nc	1.0E+05	max	3.7E+04	nc	1.5E+02	nc
Benzotrichloride	98-07-7	1.3E+01	i							0	0.10	1	3.7E-02	ca	1.3E+00	ca	4.9E-03	ca			
Benzyl alcohol	100-51-6			3.0E-01	h					0	0.10	1	4.6E+03	nc	1.0E+05	max	2.7E+03	nc			
Benzyl chloride	100-44-7	1.7E-01	i					1.0E-02	n	1			3.8E+00	ca	1.7E+02	ca	3.8E-01	ca	2.3E-03	ca	
Beryllium and compounds	7440-41-7			2.0E-03	i	2.4E-03	i	2.0E-05	i	0			3.9E+01	nc	1.9E+03	nc	4.0E+00	m	5.9E+01	m	
Bidrin	141-66-2			1.0E-04	i					0	0.10	1	1.5E+00	nc	6.2E+01	nc	9.1E-01	nc			
Biphenthrin (Talstar)	82657-04-3			1.5E-02	i					0	0.10	1	2.3E+02	nc	9.2E+03	nc	1.4E+02	nc			
1,1-Biphenyl	92-52-4			5.0E-02	i					1	S		9.8E+02	nc	5.1E+04	nc	4.6E+02	nc	1.4E+02	nc	
Bis(2-chloroethyl)ether	111-44-4	1.1E+00	i			3.3E-04	i			1			2.7E-01	ca	6.3E+00	ca	1.2E-02	ca	8.4E-05	ca	
Bis(2-chloroisopropyl)ether	39638-32-9	7.0E-02	R9-3	4.0E-02	i	1.0E-05	R9-3			1			3.7E+00	ca	8.4E+01	ca	3.2E-01	ca	2.1E-03	ca	
Bis(chloromethyl)ether	542-88-1	2.2E+02	i			6.2E-02	i			1			2.8E-04	ca	5.0E-03	ca	6.2E-05	ca	2.5E-07	ca	
Bis(2-chloro-1-methylethyl)ether	108-60-1	7.0E-02	h	4.0E-02	i	1.0E-05	h			1			3.7E+00	ca	8.4E+01	ca	3.2E-01	ca	2.1E-03	ca	
Bis(2-ethylhexyl)phthalate (DEHP)	117-81-7	1.4E-02	i	2.0E-02	i					0	0.10	1	3.5E+01	ca	1.2E+03	ca	6.0E+00	m	3.6E+03	m	
Bisphenol A	80-05-7			5.0E-02	i					0	0.10	1	7.6E+02	nc	3.1E+04	nc	4.6E+02	nc			
Boron	7440-42-8			9.0E-02	i			2.0E-02	h	0			1.8E+03	nc	9.2E+04	nc	8.2E+02	nc			
Boron trifluoride	7637-07-2					7.0E-04	h	n/a		1											
Bromate	15541-45-4	7.0E-01	i	4.0E-03	i					n/a			9.1E-01	ca	4.1E+01	ca	1.0E+01	m			
Bromobenzene	108-86-1			2.0E-02	p			1.0E-02	p	1			1.8E+01	nc	1.1E+02	nc	5.1E+00	nc	6.7E-02	nc	
Bromodichloromethane	75-27-4	6.2E-02	i	2.0E-02	i					1			1.0E+01	ca	4.6E+02	ca	1.1E+00	ca	6.9E-03	ca	
Bromoform (tribromomethane)	75-25-2	7.9E-03	i	2.0E-02	i	1.1E-06	i			1	0.10	1	6.1E+01	ca	2.2E+03	ca	2.9E+00	ca	2.2E-02	ca	
Bromomethane	74-83-9			1.4E-03	i			5.0E-03	i	1			2.5E+00	nc	1.5E+01	nc	2.2E+00	nc	1.0E-02	nc	
Bromophos	2104-96-3			5.0E-03	h					0	0.10	1	7.6E+01	nc	3.1E+03	nc	4.6E+01	nc			
Bromoxynil	1689-84-5			2.0E-02	i					0	0.10	1	3.1E+02	nc	1.2E+04	nc	1.8E+02	nc			
Bromoxynil octanoate	1689-99-2			2.0E-02	i					0	0.10	1	3.1E+02	nc	1.2E+04	nc	1.8E+02	nc			
1,3-Butadiene	106-99-0					3.0E-05	i	2.0E-03	i	1			9.2E-02	ca	1.5E+00	ca	1.6E-01	ca	3.5E-03	ca	
1-Butanol	71-36-3			1.0E-01	i			9.1E-03	n	0	0.10	1	1.5E+03	nc	6.1E+04	nc	9.1E+02	nc	3.9E+00	nc	
Butylate	2008-41-5			5.0E-02	i					0	0.10	1	7.6E+02	nc	3.1E+04	nc	4.6E+02	nc			
n-Butylbenzene	104-51-8			4.0E-02	n					1			7.8E+02	nc	4.1E+04	nc	3.7E+02	nc	4.3E+01	nc	
sec-Butylbenzene	135-9-88			4.0E-02	n					1			7.8E+02	nc	4.1E+04	nc	3.7E+02	nc	3.3E+01	nc	
tert-Butylbenzene	98-06-6			4.0E-02	n					1			7.8E+02	nc	4.1E+04	nc	3.7E+02	nc	3.3E+01	nc	
Butyl benzyl phthalate	85-68-7			2.0E-01	i					0	0.10	1	3.1E+03	nc	1.0E+05	max	6.0E+00	m	1.4E+01	m	
Butylphthalyl butylglycolate	85-70-1			1.0E+00	i					0	0.10	1	1.5E+04	nc	1.0E+05	max	9.1E+03	nc			
Cacodylic acid	75-60-5	2.5E-01	R9-1	3.0E-04	p					0	0.10	1	1.9E+00	ca	6.9E+01	ca	2.7E-01	ca			
Cadmium and compounds+++	7440-43-9			5.0E-04	i	1.8E-03	i			0	0.00	0.05	9.3E+00	nc	4.5E+02	nc	5.0E+00	m	7.5E+00	m	
Caprolactam	105-60-2			5.0E-01	i					0	0.10	1	7.6E+03	nc	1.0E+05	max	4.6E+03	nc			
Captafol	2425-06-1	8.6E-03	h	2.0E-03	i					0	0.10	1	3.1E+01	nc	1.2E+03	nc	7.8E+00	ca			
Captan	133-06-2	3.5E-03	h	1.3E-01	i					0	S	0.10	1	1.4E+02	ca	4.9E+03	ca	1.9E+01	ca		
Carbaryl	63-25-2			1.0E-01	i					0	S	0.10	1	1.5E+03	nc	6.2E+04	nc	9.1E+02	nc		
Carbazole	86-74-8	2.0E-02	h							0	S	0.10	1	2.4E+01	ca	8.6E+02	ca	3.4E+00	ca	4.7E-01	ca
Carbofuran	1563-66-2			5.0E-03	i					0	S	0.10	1	7.6E+01	nc	3.1E+03	nc	4.0E+01	m		
Carbon disulfide	75-15-0			1.0E-01	i			7.0E-01	i	1			2.3E+02	nc	1.4E+03	nc	2.5E+02	nc	2.0E+00	nc	
Carbon tetrachloride	56-23-5	1.3E-01	i	7.0E-04	i	1.5E-05	i	2.0E-03	n	1			3.6E-01	ca	6.4E+00	ca	5.0E+00	m	6.6E-02	m	
Carbosulfan	55285-14-8			1.0E-02	i					0	0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc			
Carboxin	5234-68-4			1.0E-01	i					0	0.10	1	1.5E+03	nc	6.2E+04	nc	9.1E+02	nc			
Chloramben	133-90-4			1.5E-02	i					0	0.10	1	2.3E+02	nc	9.2E+03	nc	1.4E+02	nc			
Chloranil	118-75-2	4.0E-01	h							0	0.10	1	1.2E+00	ca	4.3E+01	ca	1.7E-01	ca			
Chlordane	12789-03-6	3.5E-01	i	5.0E-04	i	1.0E-04	i	7.0E-04	i	1	S	0.04	1	1.6E+00	ca	6.5E+01	ca	2.0E+00	m	4.3E+02	m
Chlorimuron-ethyl	90982-32-4			2.0E-02	i					0	0.10	1	3.1E+02	nc	1.2E+04	nc	1.8E+02	nc			
Chlorine	7782-50-5			1.0E-01	i			2.0E-04	n	n/a			2.0E+03	nc	1.0E+05	max	2.5E+05	m			

VCP REMEDIATION GOALS

Key : SFo = Oral Slope Factor; RfDo = Oral Reference Dose; IUR = Inhalation Unit Risk; RfC = Inhalation Reference Concentration; i = IRIS; h = HEAST; n = NCEA; x = Withdrawn (reference for value provided); o = Other EPA Source (reference for value provided); p = NCEA PPRTV; R3 = EPA Region 3 RBC Table; R6 = EPA Region 6 MSSL Table; R9 = EPA Region 9 PRG Table; ca = Cancer VCP RG; nc = Noncancer VCP RG; m = MCL-based; s = solubility; sat = Soil Saturation; max = Ceiling limit; DAF = Dilution Attenuation Factor; CAS = Chemical Abstract Services; +++ = Non-Standard Method Applied; see Notes section at bottom of table and Appendix A, Protocol for VCP Remediation Goal Lookup Tables, Nebraska Voluntary Cleanup Program for more information

CONTAMINANT	TOXICITY INFORMATION ¹										VCP REMEDIATION GOALS (RGs)								
	CAS No.	SFo (mg/kg-d) ⁻¹	RfDo (mg/kg-d)	IUR (µg/m ³) ⁻¹	RfC (mg/m ³)	V		ABS _d (unitless)	ABS _{GI} (unitless)	Direct Contact Exposure Pathways			Migration to Ground Water						
						O	S			Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ground Water (µg/l)	DAF 20 (mg/kg)						
Chlorine dioxide	10049-04-4		3.0E-02	i		2.0E-04	i	n/a		1	5.9E+02	nc	3.1E+04	nc	2.7E+02	nc			
Chloroacetic acid	79-11-8		2.0E-03	h					0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc			
2-Chloroacetophenone	532-27-4					3.0E-05	i	1		1	2.3E-02	nc	1.3E-01	nc	1.6E-02	nc	3.1E-04	nc	
4-Chloroaniline	106-47-8		4.0E-03	i			1	S	0.10	1	6.1E+01	nc	2.5E+03	nc	3.7E+01	nc	4.4E+00	nc	
Chlorobenzene	108-90-7		2.0E-02	i		6.0E-02	n	1		1	8.9E+01	nc	6.2E+02	nc	1.0E+02	m	1.3E+00	m	
Chlorobenzilate	510-15-6	2.7E-01	h	2.0E-02	i	7.8E-05	h		0	S	0.10	1	1.8E+00	ca	6.4E+01	ca	2.5E-01	ca	
p-Chlorobenzoic acid	74-11-3		2.0E-01	h					0	0.10	1	3.1E+03	nc	1.0E+05	max	1.8E+03	nc		
4-Chlorobenzotrifluoride	98-56-6		2.0E-02	h					0	0.10	1	3.1E+02	nc	1.2E+04	nc	1.8E+02	nc		
2-Chloro-1,3-butadiene	126-99-8		2.0E-02	h		7.0E-03	h	1		1	2.5E+00	nc	1.4E+01	nc	3.6E+00	nc	3.0E-02	nc	
1-Chlorobutane	109-69-3		4.0E-01	h					1	1	7.8E+03	nc	1.0E+05	max	3.7E+03	nc	3.0E+01	nc	
1-Chloro-1,1-difluoroethane	75-68-3					5.0E+00	i	1		1	1.6E+03	nc	9.1E+03	nc	2.6E+03	nc	3.6E+01	nc	
Chlorodifluoromethane	75-45-6					5.0E+00	i	1		1	1.6E+03	nc	9.1E+03	nc	2.6E+03	nc	3.6E+01	nc	
Chloroethane	75-00-3	2.9E-03	n	4.0E-01	n	1.0E+01	i	1		1	2.2E+02	ca	9.9E+03	ca	2.3E+01	ca	1.3E-01	ca	
Chloroform	67-66-3		1.0E-02	i	2.3E-05	i	4.5E-02	n	1	1	3.3E-01	ca	5.5E+00	ca	2.1E-01	ca	1.2E-03	ca	
Chloromethane	74-87-3	1.3E-02	h		1.8E-06	h	9.0E-02	i	1	1	1.8E+00	ca	3.1E+01	ca	1.8E+00	ca	1.3E-02	ca	
4-Chloro-2-methylaniline	95-69-2	5.8E-01	h					0	0.10	1	8.4E-01	ca	3.0E+01	ca	1.2E-01	ca			
4-Chloro-2-methylaniline hydrochloride	3165-93-3	4.6E-01	h					0	0.10	1	1.1E+00	ca	3.7E+01	ca	1.5E-01	ca			
beta-Chloronaphthalene	91-58-7		8.0E-02	i				1	S	1	1.6E+03	nc	8.2E+04	nc	7.3E+02	nc	4.8E+01	nc	
o-Chloronitrobenzene	88-73-3	9.7E-03	p	1.0E-03	p	7.0E-05	p	1		1	9.0E-01	nc	5.3E+00	nc	3.6E-02	nc	2.4E-04	nc	
p-Chloronitrobenzene	100-00-5	6.7E-03	p	1.0E-03	p	6.0E-04	p	1		1	5.7E+00	nc	4.3E+01	nc	3.0E-01	nc	2.0E-03	nc	
2-Chlorophenol	95-57-8		5.0E-03	i				1		1	9.8E+01	nc	5.1E+03	nc	4.1E+01	nc	8.2E-01	nc	
2-Chloropropane	75-29-6					1.0E-01	h	1		1	1.3E+02	nc	7.0E+02	nc	5.2E+01	nc	3.2E-01	nc	
Chlorothalonil	1897-45-6	1.1E-02	h	1.5E-02	i			0	0.10	1	4.4E+01	ca	1.6E+03	ca	5.4E+00	ca			
o-Chlorotoluene	95-49-8		2.0E-02	i				1		1	3.9E+02	nc	2.0E+04	nc	1.8E+02	nc	1.9E+00	nc	
Chlorpropham	101-21-3		2.0E-01	i				0	0.10	1	3.1E+03	nc	1.0E+05	max	1.8E+03	nc			
Chlorpyrifos	2921-88-2		3.0E-03	i				0	S	0.10	1	4.6E+01	nc	1.8E+03	nc	2.7E+01	nc		
Chlorpyrifos-methyl	5598-13-0		1.0E-02	h				0	0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc			
Chlorsulfuron	64902-72-3		5.0E-02	i				0	0.10	1	7.6E+02	nc	3.1E+04	nc	4.6E+02	nc			
Chlorthiophos	60238-56-4		8.0E-04	h				0	0.10	1	1.2E+01	nc	4.9E+02	nc	7.3E+00	nc			
Total Chromium (1:6 ratio Cr VI:Cr III)+++					8.4E-02	i		0		0.013	3.4E+01	ca	5.8E+02	ca	1.0E+02	m	1.0E+05	m	
Chromium III	16065-83-1		1.5E+00	i				0		0.013	2.9E+04	nc	1.0E+05	max	1.0E+02	m	1.0E+05	m	
Chromium VI+++	18540-29-9		3.0E-03	i	1.2E-02	i	8.0E-06	i	0	0.025	5.7E+01	nc	2.5E+03	nc	1.0E+02	m	3.8E+01	m	
Cobalt	7440-48-4		2.0E-02	p	2.8E-03	p	2.0E-05	p	0		1	3.7E+02	nc	1.3E+04	nc	1.8E+02	nc		
Coke Oven Emissions	8007-45-2				6.2E-04	i		0		1	4.6E+03	ca	7.8E+04	ca					
Copper and compounds	7440-50-8		4.0E-02	h				0		1	7.8E+02	nc	4.1E+04	nc	1.3E+03	m			
Crotonaldehyde	123-73-9	1.9E+00	h					1		1	3.4E-01	ca	1.5E+01	ca	3.5E-02	ca	2.0E-03	ca	
Cumene (isopropylbenzene)	98-82-8		1.0E-01	i		4.0E-01	i	1		1	3.6E+02	nc	2.4E+03	nc	1.7E+02	nc	2.3E+00	nc	
Cyanazine	21725-46-2	8.4E-01	h	2.0E-03	h			0	0.10	1	5.8E-01	ca	2.1E+01	ca	8.0E-02	ca			
Cyanide (free)	57-12-5		2.0E-02	i				0	0.10	1	3.1E+02	nc	1.2E+04	nc	2.0E+02	m			
Cyanide (hydrogen)	74-90-8		2.0E-02	i		3.0E-03	i	1		1	7.3E+00	nc	4.1E+01	nc	1.6E+00	nc	7.3E-03	nc	
Cyanogen	460-19-5		4.0E-02	i				1		1	7.8E+02	nc	4.1E+04	nc	3.7E+02	nc	2.0E+00	nc	
Cyanogen bromide	506-68-3		9.0E-02	i				1		1	1.8E+03	nc	9.2E+04	nc	8.2E+02	nc	4.4E+00	nc	
Cyanogen chloride	506-77-4		5.0E-02	i				1		1	9.8E+02	nc	5.1E+04	nc	4.6E+02	nc	2.5E+00	nc	
Cyclohexane	110-82-7					6.0E+00	i	1		1	2.0E+03	nc	1.1E+04	nc	3.1E+03	nc	7.8E+01	nc	
Cyclohexanone	108-94-1		5.0E+00	i				0	0.10	1	7.6E+04	nc	1.0E+05	max	4.6E+04	nc			
Cyclohexylamine	108-91-8		2.0E-01	i				0	0.10	1	3.1E+03	nc	1.0E+05	max	1.8E+03	nc			
Cyhalothrin/Karate	68085-85-8		5.0E-03	i				0	0.10	1	7.6E+01	nc	3.1E+03	nc	4.6E+01	nc			
Cypermethrin	52315-07-8		1.0E-02	i				0	0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc			
Cyromazine	66215-27-8		7.5E-03	i				0	0.10	1	1.1E+02	nc	4.6E+03	nc	6.8E+01	nc			
Dacthal	1861-32-1		1.0E-02	i				0	0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc			
Dalapon	75-99-0		3.0E-02	i				0	0.10	1	4.6E+02	nc	1.8E+04	nc	2.0E+02	m			

VCP REMEDIATION GOALS

Key : SFo = Oral Slope Factor; RfDo = Oral Reference Dose; IUR = Inhalation Unit Risk; RfC = Inhalation Reference Concentration; i = IRIS; h = HEAST; n = NCEA; x = Withdrawn (reference for value provided); o = Other EPA Source (reference for value provided); p = NCEA PPRTV; R3 = EPA Region 3 RBC Table; R6 = EPA Region 6 MSSSL Table; R9 = EPA Region 9 PRG Table; ca = Cancer VCP RG; nc = Noncancer VCP RG; m = MCL-based; s = solubility; sat = Soil Saturation; max = Ceiling limit; DAF = Dilution Attenuation Factor; CAS = Chemical Abstract Services; +++ = Non-Standard Method Applied; see Notes section at bottom of table and Appendix A, Protocol for VCP Remediation Goal Lookup Tables, Nebraska Voluntary Cleanup Program for more information

CONTAMINANT	TOXICITY INFORMATION ¹											VCP REMEDIATION GOALS (RGs)					
	CAS No.	SFo (mg/kg-d) ⁻¹	RfDo (mg/kg-d)	IUR (µg/m ³) ⁻¹	RfC (mg/m ³)	V				Direct Contact Exposure Pathways			Migration to Ground Water				
						O	S =	ABS _d (unitless)	ABS _{GI} (unitless)	Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ground Water (µg/l)	DAF 20 (mg/kg)				
														C	solid		
Danitrol	39515-41-8		2.5E-02			0		0.10	1	3.8E+02	nc	1.5E+04	nc	2.3E+02	nc		
DDD	72-54-8	2.4E-01	i			0	S	0.03	1	2.4E+00	ca	1.0E+02	ca	1.1E-01	ca	4.5E+00	
DDE	72-55-9	3.4E-01	i			1	S	0.03	1	1.7E+00	ca	7.0E+01	ca	8.6E-02	ca	1.5E+01	
DDT	50-29-3	3.4E-01	i	5.0E-04		0	S	0.03	1	1.7E+00	ca	7.0E+01	ca	5.7E-02	ca	5.1E+00	
Decabromodiphenyl ether	1163-19-5			1.0E-02		0		0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc		
Demeton	8065-48-3			4.0E-05		0		0.10	1	6.1E-01	nc	2.5E+01	nc	3.7E-01	nc		
Diallate	2303-16-4	6.1E-02	h			0		0.10	1	8.0E+00	ca	2.8E+02	ca	1.1E+00	ca		
Diazinon	333-41-5			9.0E-04		0		0.10	1	1.4E+01	nc	5.5E+02	nc	8.2E+00	nc		
Dibenzofuran	132-64-9			2.0E-03		1	S		1	3.9E+01	nc	2.0E+03	nc	1.8E+01	nc	5.7E+00	
1,4-Dibromobenzene	106-37-6			1.0E-02		0		0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc		
Dibromochloromethane	124-48-1	8.4E-02	i	2.0E-02		0			1	7.6E+00	ca	3.4E+02	ca	8.0E-01	ca	1.8E-02	
1,2-Dibromo-3-chloropropane	96-12-8	1.4E+00	h		6.9E-07	h	2.0E-04	i	0	4.6E-01	ca	2.0E+01	ca	2.0E-01	m	1.0E-03	
1,2-Dibromoethane	106-93-4	8.5E+01	i		2.2E-04	i	2.0E-04	h	1	7.1E-03	ca	2.9E-01	ca	5.0E-02	m	2.6E-04	
Dibutyl phthalate	84-74-2			1.0E-01		0		0.10	1	1.5E+03	nc	6.2E+04	nc	6.0E+00	m	8.2E+00	
Dicamba	1918-00-9			3.0E-02		0	S	0.10	1	4.6E+02	nc	1.8E+04	nc	2.7E+02	nc		
1,2-Dichlorobenzene	95-50-1			9.0E-02		2.0E-01	h	1	1	5.9E+02	nc	4.8E+03	nc	6.0E+02	m	1.7E+01	
1,3-Dichlorobenzene	541-73-1			1.0E-03		8.0E-03	n	1	1	1.3E+01	nc	1.7E+02	nc	2.2E+00	nc	6.4E-02	
1,4-Dichlorobenzene	106-46-7	2.4E-02	h	2.4E-03		8.0E-01	i	1	S	2.7E+01	ca	1.2E+03	ca	7.5E+01	m	2.2E+00	
3,3-Dichlorobenzidine	91-94-1	4.5E-01	i			0	S	0.10	1	1.1E+00	ca	3.8E+01	ca	1.4E-01	ca	4.5E-03	
4,4'-Dichlorobenzophenone	90-98-2			3.0E-02		0		0.10	1	4.6E+02	nc	1.8E+04	nc	2.7E+02	nc		
1,4-Dichloro-2-butene	764-41-0				2.6E-03	h			1	1.4E-02	ca	2.3E-01	ca	1.9E-03	ca	1.1E-05	
Dichlorodifluoromethane	75-71-8			2.0E-01		2.0E-01	h	1		6.4E+01	nc	3.6E+02	nc	9.8E+01	nc	1.3E+00	
1,1-Dichloroethane	75-34-3			1.0E-01		5.0E-01	h	1		3.1E+02	nc	2.0E+03	nc	2.0E+02	nc	1.2E+00	
1,2-Dichloroethane	107-06-2	9.1E-02	i	2.0E-02		4.0E-01	n	1	1	4.0E-01	ca	7.1E+00	ca	5.0E+00	m	2.4E-02	
1,1-Dichloroethylene	75-35-4			5.0E-02		2.0E-01	i	1		8.0E+01	nc	4.9E+02	nc	7.0E+00	m	5.8E-02	
1,2-Dichloroethylene (cis)	156-59-2			1.0E-02				1		2.0E+02	nc	1.0E+04	nc	7.0E+01	m	4.0E-01	
1,2-Dichloroethylene (trans)	156-60-5			2.0E-02				1		3.9E+02	nc	2.0E+04	nc	1.0E+02	m	6.8E-01	
2,4-Dichlorophenol	120-83-2			3.0E-03		0	S	0.10	1	4.6E+01	nc	1.8E+03	nc	2.0E+01	nc	2.0E-01	
4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB)	94-82-6			8.0E-03		0		0.10	1	1.2E+02	nc	4.9E+03	nc	7.3E+01	nc		
2,4-Dichlorophenoxyacetic Acid (2,4-D)	94-75-7			1.0E-02		0	S	0.05	1	1.7E+02	nc	7.7E+03	nc	7.0E+01	m		
1,2-Dichloropropane	78-87-5	6.8E-02	h			4.0E-03	i	1		4.4E+00	nc	2.5E+01	nc	5.0E+00	m	3.0E-02	
1,3-Dichloropropane	542-75-6	1.0E-01	i	3.0E-02		4.0E-06	i	1		1.1E+00	ca	2.1E+01	ca	4.3E-01	ca	3.1E-03	
2,3-Dichloropropanol	616-23-9			3.0E-03		0		0.10	1	4.6E+01	nc	1.8E+03	nc	2.7E+01	nc		
Dichlorvos	62-73-7	2.9E-01	i	5.0E-04		5.0E-04	i	0		1.7E+00	ca	5.9E+01	ca	2.3E-01	ca		
Dicofol	115-32-2	4.4E-01	R9-			0		0.10	1	1.1E+00	ca	3.9E+01	ca	1.5E-01	ca		
Dicyclopentadiene	77-73-6			3.0E-02		2.0E-04	h	1		3.7E-01	nc	2.1E+00	nc	1.0E-01	nc	2.9E-03	
Dieldrin	60-57-1	1.6E+01	i	5.0E-05		4.6E-03	i	1	S	3.0E-02	ca	1.1E+00	ca	8.2E-04	ca	7.1E-04	
Diethylene glycol, monobutyl ether	112-34-5			1.0E-02		2.0E-02	p	0		1.5E+02	nc	6.2E+03	nc	9.1E+01	nc		
Diethylene glycol, monoethyl ether	111-90-0			6.0E-02		3.0E-03	p	0		9.2E+02	nc	3.7E+04	nc	5.5E+02	nc		
Diethylformamide	617-84-5			4.0E-04		0		0.10	1	6.1E+00	nc	2.5E+02	nc	3.7E+00	nc		
Di(2-ethylhexyl)adipate	103-23-1	1.2E-03	i	6.0E-01		0		0.10	1	4.0E+02	ca	1.4E+04	ca	4.0E+02	m		
Diethyl phthalate	84-66-2			8.0E-01		0		0.10	1	1.2E+04	nc	1.0E+05	max	6.0E+00	m	9.3E-02	
Diethylstilbestrol	56-53-1	4.7E+03	h			0	S	0.10	1	1.0E-04	ca	3.7E-03	ca	1.4E-05	ca		
Difenzoquat (Avenge)	43222-48-6			8.0E-02		0		0.10	1	1.2E+03	nc	4.9E+04	nc	7.3E+02	nc		
Diffubenzuron	35367-38-5			2.0E-02		0		0.10	1	3.1E+02	nc	1.2E+04	nc	1.8E+02	nc		
1,1-Difluoroethane	75-37-6				4.0E+01	i	0		1	1.0E+05	max	1.0E+05	max				
Diisononyl phthalate	28553-12-0			2.0E-02		0		0.10	1	3.1E+02	nc	1.2E+04	nc	6.0E+00	m		
Diisopropyl methylphosphonate	1445-75-6			8.0E-02		0		0.10	1	1.2E+03	nc	4.9E+04	nc	7.3E+02	nc		
Dimethipin	55290-64-7			2.0E-02		0		0.10	1	3.1E+02	nc	1.2E+04	nc	1.8E+02	nc		
Dimethoate	60-51-5			2.0E-04		0		0.10	1	3.1E+00	nc	1.2E+02	nc	1.8E+00	nc		
3,3-Dimethoxybenzidine	119-90-4	1.4E-02	h			0		0.10	1	3.5E+01	ca	1.2E+03	ca	4.8E+00	ca		

VCP REMEDIATION GOALS

Key : SFo = Oral Slope Factor; RfDo = Oral Reference Dose; IUR = Inhalation Unit Risk; RfC = Inhalation Reference Concentration; i = IRIS; h = HEAST; n = NCEA; x = Withdrawn (reference for value provided); o = Other EPA Source (reference for value provided); p = NCEA PPRTV; R3 = EPA Region 3 RBC Table; R6 = EPA Region 6 MSSSL Table; R9 = EPA Region 9 PRG Table; ca = Cancer VCP RG; nc = Noncancer VCP RG; m = MCL-based; s = solubility; sat = Soil Saturation; max = Ceiling limit; DAF = Dilution Attenuation Factor; CAS = Chemical Abstract Services; +++ = Non-Standard Method Applied; see Notes section at bottom of table and Appendix A, Protocol for VCP Remediation Goal Lookup Tables, Nebraska Voluntary Cleanup Program for more information

CONTAMINANT	TOXICITY INFORMATION ¹											VCP REMEDIATION GOALS (RGs)							
	CAS No.	SFo (mg/kg-d) ⁻¹	RfDo (mg/kg-d)	IUR (µg/m ³) ⁻¹	RfC (mg/m ³)	V				Direct Contact Exposure Pathways			Migration to Ground Water						
						O	S =	ABS _d (unitless)	ABS _{GI} (unitless)	Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ground Water (µg/l)	DAF 20 (mg/kg)						
														C solid	1	1	1		
Dimethylamine	124-40-3				2.0E-05	R9-	1			1	5.4E-02	nc	3.0E-01	nc	1.0E-02	nc	4.3E-05	nc	
N-N-Dimethylaniline	121-69-7		2.0E-03	i					0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc			
2,4-Dimethylaniline	95-68-1	7.5E-01	h					0	0.10	1	6.5E-01	ca	2.3E+01	ca	9.0E-02	ca			
2,4-Dimethylaniline hydrochloride	21436-96-4	5.8E-01	h					0	0.10	1	8.4E-01	ca	3.0E+01	ca	1.2E-01	ca			
3,3-Dimethylbenzidine	119-93-7	2.3E+00	p					0	S	0.10	1	2.1E-01	ca	7.5E+00	ca	2.9E-02	ca		
N,N-Dimethylformamide	68-12-2		1.0E-01	h	3.0E-02	i	0		0.10	1	1.5E+03	nc	6.1E+04	nc	9.1E+02	nc			
Dimethylphenethylamine	122-09-8		1.0E-03	n				0	0.10	1	1.5E+01	nc	6.2E+02	nc	9.1E+00	nc			
2,4-Dimethylphenol	105-67-9		2.0E-02	i				0	S	0.10	1	3.1E+02	nc	1.2E+04	nc	1.6E+02	nc	2.0E+00	nc
2,6-Dimethylphenol	576-26-1		6.0E-04	i				0	0.10	1	9.2E+00	nc	3.7E+02	nc	5.5E+00	nc			
3,4-Dimethylphenol	95-65-8		1.0E-03	i				0	0.10	1	1.5E+01	nc	6.2E+02	nc	8.1E+00	nc			
Dimethyl phthalate	131-11-3		1.0E+01	R9-				0	0.10	1	1.0E+05	max	1.0E+05	max	6.0E+00	m			
Dimethyl terephthalate	120-61-6		1.0E-01	i				0	0.10	1	1.5E+03	nc	6.2E+04	nc	6.0E+00	m			
4,6-Dinitro-o-cyclohexyl phenol	131-89-5		2.0E-03	i				0	0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc			
1,2-Dinitrobenzene	528-29-0		1.0E-04	p				0	0.10	1	1.5E+00	nc	6.2E+01	nc	9.1E-01	nc			
1,3-Dinitrobenzene	99-65-0		1.0E-04	i				0	S	0.10	1	1.5E+00	nc	6.2E+01	nc	9.1E-01	nc		
1,4-Dinitrobenzene	100-25-4		1.0E-04	p				0	S	0.10	1	1.5E+00	nc	6.2E+01	nc	9.1E-01	nc		
2,4-Dinitrophenol	51-28-5		2.0E-03	i				0	S	0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc	7.3E-02	nc
Dinitrotoluene mixture	25321-14-6	6.8E-01	i					0	0.10	1	7.1E-01	ca	2.5E+01	ca	9.9E-02	ca			
2,4-Dinitrotoluene	121-14-2		2.0E-03	i				0	S	0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc	1.4E-01	nc
2,6-Dinitrotoluene	606-20-2		1.0E-03	h				0	S	0.10	1	1.5E+01	nc	6.2E+02	nc	9.1E+00	nc		
Dinoseb	88-85-7		1.0E-03	i				0	0.10	1	1.5E+01	nc	6.2E+02	nc	7.0E+00	m			
di-n-Octyl phthalate	117-84-0		4.0E-02	p				1	0.10	1	6.1E+02	nc	2.5E+04	nc	6.0E+00	m	2.0E+04	m	
1,4-Dioxane	123-91-1	1.1E-02	i					0	0.10	1	4.4E+01	ca	1.6E+03	ca	6.1E+00	ca			
Dioxin (2,3,7,8-TCDD)	1746-01-6	1.5E+05	h		3.3E-03	h		0	S	0.03	1	3.9E-06	ca	1.6E-04	ca	3.0E-05	m		
Diphenamid	957-51-7		3.0E-02	i				0	0.10	1	4.6E+02	nc	1.8E+04	nc	2.7E+02	nc			
Diphenylamine	122-39-4		2.5E-02	i				0	0.10	1	3.8E+02	nc	1.5E+04	nc	2.3E+02	nc			
N,N-Diphenyl-1,4 benzenediamine (DPPP)	74-31-7		3.0E-04	p				0	0.10	1	4.6E+00	nc	1.8E+02	nc	2.7E+00	nc			
1,2-Diphenylhydrazine	122-66-7	8.0E-01	i		2.2E-04	i		0	0.10	1	6.1E-01	ca	2.2E+01	ca	8.0E-02	ca			
Diphenyl sulfone	127-63-9		3.0E-03	p				0	0.10	1	4.6E+01	nc	1.8E+03	nc	2.7E+01	nc			
Diquat	85-00-7		2.2E-03	i				0	0.10	1	3.4E+01	nc	1.4E+03	nc	2.0E+01	m			
Direct black 38	1937-37-7	8.6E+00	h					0	0.10	1	5.6E-02	ca	2.0E+00	ca	7.8E-03	ca			
Direct blue 6	2602-46-2	8.1E+00	h					0	0.10	1	6.0E-02	ca	2.1E+00	ca	8.3E-03	ca			
Direct brown 95	16071-86-6	9.3E+00	h					0	0.10	1	5.2E-02	ca	1.9E+00	ca	7.2E-03	ca			
Disulfoton	298-04-4		4.0E-05	i				0	0.10	1	6.1E-01	nc	2.5E+01	nc	3.7E-01	nc			
1,4-Dithiane	505-29-3		1.0E-02	i				0	0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc			
Diuron	330-54-1		2.0E-03	i				0	0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc			
Dodine	2439-10-3		4.0E-03	i				0	0.10	1	6.1E+01	nc	2.5E+03	nc	3.7E+01	nc			
Dysprosium	7429-91-6		2.0E-01	n				0			3.9E+03	nc	1.0E+05	max	1.8E+03	nc			
Endosulfan	115-29-7		6.0E-03	i				1	S	0.10	1	9.2E+01	nc	3.7E+03	nc	5.5E+01	nc	4.9E+00	nc
Endothall	145-73-3		2.0E-02	i				0	S	0.10	1	3.1E+02	nc	1.2E+04	nc	1.0E+02	m		
Endrin	72-20-8		3.0E-04	i				0	S	0.10	1	4.6E+00	nc	1.8E+02	nc	2.0E+00	m	9.9E-01	m
Epichlorohydrin	106-89-8	9.9E-03	i	2.0E-03	h	1.2E-06	i	1			4.8E+00	nc	3.0E+01	nc	5.1E-01	nc	2.1E-03	nc	
1,2-Epoxybutane	106-88-7							1	0.10	1	1.0E+05	max	1.0E+05	max					
EPTC (S-Ethyl dipropylthiocarbamate)	759-94-4		2.5E-02	i				0	0.10	1	3.8E+02	nc	1.5E+04	nc	2.3E+02	nc			
Ethephon (2-chloroethyl phosphonic acid)	16672-87-0		5.0E-03	i				0	0.10	1	7.6E+01	nc	3.1E+03	nc	4.6E+01	nc			
Ethion	563-12-2		5.0E-04	i				0	0.10	1	7.6E+00	nc	3.1E+02	nc	4.6E+00	nc			
2-Ethoxyethanol	110-80-5		4.0E-01	h				2.0E-01	i	0	0.10	1	6.1E+03	nc	1.0E+05	max	3.7E+03	nc	
2-Ethoxyethanol acetate	111-15-9		3.0E-01	h				1	0.10	1	4.6E+03	nc	1.0E+05	max	2.7E+03	nc			
Ethyl acetate	141-78-6		9.0E-01	i				0			1.8E+04	nc	1.0E+05	max	8.2E+03	nc	5.2E+01	nc	
Ethyl acrylate	140-88-5	4.8E-02	h					1			1.3E+01	ca	6.0E+02	ca	1.4E+00	ca	7.7E-02	ca	
Ethylbenzene	100-41-4		1.0E-01	i				1.0E+00	i	1	8.9E+02	nc	8.5E+03	nc	7.0E+02	m	1.3E+01	m	

VCP REMEDIATION GOALS

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CONTAMINANT	TOXICITY INFORMATION ¹											VCP REMEDIATION GOALS (RGs)									
	CAS No.	SFo (mg/kg-d) ⁻¹	RfDo (mg/kg-d)	IUR (µg/m ³) ⁻¹	RfC (mg/m ³)	V		ABS _d (unitless)	ABS _{GI} (unitless)	Direct Contact Exposure Pathways			Migration to Ground Water								
						O	S			Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ground Water (µg/l)	DAF 20 (mg/kg)								
Ethyl chloride	75-00-3	2.9E-03	n	4.0E-01	n			1.0E+01	i	1			2.2E+02	ca	9.9E+03	ca	2.3E+01	ca	1.3E-01	ca	
Ethylene cyanohydrin	109-78-4			3.0E-01	h					0	0.10	1	4.6E+03	nc	1.0E+05	max	2.7E+03	nc			
Ethylene diamine	107-15-3			9.0E-02	p					0	0.10	1	1.4E+03	nc	5.5E+04	nc	8.2E+02	nc			
Ethylene glycol	107-21-1			2.0E+00	i					0	0.10	1	3.1E+04	nc	1.0E+05	max	1.8E+04	nc			
Ethylene glycol, monobutyl ether	111-76-2			5.0E-01	i			1.3E+01	i	0	0.10	1	7.6E+03	nc	1.0E+05	max	4.6E+03	nc			
Ethylene oxide	75-21-8	1.0E+00	h			1.0E-04	h			1		1	1.9E-01	ca	3.9E+00	ca	2.8E-02	ca	1.1E-04	ca	
Ethylene thiourea (ETU)	96-45-7	1.1E-01	h	8.0E-05	i					0	S	0.10	1	1.2E+00	nc	4.9E+01	nc	6.1E-01	ca		
Ethyl ether	60-29-7			2.0E-01	i					1			3.9E+03	nc	1.0E+05	max	1.8E+03	nc	8.3E+00	nc	
Ethyl methacrylate	97-63-2			9.0E-02	h					1			1.8E+03	nc	9.2E+04	nc	8.2E+02	nc	4.5E+01	nc	
Ethyl p-nitrophenyl phenylphosphorothioate	2104-64-5			1.0E-05	i					0	0.10	1	1.5E-01	nc	6.2E+00	nc	9.1E-02	nc			
Ethylphthalyl ethyl glycolate	84-72-0			3.0E+00	i					0	0.10	1	4.6E+04	nc	1.0E+05	max	2.7E+04	nc			
Express	101200-48-0			8.0E-03	i					0	0.10	1	1.2E+02	nc	4.9E+03	nc	7.3E+01	nc			
Fenamiphos	222224-92-6			2.5E-04	i					0	0.10	1	3.8E+00	nc	1.5E+02	nc	2.3E+00	nc			
Fluometuron	2164-17-2			1.3E-02	i					0	0.10	1	2.0E+02	nc	8.0E+03	nc	1.2E+02	nc			
Fluoride	16984-48-8			6.0E-02	i					0	0.10	1	9.2E+02	nc	3.7E+04	nc	4.0E+03	m			
Fluoridone	59756-60-4			8.0E-02	i					0	0.10	1	1.2E+03	nc	4.9E+04	nc	7.3E+02	nc			
Flurprimidol	56425-91-3			2.0E-02	i					0	0.10	1	3.1E+02	nc	1.2E+04	nc	1.8E+02	nc			
Flutolanil	66332-96-5			6.0E-02	i					0	0.10	1	9.2E+02	nc	3.7E+04	nc	5.5E+02	nc			
Fluvalinate	69409-94-5			1.0E-02	i					0	0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc			
Folpet	133-07-3	3.5E-03	i	1.0E-01	i					0	0.10	1	1.4E+02	ca	4.9E+03	ca	1.9E+01	ca			
Fomesafen	72178-02-0	1.9E-01	i							0	0.10	1	2.6E+00	ca	9.1E+01	ca	3.5E-01	ca			
Fonofos	944-22-9			2.0E-03	i					0	0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc			
Formaldehyde	50-00-0			2.0E-01	i	1.3E-05	i			0	0.10	1	3.1E+03	nc	1.0E+05	max	1.8E+03	nc			
Formic acid	64-18-6			2.0E+00	p			3.0E-03	p	0	0.10	1	3.0E+04	nc	1.0E+05	max	1.8E+04	nc			
Fosetyl-al	39148-24-8			3.0E+00	i					0	0.10	1	4.6E+04	nc	1.0E+05	max	2.7E+04	nc			
Freon 113	76-13-1			3.0E+01	i			3.0E+01	h	1		1	1.4E+04	nc	8.1E+04	nc	1.5E+04	nc	7.2E+02	nc	
Furan	110-00-9			1.0E-03	i					1		1	2.0E+01	nc	1.0E+03	nc	9.1E+00	nc	4.5E-02	nc	
Furazolidone	67-45-8	3.8E+00	h							0	0.10	1	1.3E-01	ca	4.5E+00	ca	1.8E-02	ca			
Furfural	98-01-1			3.0E-03	i			5.0E-02	h	0	0.10	1	4.6E+01	nc	1.8E+03	nc	2.7E+01	nc			
Furium	531-82-8	5.0E+01	h							0	0.10	1	9.7E-03	ca	3.4E-01	ca	1.3E-03	ca			
Furmecyclox	60568-05-0	3.0E-02	i							0	0.10	1	1.6E+01	ca	5.7E+02	ca	2.2E+00	ca			
Glufosinate-ammonium	77182-82-2			4.0E-04	i					0	0.10	1	6.1E+00	nc	2.5E+02	nc	3.7E+00	nc			
Glycidaldehyde	765-34-4			4.0E-04	i			1.0E-03	h	0	0.10	1	6.1E+00	nc	2.5E+02	nc	3.7E+00	nc			
Glyphosate	1071-83-6			1.0E-01	i					0	0.10	1	1.5E+03	nc	6.2E+04	nc	7.0E+02	m			
Haloxypop-methyl	69806-40-2			5.0E-05	i					0	0.10	1	7.6E-01	nc	3.1E+01	nc	4.6E-01	nc			
Harmony	79277-27-3			1.3E-02	i					0	0.10	1	2.0E+02	nc	8.0E+03	nc	1.2E+02	nc			
Heptachlor	76-44-8	4.5E+00	i	5.0E-04	i	1.3E-03	i			1	S	0.10	1	1.1E-01	ca	3.8E+00	ca	4.0E-01	m	2.3E+01	m
Heptachlor epoxide	1024-57-3	9.1E+00	i	1.3E-05	i	2.6E-03	i			0	S	0.10	1	5.3E-02	ca	1.9E+00	ca	2.0E-01	m	6.7E-01	m
Hexabromobenzene	87-82-1			2.0E-03	i					0	0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc			
Hexachlorobenzene	118-74-1	1.6E+00	i	8.0E-04	i	4.6E-04	i			1	S	0.10	1	3.0E-01	ca	1.1E+01	ca	1.0E+00	m	2.2E+00	m
Hexachlorobutadiene	87-68-3	7.8E-02	i	2.0E-04	h	2.2E-05	i			1		0.10	1	3.1E+00	nc	1.2E+02	nc	1.6E-01	ca	3.4E-01	ca
HCH (alpha)	319-84-6	6.3E+00	i	5.0E-04	n	1.8E-03	i			1	S	0.04	1	9.0E-02	ca	3.6E+00	ca	2.2E-03	ca	1.1E-04	ca
HCH (beta)	319-85-7	1.8E+00	i	2.0E-04	n	5.3E-04	i			0	S	0.04	1	3.2E-01	ca	1.3E+01	ca	3.7E-02	ca	2.0E-03	ca
HCH (gamma) Lindane	58-89-9	1.3E+00	h	3.0E-04	i					1	S	0.04	1	4.4E-01	ca	1.7E+01	ca	2.0E-01	m	9.4E-03	m
HCH-technical	608-73-1	1.8E+00	i			5.1E-04	i			1		0.04	1	3.2E-01	ca	1.3E+01	ca	3.7E-02	ca		
Hexachlorocyclopentadiene	77-47-4			6.0E-03	i			2.0E-04	i	1		0.10	1	9.2E+01	nc	3.7E+03	nc	5.0E+01	m	4.0E+02	m
Hexachloroethane	67-72-1	1.4E-02	i	1.0E-03	i	4.0E-06	i			1	S	0.10	1	1.5E+01	nc	6.2E+02	nc	9.4E-01	ca	7.1E-02	ca
Hexachlorophene	70-30-4			3.0E-04	i					0	0.10	1	4.6E+00	nc	1.8E+02	nc	2.7E+00	nc			
Hexahydro-1,3,5-trinitro-1,3,5-triazine	121-82-4	1.1E-01	i	3.0E-03	i					0	0.10	1	4.4E+00	ca	1.6E+02	ca	6.1E-01	ca			
1,6-Hexamethylene diisocyanate	822-06-0					1.0E-05	i			0	0.10	1	3.1E+03	nc	1.7E+04	nc					
n-Hexane	110-54-3			1.1E+01	p			2.0E-01	i	1		1	8.5E+01	nc	4.8E+02	nc	1.0E+02	nc	5.1E+00	nc	

VCP REMEDIATION GOALS

Key : SFo = Oral Slope Factor; RfDo = Oral Reference Dose; IUR = Inhalation Unit Risk; RfC = Inhalation Reference Concentration; i = IRIS; h = HEAST; n = NCEA; x = Withdrawn (reference for value provided); o = Other EPA Source (reference for value provided); p = NCEA PPRTV; R3 = EPA Region 3 RBC Table; R6 = EPA Region 6 MSSL Table; R9 = EPA Region 9 PRG Table; ca = Cancer VCP RG; nc = Noncancer VCP RG; m = MCL-based; s = solubility; sat = Soil Saturation; max = Ceiling limit; DAF = Dilution Attenuation Factor; CAS = Chemical Abstract Services; +++ = Non-Standard Method Applied; see Notes section at bottom of table and Appendix A, Protocol for VCP Remediation Goal Lookup Tables, Nebraska Voluntary Cleanup Program for more information

CONTAMINANT	TOXICITY INFORMATION ¹											VCP REMEDIATION GOALS (RGs)								
	CAS No.	SFo (mg/kg-d) ⁻¹	RfDo (mg/kg-d)	IUR (µg/m ³) ⁻¹	RfC (mg/m ³)	V		ABS _d (unitless)	ABS _{GI} (unitless)	Direct Contact Exposure Pathways			Migration to Ground Water							
						O	S			Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ground Water (µg/l)	DAF 20 (mg/kg)							
						C	solid													
Hexazinone	51235-04-2		3.3E-02					0.10	1		5.0E+02	nc	2.0E+04	nc	3.0E+02	nc				
Hydrazine, hydrazine sulfate	302-01-2	3.0E+00	i	4.9E-03	i			0.10	1		1.6E-01	ca	5.7E+00	ca	2.2E-02	ca				
Hydrazine, monomethyl	60-34-4	3.0E+00	n	4.9E-03	n			0.10	1		1.6E-01	ca	5.7E+00	ca	2.2E-02	ca				
Hydrazine, dimethyl	57-14-7	3.0E+00	n	4.9E-03	n			0.10	1		1.6E-01	ca	5.7E+00	ca	2.2E-02	ca				
Hydrogen chloride	7647-01-0							2.0E-02	i	n/a										
Hydrogen cyanide	74-90-8		2.0E-02					3.0E-03	i	1			7.3E+00	nc	4.1E+01	nc	1.6E+00	nc	7.3E-03	nc
Hydrogen sulfide	7783-06-4		3.0E-03	i-x				2.0E-03	i	n/a			5.9E+01	nc	3.1E+03	nc	2.7E+01	nc		
p-Hydroquinone	123-31-9		4.0E-02	p				0		0.10	1		6.1E+02	nc	2.5E+04	nc	3.7E+02	nc		
Imazail	35554-44-0		1.3E-02	i				0		0.10	1		2.0E+02	nc	8.0E+03	nc	1.2E+02	nc		
Imazaquin	81335-37-7		2.5E-01	i				0		0.10	1		3.8E+03	nc	1.0E+05	max	2.3E+03	nc		
Iprodione	36734-19-7		4.0E-02	i				0		0.10	1		6.1E+02	nc	2.5E+04	nc	3.7E+02	nc		
Iron	7439-89-6		3.0E-01	n				0			1		5.9E+03	nc	1.0E+05	max	3.0E+02	m		
Isobutanol	78-83-1		3.0E-01	i				1			1		5.9E+03	nc	1.0E+05	max	2.7E+03	nc	1.8E+01	nc
Isophorone	78-59-1	9.5E-04	i	2.0E-01	i			0		0.10	1		5.1E+02	ca	1.8E+04	ca	7.1E+01	ca	4.2E-01	ca
Isopropalin	33820-53-0		1.5E-02	i				0		0.10	1		2.3E+02	nc	9.2E+03	nc	1.4E+02	nc		
Isopropyl methyl phosphonic acid	1832-54-8		1.0E-01	i				0		0.10	1		1.5E+03	nc	6.2E+04	nc	9.1E+02	nc		
Isoxaben	82558-50-7		5.0E-02	i				0		0.10	1		7.6E+02	nc	3.1E+04	nc	4.6E+02	nc		
Kepone	143-50-0	8.0E+00	p	2.0E-04	p			0	S	0.10	1		6.1E-02	ca	2.2E+00	ca	8.4E-03	ca		
Lactofen	77501-63-4		2.0E-03	i				0		0.10	1		3.1E+01	nc	1.2E+03	nc	1.8E+01	nc		
Lead+++	7439-92-1							n/a			1		4.0E+02	nc	7.5E+02	nc	1.5E+01	m		
Lead (tetraethyl)	78-00-2		1.0E-07	i				0		0.10	1		1.5E-03	nc	6.2E-02	nc	9.1E-04	nc		
Linuron	330-55-2		2.0E-03	i				0		0.10	1		3.1E+01	nc	1.2E+03	nc	1.8E+01	nc		
Lithium	7439-93-2		2.0E-02	n				0			1		3.9E+02	nc	2.0E+04	nc	1.8E+02	nc		
Londax	83055-99-6		2.0E-01	i				0		0.10	1		3.1E+03	nc	1.0E+05	max	1.8E+03	nc		
Malathion	121-75-5		2.0E-02	i				0		0.10	1		3.1E+02	nc	1.2E+04	nc	1.8E+02	nc		
Maleic anhydride	108-31-6		1.0E-01	i				0	S	0.10	1		1.5E+03	nc	6.2E+04	nc	9.1E+02	nc		
Maleic hydrazide	123-33-1		5.0E-01	i				1			1		9.8E+03	nc	1.0E+05	max	4.6E+03	nc	2.8E+01	nc
Malononitrile	109-77-3		1.0E-04	p				0		0.10	1		1.5E+00	nc	6.2E+01	nc	9.1E-01	nc	3.7E-03	nc
Mancozeb			3.0E-02	h				0		0.10	1		4.6E+02	nc	1.8E+04	nc	2.7E+02	nc		
Maneb	12427-38-2	6.0E-02	R9-c	5.0E-03	i			0		0.10	1		8.1E+00	ca	2.9E+02	ca	1.1E+00	ca		
Manganese (non-food)+++	7439-96-5		2.4E-02	i				5.0E-05	i	0			4.6E+02	nc	1.9E+04	nc	5.0E+01	m		
Mephosfolan	950-10-7		9.0E-05	h				0		0.10	1		1.4E+00	nc	5.5E+01	nc	8.2E-01	nc		
Mepiquat	24307-26-4		3.0E-02	i				0		0.10	1		4.6E+02	nc	1.8E+04	nc	2.7E+02	nc		
2-Mercaptobenzothiazole	149-30-4	2.9E-02	n	1.0E-01	n			0		0.10	1		1.7E+01	ca	5.9E+02	ca	2.3E+00	ca		
Mercury and compounds	7487-94-7		3.0E-04	i				3.0E-04	i	n/a			5.9E+00	nc	3.1E+02	nc	2.0E+00	m	1.4E-02	m
Mercury (elemental)	7439-97-6							3.0E-04	i	n/a							2.0E+00	m	1.4E-02	m
Mercury (methyl)	22967-92-6		1.0E-04	i				0		0.10	1		1.5E+00	nc	6.2E+01	nc	9.1E-01	nc		
Merphos	150-50-5		3.0E-05	i				0		0.10	1		4.6E-01	nc	1.8E+01	nc	2.7E-01	nc		
Merphos oxide	78-48-8		3.0E-05	i				0		0.10	1		4.6E-01	nc	1.8E+01	nc	2.7E-01	nc		
Metalaxyl	57837-19-1		6.0E-02	i				0		0.10	1		9.2E+02	nc	3.7E+04	nc	5.5E+02	nc		
Methacrylonitrile	126-98-7		1.0E-04	i				7.0E-04	h	1			9.7E-01	nc	9.7E+00	nc	2.6E-01	nc	1.1E-03	nc
Methamidophos	10265-92-6		5.0E-05	i				0		0.10	1		7.6E-01	nc	3.1E+01	nc	4.6E-01	nc		
Methanol	67-56-1		5.0E-01	i				0		0.10	1		7.6E+03	nc	1.0E+05	max	4.6E+03	nc		
Methidathion	950-37-8		1.0E-03	i				0		0.10	1		1.5E+01	nc	6.2E+02	nc	9.1E+00	nc		
Methomyl	16752-77-5		2.5E-02	i				1			1		4.9E+02	nc	2.6E+04	nc	2.3E+02	nc	1.7E+00	nc
Methoxychlor	72-43-5		5.0E-03	i				1	S	0.10	1		7.6E+01	nc	3.1E+03	nc	4.0E+01	m	1.6E+02	m
2-Methoxyethanol	109-86-4		1.0E-03	h				2.0E-02	i	0			1.5E+01	nc	6.2E+02	nc	9.1E+00	nc		
2-Methoxyethanol acetate	110-49-6		2.0E-03	h				0		0.10	1		3.1E+01	nc	1.2E+03	nc	1.8E+01	nc		
2-Methoxy-5-nitroaniline	99-59-2	4.6E-02	h					0		0.10	1		1.1E+01	ca	3.7E+02	ca	1.5E+00	ca		
Methyl acetate	79-20-9		1.0E+00	h				1			1		2.0E+04	nc	1.0E+05	max	9.1E+03	nc	3.7E+01	nc
Methyl acrylate	96-33-3		3.0E-02	h				1			1		5.9E+02	nc	3.1E+04	nc	2.7E+02	nc	1.5E+01	nc

VCP REMEDIATION GOALS

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CONTAMINANT	TOXICITY INFORMATION ¹										VCP REMEDIATION GOALS (RGs)									
	CAS No.	SFo (mg/kg-d) ⁻¹	RfDo (mg/kg-d)	IUR (µg/m ³) ⁻¹	RfC (mg/m ³)	V		ABS _d (unitless)	ABS _{GI} (unitless)	Direct Contact Exposure Pathways			Migration to Ground Water							
						O	S			Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ground Water (µg/l)	DAF 20 (mg/kg)							
2-Methylaniline (o-toluidine)	95-53-4	2.4E-01	h				0	0.10	1	2.0E+00	ca	7.2E+01	ca	2.8E-01	ca					
2-Methylaniline hydrochloride	636-21-5	1.8E-01	h				0	0.10	1	2.7E+00	ca	9.6E+01	ca	3.7E-01	ca					
2-Methyl-4-chlorophenoxyacetic acid (MCPA)	94-74-6			5.0E-04	i		0	0.10	1	7.6E+00	nc	3.1E+02	nc	4.6E+00	nc					
4-(2-Methyl-4-chlorophenoxy) butyric acid (MCPB)	94-81-5			1.0E-02	i		0	0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc					
2-(2-Methyl-4-chlorophenoxy) propionic acid	93-65-2			1.0E-03	i		0	0.10	1	1.5E+01	nc	6.2E+02	nc	9.1E+00	nc					
2-(2-Methyl-1,4-chlorophenoxy) propionic acid (MCPPE)	16484-77-8			1.0E-03	i		0	0.10	1	1.5E+01	nc	6.2E+02	nc	9.1E+00	nc					
Methylcyclohexane	108-87-2					3.0E+00	h	1		1.8E+03	nc	1.0E+04	nc	1.6E+03	nc	1.9E+02	nc			
4,4'-Methylenebisbenzeneamine	101-77-9	2.5E-01	R9-I				0	0.10	1	1.9E+00	ca	6.9E+01	ca	2.7E-01	ca					
4,4'-Methylene bis(2-chloroaniline)	101-14-4	1.3E-01	h	7.0E-04	h	3.7E-05	h			3.7E+00	ca	1.3E+02	ca	4.5E-01	ca					
4,4'-Methylene bis(N,N'-dimethyl)aniline	101-61-1	4.6E-02	i				0	0.10	1	1.1E+01	ca	3.7E+02	ca	9.3E-01	ca					
Methylene bromide	74-95-3			1.0E-02	h			1		2.0E+02	nc	1.0E+04	nc	9.1E+01	nc	4.6E-01	nc			
Methylene chloride	75-09-2	7.5E-03	i	6.0E-02	i	4.7E-07	h	1		1.3E+01	ca	2.4E+02	ca	5.0E+00	m	2.3E-02	m			
4,4'-Methylenediphenyl isocyanate	101-68-8					6.0E-04	i	0	0.10	1	1.0E+05	max	1.0E+05	max						
Methyl ethyl ketone	78-93-3			6.0E-01	i	5.0E+00	i	1		8.4E+03	nc	1.0E+05	max	1.8E+03	nc	7.4E+00	nc			
Methyl isobutyl ketone	108-10-1			8.0E-02	h	3.0E+00	i	1		1.5E+03	nc	5.0E+04	nc	5.0E+02	nc	4.7E+00	nc			
Methyl mercaptan	74-93-1					2.0E-03	n	0	0.10	1	1.0E+05	max	1.0E+05	max						
Methyl methacrylate	80-62-6			1.4E+00	i	7.0E-01	i	1		1.4E+03	nc	8.5E+03	nc	3.5E+02	nc	1.6E+00	nc			
2-Methyl-5-nitroaniline	99-55-8	3.3E-02	h				0	0.10	1	1.5E+01	ca	5.2E+02	ca	2.0E+00	ca					
Methyl parathion	298-00-0			2.5E-04	i		0	0.10	1	3.8E+00	nc	1.5E+02	nc	2.3E+00	nc					
2-Methylphenol	95-48-7			5.0E-02	i		0	S	0.10	1	7.6E+02	nc	3.1E+04	nc	4.6E+02	nc	3.5E+00	nc		
3-Methylphenol	108-39-4			5.0E-02	i		0	0.10	1	7.6E+02	nc	3.1E+04	nc	4.6E+02	nc					
4-Methylphenol	106-44-5			5.0E-03	h		0	0.10	1	7.6E+01	nc	3.1E+03	nc	4.6E+01	nc					
Methyl phosphonic acid	993-13-5			2.0E-02	p		0	0.10	1	3.1E+02	nc	1.2E+04	nc	1.8E+02	nc					
Methyl styrene (mixture)	25013-15-4			6.0E-03	h	4.0E-02	h	1		6.0E+01	nc	6.2E+02	nc	1.5E+01	nc	2.8E-01	nc			
Methyl styrene (alpha)	98-83-9			7.0E-02	h		1			1.4E+03	nc	7.2E+04	nc	6.4E+02	nc	1.2E+01	nc			
Methyl tertbutyl ether (MTBE)	1634-04-4	3.3E-03	n		1.0E-06	n	3.0E+00	i	1	1.3E+01	ca	2.2E+02	ca	3.9E+00	ca	1.7E-02	ca			
Metolaclo (Dual)	51218-45-2			1.5E-01	i			0	0.10	1	2.3E+03	nc	9.2E+04	nc	1.4E+03	nc				
Metribuzin	21087-64-9			2.5E-02	i		0	0.10	1	3.8E+02	nc	1.5E+04	nc	2.3E+02	nc					
Mirex	2385-85-5	1.8E+00	R9->	2.0E-04	i		0	0.10	1	2.7E-01	ca	9.6E+00	ca	3.7E-02	ca					
Molinate	2212-67-1			2.0E-03	i		0	0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc					
Molybdenum	7439-98-7			5.0E-03	i		0			9.8E+01	nc	5.1E+03	nc	4.6E+01	nc					
Monochloramine	10599-90-3			1.0E-01	i		0	0.10	1	1.5E+03	nc	6.2E+04	nc	9.1E+02	nc					
Naled	300-76-5			2.0E-03	i		0	0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc					
Napropamide	15299-99-7			1.0E-01	i		0	0.10	1	1.5E+03	nc	6.2E+04	nc	9.1E+02	nc					
Nickel and compounds	7440-02-0			2.0E-02	i		0			3.9E+02	nc	2.0E+04	nc	1.8E+02	nc	2.4E+02	nc			
Nickel refinery dust						2.4E-04	i			0		0.04	1.2E+04	ca	1.0E+05	max				
Nickel subsulfide	12035-72-2					4.8E-04	i			0		0.04	6.0E+03	ca	1.0E+05	max				
Nitrate	14797-55-8			1.6E+00	i			n/a		1	3.1E+04	nc	1.0E+05	max	1.0E+04	m				
Nitrite	14797-65-0			1.0E-01	i			n/a		1	2.0E+03	nc	1.0E+05	max	1.0E+03	m				
2-Nitroaniline	88-74-4			3.0E-03	p		1.0E-04	p	S	0.10	1	4.6E+01	nc	1.8E+03	nc	2.7E+01	nc			
Nitrobenzene	98-95-3			5.0E-04	i		2.0E-03	h	1	7.2E+00	nc	1.2E+02	nc	8.5E-01	nc	5.6E-03	nc			
Nitrofurantoin	67-20-9			7.0E-02	h		0	0.10	1	1.1E+03	nc	4.3E+04	nc	6.4E+02	nc					
Nitrofurazone	59-87-0	1.5E+00	h				0	0.10	1	3.2E-01	ca	1.1E+01	ca	4.5E-02	ca					
Nitroglycerin	55-63-0	1.4E-02	n				0	0.10	1	3.5E+01	ca	1.2E+03	ca	4.8E+00	ca					
Nitroguanidine	556-88-7			1.0E-01	i		0	0.10	1	1.5E+03	nc	6.2E+04	nc	9.1E+02	nc					
2-Nitropropane	79-46-9					2.7E-03	h	2.0E-02	i	0	0.10	1	1.1E+03	ca	1.8E+04	ca				
N-Nitrosodi-n-butylamine	924-16-3	5.4E+00	i			1.6E-03	i		1	3.3E-02	ca	6.7E-01	ca	2.4E-03	ca	3.5E-05	ca			
N-Nitrosodiethanolamine	1116-54-7	2.8E+00	i				0	0.10	1	1.7E-01	ca	6.2E+00	ca	2.4E-02	ca					
N-Nitrosodiethylamine	55-18-5	1.5E+02	i			4.3E-02	i		0	0.10	1	3.2E-03	ca	1.1E-01	ca	4.5E-04	ca			
N-Nitrosodimethylamine	62-75-9	5.1E+01	i	8.0E-06	p	1.4E-02	i		0	0.10	1	9.5E-03	ca	3.4E-01	ca	1.3E-03	ca			
N-Nitrosodiphenylamine	86-30-6	4.9E-03	i	2.0E-02	p		0	S	0.10	1	9.9E+01	ca	3.5E+03	ca	1.3E+01	ca	7.1E-01	ca		

VCP REMEDIATION GOALS

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CONTAMINANT	TOXICITY INFORMATION ¹										VCP REMEDIATION GOALS (RGs)						
	CAS No.	SFo (mg/kg-d) ⁻¹	RfDo (mg/kg-d)	IUR (µg/m ³) ⁻¹	RfC (mg/m ³)	V				Direct Contact Exposure Pathways			Migration to Ground Water				
						O	S =	ABS _d (unitless)	ABS _{GI} (unitless)	Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ground Water (µg/l)	DAF 20 (mg/kg)				
														C solid	sat	max	
N-Nitroso di-n-propylamine	621-64-7	7.0E+00	i			0	S	0.10	1	6.9E-02	ca	2.5E+00	ca	9.6E-03	ca	4.8E-05	ca
N-Nitroso-N-methylethylamine	10595-95-6	2.2E+01	i			0		0.10	1	2.2E-02	ca	7.8E-01	ca	3.1E-03	ca		
N-Nitrosopyrrolidine	930-55-2	2.1E+00	i		6.1E-01	0		0.10	1	2.2E-01	ca	7.4E+00	ca	3.2E-02	ca		
m-Nitrotoluene	99-08-1			2.0E-02	p	1				3.9E+02	nc	2.0E+04	nc	1.8E+02	nc	1.2E+00	nc
o-Nitrotoluene	99-08-1	2.3E-01	p	1.0E-02	p	1				2.8E+00	ca	1.2E+02	ca	2.9E-01	ca	1.9E-03	ca
p-Nitrotoluene	99-99-0	1.7E-02	p	1.0E-02	p	1	S			3.8E+01	ca	1.7E+03	ca	4.0E+00	ca	2.6E-02	ca
Norflurazon	27314-13-2			4.0E-02	i	0		0.10	1	6.1E+02	nc	2.5E+04	nc	3.7E+02	nc		
NuStar	85509-19-9			7.0E-04	i	0		0.10	1	1.1E+01	nc	4.3E+02	nc	6.4E+00	nc		
Octabromodiphenyl ether	32536-52-0			3.0E-03	i	0		0.10	1	4.6E+01	nc	1.8E+03	nc	2.7E+01	nc		
Octahydro-1357-tetranitro-1357- tetrazocine (HMX)	2691-41-0			5.0E-02	i	0		0.10	1	7.6E+02	nc	3.1E+04	nc	4.6E+02	nc		
Octamethylpyrophosphoramidate	152-16-9			2.0E-03	h	0		0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc		
Oryzalin	19044-88-3			5.0E-02	i	0		0.10	1	7.6E+02	nc	3.1E+04	nc	4.6E+02	nc		
Oxadiazon	19666-30-9			5.0E-03	i	0		0.10	1	7.6E+01	nc	3.1E+03	nc	4.6E+01	nc		
Oxamyl	23135-22-0			2.5E-02	i	0	S	0.10	1	3.8E+02	nc	1.5E+04	nc	2.0E+02	m		
Oxyfluorfen	42874-03-3			3.0E-03	i	0		0.10	1	4.6E+01	nc	1.8E+03	nc	2.7E+01	nc		
Paclobutrazol	76738-62-0			1.3E-02	i	0		0.10	1	2.0E+02	nc	8.0E+03	nc	1.2E+02	nc		
Paraquat	4685-14-7			4.5E-03	i	0		0.10	1	6.9E+01	nc	2.8E+03	nc	4.1E+01	nc		
Parathion	56-38-2			6.0E-03	h	0	S	0.10	1	9.2E+01	nc	3.7E+03	nc	3.7E+01	nc		
Pebulate	1114-71-2			5.0E-02	h	0		0.10	1	7.6E+02	nc	3.1E+04	nc	4.6E+02	nc		
Pendimethalin	40487-42-1			4.0E-02	i	0		0.10	1	6.1E+02	nc	2.5E+04	nc	3.7E+02	nc		
Pentabromo-6-chloro cyclohexane	87-84-3	2.3E-02	h			0		0.10	1	2.1E+01	ca	7.5E+02	ca	2.9E+00	ca		
Pentabromodiphenyl ether	32534-81-9			2.0E-03	i	0		0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc		
Pentachlorobenzene	608-93-5			8.0E-04	i	0		0.10	1	1.2E+01	nc	4.9E+02	nc	7.3E+00	nc		
Pentachloronitrobenzene	82-68-8	2.6E-01	h	3.0E-03	i	0		0.10	1	1.9E+00	ca	6.6E+01	ca	1.9E-01	ca		
Pentachlorophenol	87-86-5	1.2E-01	i	3.0E-02	i	0	S	0.25	1	3.0E+00	ca	9.0E+01	ca	1.0E+00	m	2.8E-02	m
Perchlorate	7601-90-3			1.0E-04	R9-	0			1	2.0E+00	nc	1.0E+02	nc	9.1E-01	nc		
Permethrin	52645-53-1			5.0E-02	i	0		0.10	1	7.6E+02	nc	3.1E+04	nc	4.6E+02	nc		
Phenmedipham	13684-63-4			2.5E-01	i	0		0.10	1	3.8E+03	nc	1.0E+05	max	2.3E+03	nc		
Phenol	108-95-2			3.0E-01	i	0	S	0.10	1	4.6E+03	nc	1.0E+05	max	2.7E+03	nc	1.4E+01	nc
Phenothiazine	92-84-2			2.0E-03	n	0		0.10	1	3.1E+01	nc	1.2E+03	nc	1.8E+01	nc		
m-Phenylenediamine	108-45-2			6.0E-03	i	0		0.10	1	9.2E+01	nc	3.7E+03	nc	5.5E+01	nc		
p-Phenylenediamine	106-50-3			1.9E-01	h	0		0.10	1	2.9E+03	nc	1.0E+05	max	1.7E+03	nc		
Phenylmercuric acetate	62-38-4			8.0E-05	i	0		0.10	1	1.2E+00	nc	4.9E+01	nc	7.3E-01	nc		
2-Phenylphenol	90-43-7	1.9E-03	h			0		0.10	1	2.5E+02	ca	8.9E+03	ca	3.5E+01	ca		
Phorate	298-02-2			2.0E-04	h	0		0.10	1	3.1E+00	nc	1.2E+02	nc	1.8E+00	nc		
Phosmet	732-11-6			2.0E-02	i	0		0.10	1	3.1E+02	nc	1.2E+04	nc	1.8E+02	nc		
Phosphine	7803-51-2			3.0E-04	i	0		0.10	1	4.6E+00	nc	1.8E+02	nc	2.7E+00	nc		
Phosphoric acid	7664-38-2					1.0E-02	i	n/a	1								
Phosphorus (white)	7723-14-0			2.0E-05	i	0			1	3.9E-01	nc	2.0E+01	nc	1.8E-01	nc		
p-Phthalic acid	100-21-0			1.0E+00	h	0		0.10	1	1.5E+04	nc	1.0E+05	max	9.1E+03	nc		
Phthalic anhydride	85-44-9			2.0E+00	i	0		0.10	1	3.1E+04	nc	1.0E+05	max	1.8E+04	nc		
Picloram	1918-02-1			7.0E-02	i	0		0.10	1	1.1E+03	nc	4.3E+04	nc	5.0E+02	m		
Pirimiphos-methyl	29232-93-7			1.0E-02	i	0		0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc		
Polybrominated biphenyls		8.9E+00	h	7.0E-06	h	0	S	0.10	1	5.5E-02	ca	1.9E+00	ca	7.6E-03	ca		
Polychlorinated biphenyls (PCBs)	1336-36-3	2.0E+00	i		1.0E-04	0		0.14	1	2.2E-01	ca	7.4E+00	ca	5.0E-01	m		
Aroclor 1016	12674-11-2	7.0E-02	i	7.0E-05	i	0		0.14	1	9.8E-01	nc	3.7E+01	nc	6.4E-01	nc		
Aroclor 1221	11104-28-2	2.0E+00	i		5.7E-04	0		0.14	1	2.2E-01	ca	7.4E+00	ca	3.4E-02	ca		
Aroclor 1232	11141-16-5	2.0E+00	i		5.7E-04	0		0.14	1	2.2E-01	ca	7.4E+00	ca	3.4E-02	ca		
Aroclor 1242	53469-21-9	2.0E+00	i		5.7E-04	0		0.14	1	2.2E-01	ca	7.4E+00	ca	3.4E-02	ca		
Aroclor 1248	12672-29-6	2.0E+00	i		5.7E-04	0		0.14	1	2.2E-01	ca	7.4E+00	ca	3.4E-02	ca		
Aroclor 1254	11097-69-1	2.0E+00	i	2.0E-05	i	0		0.14	1	2.2E-01	ca	7.4E+00	ca	3.4E-02	ca		

VCP REMEDIATION GOALS

Key : SFo = Oral Slope Factor; RfDo = Oral Reference Dose; IUR = Inhalation Unit Risk; RfC = Inhalation Reference Concentration; i = IRIS; h = HEAST; n = NCEA; x = Withdrawn (reference for value provided); o = Other EPA Source (reference for value provided); p = NCEA PPRTV; R3 = EPA Region 3 RBC Table; R6 = EPA Region 6 MSSL Table; R9 = EPA Region 9 PRG Table; ca = Cancer VCP RG; nc = Noncancer VCP RG; m = MCL-based; s = solubility; sat = Soil Saturation; max = Ceiling limit; DAF = Dilution Attenuation Factor; CAS = Chemical Abstract Services; +++ = Non-Standard Method Applied; see Notes section at bottom of table and Appendix A, Protocol for VCP Remediation Goal Lookup Tables, Nebraska Voluntary Cleanup Program for more information

CONTAMINANT	TOXICITY INFORMATION ¹										VCP REMEDIATION GOALS (RGs)							
	CAS No.	SFo (mg/kg-d) ⁻¹	RfDo (mg/kg-d)	IUR (µg/m ³) ⁻¹	RfC (mg/m ³)	V				Direct Contact Exposure Pathways			Migration to Ground Water					
						O	S =	ABS _d (unitless)	ABS _{GI} (unitless)	Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ground Water (µg/l)	DAF 20 (mg/kg)					
														C	solid	sat		
Aroclor 1260	11096-82-5	2.0E+00	i	5.7E-04	i	0		0.14	1		2.2E-01	ca	7.4E+00	ca	3.4E-02	ca		
Polychlorinated terphenyls	61788-33-8	4.5E+00	n			0		0.10	1		1.1E-01	ca	3.8E+00	ca	1.5E-02	ca		
Polynuclear aromatic hydrocarbons						n/a		0.13	1									
Acenaphthene	83-32-9		6.0E-02	i		1	S		1		1.2E+03	nc	6.1E+04	nc	5.5E+02	nc	1.1E+02	nc
Anthracene	120-12-7		3.0E-01	i		1	S		1		5.9E+03	nc	1.0E+05	max	4.3E+01	s	2.6E+03	nc
Benz[a]anthracene	56-55-3	7.3E-01	n			0	S	0.13	1		6.2E-01	ca	2.1E+01	ca	2.5E-02	ca	3.9E-01	ca
Benzo[b]fluoranthene	205-99-2	7.3E-01	n			1	S	0.13	1		6.2E-01	ca	2.1E+01	ca	1.6E-02	ca	7.9E-01	ca
Benzo[k]fluoranthene	207-08-9	7.3E-02	n			0	S	0.13	1		6.2E+00	ca	2.1E+02	ca	9.2E-01	ca	4.5E+01	ca
Benzo[a]pyrene	50-32-8	7.3E+00	i			0	S	0.13	1		6.2E-02	ca	2.1E+00	ca	2.0E-01	m	8.2E+00	m
Chrysene	218-01-9	7.3E-03	n			0	S	0.13	1		6.2E+01	ca	2.1E+03	ca	1.6E+00	s	3.9E+01	ca
Dibenz[ah]anthracene	53-70-3	7.3E+00	n			0	S	0.13	1		6.2E-02	ca	2.1E+00	ca	1.1E-03	ca	1.7E-01	ca
Fluoranthene	206-44-0		4.0E-02	i		1	S	0.13	1		5.7E+02	nc	2.2E+04	nc	6.0E+01	nc	2.6E+02	nc
Fluorene	86-73-7		4.0E-02	i		1	S		1		7.8E+02	nc	4.1E+04	nc	3.7E+02	nc	2.0E+02	nc
Indeno[1,2,3-cd]pyrene	193-39-5	7.3E-01	n			0	S	0.13	1		6.2E-01	ca	2.1E+01	ca	1.5E-02	ca	2.1E+00	ca
Naphthalene	91-20-3		2.0E-02	i		1	S		1		3.6E+01	nc	2.2E+02	nc	1.5E+00	nc	8.0E-02	nc
Pyrene	129-00-0		3.0E-02	i		0	S		1		5.9E+02	nc	3.1E+04	nc	1.4E+02	s	1.2E+03	nc
Prochloraz	67747-09-5	1.5E-01	i	9.0E-03	i	0		0.10	1		3.2E+00	ca	1.1E+02	ca	4.5E-01	ca		
Profluralin	26399-36-0		6.0E-03	h		0		0.10	1		9.2E+01	nc	3.7E+03	nc	5.5E+01	nc		
Prometon	1610-18-0		1.5E-02	i		0		0.10	1		2.3E+02	nc	9.2E+03	nc	1.4E+02	nc		
Prometryn	7287-19-6		4.0E-03	i		0		0.10	1		6.1E+01	nc	2.5E+03	nc	3.7E+01	nc		
Pronamide	23950-58-5		7.5E-02	i		0		0.10	1		1.1E+03	nc	4.6E+04	nc	6.8E+02	nc		
Propachlor	1918-16-7		1.3E-02	i		0		0.10	1		2.0E+02	nc	8.0E+03	nc	1.2E+02	nc		
Propanil	709-98-8		5.0E-03	i		0		0.10	1		7.6E+01	nc	3.1E+03	nc	4.6E+01	nc		
Propargite	2312-35-8		2.0E-02	i		0		0.10	1		3.1E+02	nc	1.2E+04	nc	1.8E+02	nc		
Propargyl alcohol	107-19-7		2.0E-03	i		0		0.10	1		3.1E+01	nc	1.2E+03	nc	1.8E+01	nc		
Propazine	139-40-2		2.0E-02	i		0		0.10	1		3.1E+02	nc	1.2E+04	nc	1.8E+02	nc		
Propham	122-42-9		2.0E-02	i		0		0.10	1		3.1E+02	nc	1.2E+04	nc	1.8E+02	nc		
Propiconazole	60207-90-1		1.3E-02	i		0		0.10	1		2.0E+02	nc	8.0E+03	nc	1.2E+02	nc		
n-Propylbenzene	103-65-1		4.0E-02	n		1			1		7.8E+02	nc	4.1E+04	nc	3.7E+02	nc	4.3E+01	nc
Propylene glycol	57-55-6		5.0E-01	p		0		0.10	1		7.6E+03	nc	1.0E+05	max	4.6E+03	nc		
Propylene glycol, monoethyl ether	52125-53-8		7.0E-01	h		0		0.10	1		1.1E+04	nc	1.0E+05	max	6.4E+03	nc		
Propylene glycol, monomethyl ether	107-98-2		7.0E-01	h		0		0.10	1		1.1E+04	nc	1.0E+05	max	6.4E+03	nc		
Propylene oxide	75-56-9	2.4E-01	i		3.7E-06	i	1		1		2.1E+00	ca	7.1E+01	ca	2.3E-01	ca	1.2E-03	ca
Pursuit	81335-77-5		2.5E-01	i		0		0.10	1		3.8E+03	nc	1.0E+05	max	2.3E+03	nc		
Pydrin	51630-58-1		2.5E-02	i		0		0.10	1		3.8E+02	nc	1.5E+04	nc	2.3E+02	nc		
Pyridine	110-86-1		1.0E-03	i		0		0.10	1		1.5E+01	nc	6.2E+02	nc	9.1E+00	nc		
Quinalphos	13593-03-8		5.0E-04	i		0		0.10	1		7.6E+00	nc	3.1E+02	nc	4.6E+00	nc		
Quinoline	91-22-5	3.0E+00	i			0		0.10	1		1.6E-01	ca	5.7E+00	ca	2.2E-02	ca		
RDX (Cyclonite)	121-82-4	1.1E-01	i	3.0E-03	i	0		0.10	1		4.4E+00	ca	1.6E+02	ca	6.1E-01	ca		
Resmethrin	10453-86-8		3.0E-02	i		0		0.10	1		4.6E+02	nc	1.8E+04	nc	2.7E+02	nc		
Ronnel	299-84-3		5.0E-02	h		0		0.10	1		7.6E+02	nc	3.1E+04	nc	4.6E+02	nc		
Rotenone	83-79-4		4.0E-03	i		0		0.10	1		6.1E+01	nc	2.5E+03	nc	3.7E+01	nc		
Savey	78587-05-0		2.5E-02	i		0		0.10	1		3.8E+02	nc	1.5E+04	nc	2.3E+02	nc		
Selenious Acid	7783-00-8		5.0E-03	i		0		0.10	1		7.6E+01	nc	3.1E+03	nc	4.6E+01	nc		
Selenium	7782-49-2		5.0E-03	i		0			1		9.8E+01	nc	5.1E+03	nc	5.0E+01	m	5.2E+00	m
Selenourea	630-10-4		5.0E-03	h		0		0.10	1		7.6E+01	nc	3.1E+03	nc	4.6E+01	nc		
Sethoxydim	74051-80-2		9.0E-02	i		0		0.10	1		1.4E+03	nc	5.5E+04	nc	8.2E+02	nc		
Silver and compounds	7440-22-4		5.0E-03	i		0			0.04		9.8E+01	nc	5.1E+03	nc	1.0E+02	m	1.7E+01	m
Simazine	122-34-9	1.2E-01	h	5.0E-03	i	0		0.10	1		4.0E+00	ca	1.4E+02	ca	4.0E+00	m		
Sodium azide	26628-22-8		4.0E-03	i		0			1		7.8E+01	nc	4.1E+03	nc	3.7E+01	nc		
Sodium diethyldithiocarbamate	148-18-5	2.7E-01	h	3.0E-02	i	0		0.10	1		1.8E+00	ca	6.4E+01	ca	2.5E-01	ca		

VCP REMEDIATION GOALS

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CONTAMINANT	TOXICITY INFORMATION ¹										VCP REMEDIATION GOALS (RGs)									
	CAS No.	SFo (mg/kg-d) ⁻¹	RfDo (mg/kg-d)	IUR (µg/m ³) ⁻¹	RfC (mg/m ³)	V		ABS _d (unitless)	ABS _{GI} (unitless)	Direct Contact Exposure Pathways			Migration to Ground Water							
						O	S			Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ground Water (µg/l)	DAF 20 (mg/kg)							
Sodium fluoroacetate	62-74-8		2.0E-05	i			0	0.10	1	3.1E-01	nc	1.2E+01	nc	1.8E-01	nc					
Sodium metavanadate	13718-26-8		1.0E-03	h			0	0.10	1	1.5E+01	nc	6.2E+02	nc	9.1E+00	nc					
Strontium, stable	7440-24-6		6.0E-01	i			0		1	1.2E+04	nc	1.0E+05	max	5.5E+03	nc					
Strychnine	57-24-9		3.0E-04	i			0	0.10	1	4.6E+00	nc	1.8E+02	nc	2.7E+00	nc					
Styrene	100-42-5		2.0E-01	i		1.0E+00	i	1	1	2.0E+03	nc	2.1E+04	nc	1.0E+02	m	3.5E+00				
1,1'-Sulfonylbis (4-chlorobenzene)	80-07-9		5.0E-03	p			0	0.10	1	7.6E+01	nc	3.1E+03	nc	4.6E+01	nc					
Systhane	88671-89-0		2.5E-02	i			0	0.10	1	3.8E+02	nc	1.5E+04	nc	2.3E+02	nc					
2,3,7,8-TCDD (dioxin)	1746-01-6	1.5E+05	h		3.3E-03	h	0	0.03	1	3.9E-06	ca	1.6E-04	ca	8.5E-08	ca					
Tebuthiuron	34014-18-1		7.0E-02	i			0	0.10	1	1.1E+03	nc	4.3E+04	nc	6.4E+02	nc					
Temephos	3383-96-8		2.0E-02	h			0	0.10	1	3.1E+02	nc	1.2E+04	nc	1.8E+02	nc					
Terbacil	5902-51-2		1.3E-02	i			0	0.10	1	2.0E+02	nc	8.0E+03	nc	1.2E+02	nc					
Terbufos	13071-79-9		2.5E-05	h			0	0.10	1	3.8E-01	nc	1.5E+01	nc	2.3E-01	nc					
Terbutryn	886-50-0		1.0E-03	i			0	0.10	1	1.5E+01	nc	6.2E+02	nc	9.1E+00	nc					
1,2,4,5-Tetrachlorobenzene	95-94-3		3.0E-04	i			0	0.10	1	4.6E+00	nc	1.8E+02	nc	2.7E+00	nc					
1,1,1,2-Tetrachloroethane	630-20-6	2.6E-02	i	3.0E-02	i	7.4E-06	i	1	S	1	4.5E+00	ca	8.4E+01	ca	5.2E-01	ca	4.1E-03	ca		
1,1,2,2-Tetrachloroethane	79-34-5	2.0E-01	i	6.0E-02	p	5.8E-05	i	1		1	5.7E-01	ca	1.1E+01	ca	6.7E-02	ca	5.2E-04	ca		
Tetrachloroethylene (PCE)	127-18-4	5.4E-01	R6-c	1.0E-02	i	6.0E-06	R6-c	4.0E-01	n	1	6.0E-01	ca	1.5E+01	ca	5.0E+00	m	5.8E-02	m		
2,3,4,6-Tetrachlorophenol	58-90-2		3.0E-02	i			0	S	0.10	1	4.6E+02	nc	1.8E+04	nc	2.7E+02	nc				
p,a,a,a-Tetrachlorotoluene	5216-25-1	2.0E+01	h				0	0.10	1	2.4E-02	ca	8.6E-01	ca	3.4E-03	ca					
Tetrachlorovinphos	961-11-5	2.4E-02	h	3.0E-02	i		0	0.10	1	2.0E+01	ca	7.2E+02	ca	2.8E+00	ca					
Tetraethylthiopyrophosphate	3689-24-5		5.0E-04	i			0	0.10	1	7.6E+00	nc	3.1E+02	nc	4.6E+00	nc					
Tetrahydrofuran	109-99-9	7.6E-03	n	2.1E-01	n	2.0E-06	n	3.0E-01	n	1	1.3E+01	ca	2.4E+02	ca	1.9E+00	ca	7.7E-03	ca		
Thallium and compounds+++	7440-28-0		6.6E-05	i			0		1	1.3E+00	nc	6.7E+01	nc	2.0E+00	m	2.8E+00	m			
Thiobencarb	28249-77-6		1.0E-02	i			0	0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc					
Thiocyanate	N/A		1.0E-04	n			0	0.10	1	1.5E+00	nc	6.2E+01	nc	9.1E-01	nc					
Thiofanox	39196-18-4		3.0E-04	h			0	0.10	1	4.6E+00	nc	1.8E+02	nc	2.7E+00	nc					
Thiophanate-methyl	23564-05-8		8.0E-02	i			0	0.10	1	1.2E+03	nc	4.9E+04	nc	7.3E+02	nc					
Thiram	137-26-8		5.0E-03	i			0	0.10	1	7.6E+01	nc	3.1E+03	nc	4.6E+01	nc					
Tin and compounds			6.0E-01	h			0		1	1.2E+04	nc	1.0E+05	max	5.5E+03	nc					
Toluene	108-88-3		2.0E-01	i		4.0E-01	i	1		1	4.3E+02	nc	2.7E+03	nc	1.0E+03	m	1.2E+01	m		
Toluene-2,4-diamine	95-80-7	3.2E+00	h				0	S	0.10	1	1.5E-01	ca	5.4E+00	ca	2.1E-02	ca				
Toluene-2,5-diamine	95-70-5		6.0E-01	h			0	0.10	1	9.2E+03	nc	1.0E+05	max	5.5E+03	nc					
Toluene-2,6-diamine	823-40-5		2.0E-01	h			0	S	0.10	1	3.1E+03	nc	1.0E+05	max	1.8E+03	nc				
p-Toluidine	106-49-0	1.9E-01	h				0	S	0.10	1	2.6E+00	ca	9.1E+01	ca	3.5E-01	ca				
Toxaphene	8001-35-2	1.1E+00	i		3.2E-04	i	0	S	0.10	1	4.4E-01	ca	1.6E+01	ca	3.0E+00	m	3.1E+01	m		
Tralometrin	66841-25-6		7.5E-03	i			0	0.10	1	1.1E+02	nc	4.6E+03	nc	6.8E+01	nc					
Triallate	2303-17-5		1.3E-02	i			0	0.10	1	2.0E+02	nc	8.0E+03	nc	1.2E+02	nc					
Triasulfuron	82097-50-5		1.0E-02	i			0	0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc					
1,2,4-Tribromobenzene	615-54-3		5.0E-03	i			0	0.10	1	7.6E+01	nc	3.1E+03	nc	4.6E+01	nc					
Tributyltin oxide (TBTO)	56-35-9		3.0E-04	i			0	0.10	1	4.6E+00	nc	1.8E+02	nc	2.7E+00	nc					
2,4,6-Trichloroaniline	634-93-5	3.4E-02	h				0	0.10	1	1.4E+01	ca	5.1E+02	ca	2.0E+00	ca					
2,4,6-Trichloroaniline hydrochloride	33663-50-2	2.9E-02	h				0	0.10	1	1.7E+01	ca	5.9E+02	ca	2.3E+00	ca					
1,2,4-Trichlorobenzene	120-82-1		1.0E-02	i		4.0E-03	p	1		1	4.2E+01	nc	2.9E+02	nc	7.0E+01	m	5.3E+00	m		
1,1,1-Trichloroethane	71-55-6		2.8E-01	n		2.2E+00	p	1		1	1.2E+03	nc	8.1E+03	nc	2.0E+02	m	1.9E+00	m		
1,1,2-Trichloroethane	79-00-5	5.7E-02	i	4.0E-03	i	1.6E-05	i	1		1	1.0E+00	ca	1.9E+01	ca	5.0E+00	m	3.0E-02	m		
Trichloroethylene (TCE)	79-01-6	4.0E-01	n	3.0E-04	n	1.1E-04	n	4.0E-02	n	1	8.0E-02	ca	1.4E+00	ca	5.0E+00	m	5.7E-02	m		
Trichlorofluoromethane	75-69-4		3.0E-01	i		7.0E-01	h	1		1	2.6E+02	nc	1.5E+03	nc	3.1E+02	nc	5.5E+00	nc		
2,4,5-Trichlorophenol	95-95-4		1.0E-01	n			0	S	0.10	1	1.5E+03	nc	6.2E+04	nc	9.1E+02	nc	6.2E+01	nc		
2,4,6-Trichlorophenol	88-06-2	1.1E-02	i	1.0E-04	i	3.1E-06	i		0	S	0.10	1	1.5E+00	nc	6.2E+01	nc	5.2E-01	nc	9.9E-03	nc
2,4,5-Trichlorophenoxyacetic acid	93-76-5		1.0E-02	i			0	0.10	1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc					
2-(2,4,5-Trichlorophenoxy) propionic acid	93-72-1		8.0E-03	i			0	0.10	1	1.2E+02	nc	4.9E+03	nc	5.0E+01	m					

VCP REMEDIATION GOALS

Key : SFo = Oral Slope Factor; RfDo = Oral Reference Dose; IUR = Inhalation Unit Risk; RfC = Inhalation Reference Concentration; i = IRIS; h = HEAST; n = NCEA; x = Withdrawn (reference for value provided); o = Other EPA Source (reference for value provided); p = NCEA PPRTV; R3 = EPA Region 3 RBC Table; R6 = EPA Region 6 MSSL Table; R9 = EPA Region 9 PRG Table; ca = Cancer VCP RG; nc = Noncancer VCP RG; m = MCL-based; s = solubility; sat = Soil Saturation; max = Ceiling limit; DAF = Dilution Attenuation Factor; CAS = Chemical Abstract Services; +++ = Non-Standard Method Applied; see Notes section at bottom of table and Appendix A, Protocol for VCP Remediation Goal Lookup Tables, Nebraska Voluntary Cleanup Program for more information

CONTAMINANT	TOXICITY INFORMATION ¹											VCP REMEDIATION GOALS (RGs)							
	CAS No.	SFo (mg/kg-d) ⁻¹	RfDo (mg/kg-d)	IUR (µg/m ³) ⁻¹	RfC (mg/m ³)	V				Direct Contact Exposure Pathways			Migration to Ground Water						
						O	S	ABS _d (unitless)	ABS _{GI} (unitless)	Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ground Water (µg/l)	DAF 20 (mg/kg)						
														C	solid				
1,1,2-Trichloropropane	598-77-6		5.0E-03				1			1	9.8E+01	nc	5.1E+03	nc	4.6E+01	nc	3.7E-01	nc	
1,2,3-Trichloropropane	96-18-4	7.0E+00	h	6.0E-03						1	9.1E-02	ca	1.0E+00	nc	9.6E-03	ca	7.8E-05	ca	
1,2,3-Trichloropropene	96-19-5			1.0E-02						1	4.6E-01	nc	2.6E+00	nc	5.2E-01	nc	4.2E-03	nc	
Tridiphane	58138-08-2			3.0E-03							0.10		1	4.6E+01	nc	1.8E+03	nc	2.7E+01	nc
Triethylamine	121-44-8									1	7.0E-03	i	1	1.9E+01	nc	1.1E+02	nc	3.7E+00	nc
Trifluralin	1582-09-8	7.7E-03	i	7.5E-03						0	0.10		1	6.3E+01	ca	2.2E+03	ca	8.7E+00	ca
Trimellitic Anhydride (TMAN)	552-30-7									1	4.0E-05	n	0	1.2E+04	nc	6.9E+04	nc		
1,2,4-Trimethylbenzene	95-63-6			5.0E-02						1	6.0E-03	p	1	3.5E+01	nc	2.0E+02	nc	3.1E+00	nc
1,3,5-Trimethylbenzene	108-67-8			5.0E-02						1	6.0E-03	p	1	1.5E+01	nc	8.2E+01	nc	3.1E+00	nc
Trimethyl phosphate	512-56-1	3.7E-02	h							0	0.10		1	1.3E+01	ca	4.7E+02	ca	1.8E+00	ca
1,3,5-Trinitrobenzene	99-35-4			3.0E-02						0	S	0.10	1	4.6E+02	nc	1.8E+04	nc	2.7E+02	nc
Trinitrophenylmethylnitramine	479-45-8			1.0E-02						0	0.10		1	1.5E+02	nc	6.2E+03	nc	9.1E+01	nc
2,4,6-Trinitrotoluene	118-96-7	3.0E-02	i	5.0E-04						0	0.10		1	7.6E+00	nc	3.1E+02	nc	2.2E+00	ca
Triphenylphosphine oxide	791-28-6			2.0E-02						0	0.10		1	3.1E+02	nc	1.2E+04	nc	1.8E+02	nc
Tris(2-chloroethyl) phosphate	115-96-8	1.4E-02	p	3.0E-01						0	0.10		1	3.5E+01	ca	1.2E+03	ca	4.8E+00	ca
Uranium (chemical toxicity only)	7440-61-0			3.0E-03						0			1	5.9E+01	nc	3.1E+03	nc	2.7E+01	nc
Vanadium and compounds	7440-62-2			9.0E-03						0			0.026	1.8E+02	nc	9.2E+03	nc	6.8E+01	nc
Vernam	1929-77-7			1.0E-03						0	0.10		1	1.5E+01	nc	6.2E+02	nc	9.1E+00	nc
Vinclozolin	50471-44-8			2.5E-02						0	0.10		1	3.8E+02	nc	1.5E+04	nc	2.3E+02	nc
Vinyl acetate	108-05-4			1.0E+00						0			1	2.9E+02	nc	1.6E+03	nc	1.0E+02	nc
Vinyl bromide	593-60-2				3.2E-05	h				1	3.0E-03	i	1	2.9E-01	ca	4.9E+00	ca	1.5E-01	ca
Vinyl chloride (residential)+++	75-01-4	1.4E+00	i	3.0E-03	i	8.8E-06	i	1.0E-01	i	1			1	9.8E-02	ca			2.0E+00	m
Vinyl chloride (industrial)+++	75-01-4	7.2E-01	i	3.0E-03	i	4.4E-06	i	1.0E-01	i	1			1			8.8E+00	ca	2.0E+00	m
Warfarin	81-81-2			3.0E-04						0	0.10		1	4.6E+00	nc	1.8E+02	nc	2.7E+00	nc
Xylenes	1330-20-7			2.0E-01				1.0E-01	i	1			1	1.8E+02	nc	1.0E+03	nc	1.0E+04	m
Zinc	7440-66-6			3.0E-01						0			1	5.9E+03	nc	1.0E+05	max	5.0E+03	m
Zinc phosphide	1314-84-7			3.0E-04						0			1	5.9E+00	nc	3.1E+02	nc	2.7E+00	nc
Notes																			
¹ Toxicity factors selected based on the hierarchy described in EPA's "Memorandum Regarding Human Health Toxicity Values in Superfund Risk Assessments." From Michael B. Cook, Director, EPA Office of Superfund Remediation and Technology Innovation. To EPA Superfund National Policy Managers, Regions 1 - 10. OSWER Directive 9285.7-53. December 5, 2003. On-Line Address: http://www.epa.gov/oerrpage/superfund/programs/risk/hhmemo.pdf																			
EPA Region 3 Risk-Based Concentrations (RBC) Table. Last update: April 14, 2004. On-Line Address: http://epa.gov/reg3hwmd/risk/human/index.htm																			
EPA Region 6 Human Health Medium-Specific Screening Levels (MSSL) Table. Last update: January 13m 2004. On-Line Address: http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/screen.htm																			
EPA Region 9 Preliminary Remediation Goals (PRG) Table. Last update: October 1, 2002. On-Line Address: http://epa.gov/region09/waste/sfund/prg/index.htm																			
+++ Designations (see Appendix A, Protocol for VCP Remediation Goal Lookup Tables, Nebraska Voluntary Cleanup Program for more information):																			
Cadmium and compounds: RfDo is value for water.																			
Total Chromium (1:6 ratio Cr VI:Cr III): IRIS IUR for Chromium VI used (since IRIS IUR is based on a 1:6 ratio of chromium VI:chromium III).																			
Chromium VI: IUR is IRIS value for Chromium VI multiplied by 7 (since IRIS IUR is based on a 1:6 ratio of chromium VI:chromium III).																			
Lead: VCP RGs calculated using EPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model																			
Manganese (non-food): RfDo reflects IRIS RfDo for manganese divided by 3, which reflects subtraction of dietary sources of manganese.																			
Thallium and compounds: RfDo is IRIS RfDo for thallium sulfate adjusted for the molecular weight of thallium																			
Vinyl chloride (residential): SFo and IUR are IRIS values based on continuous lifetime exposure from birth, derived using the linearized multistage (LMS) method.																			
Vinyl chloride (industrial): SFo and IUR are IRIS values based on continuous lifetime exposure during adulthood, derived using the linearized multistage (LMS) method.																			

ATTACHMENT 2-7

NEBRASKA UNIFORM ENVIRONMENTAL COVENANTS ACT

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LEGISLATIVE BILL 298

Approved by the Governor March 22, 2005

Introduced by Landis, 46

AN ACT relating to environmental remediation; to amend section 76-288, Reissue Revised Statutes of Nebraska, and section 66-1510, Revised Statutes Supplement, 2004; to redefine a term under the Petroleum Release Remedial Action Act; to adopt the Uniform Environmental Covenants Act; to harmonize provisions; to provide operative dates; to provide severability; to repeal the original sections; and to declare an emergency.

Be it enacted by the people of the State of Nebraska,

Section 1. Section 66-1510, Revised Statutes Supplement, 2004, is amended to read:

66-1510. Petroleum shall mean:

(1) For purposes of the fee provisions of section 66-1521:

(a) Motor vehicle fuel as defined in section 66-482, except natural gasoline used as a denaturant by an ethanol facility as defined in section 66-1333; and

~~(2)~~ (b) Diesel fuel as defined in section 66-482, including kerosene which has been blended for use as a motor fuel; and

(2) For purposes of all provisions of the Petroleum Release Remedial Action Act other than the fee provisions of section 66-1521:

(a) The fuels defined in subdivision (1) of this section; and

(b) A fraction of crude oil that is liquid at a temperature of sixty degrees Fahrenheit and a pressure of fourteen and seven-tenths pounds per square inch absolute, except any such fraction which is regulated as a hazardous substance under section 101(14) of the federal Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601(14), as such act existed on January 1, 2005.

Sec. 2. Sections 2 to 14 of this act may be cited as the Uniform Environmental Covenants Act.

Sec. 3. In the Uniform Environmental Covenants Act:

(1) Activity and use limitations means restrictions or obligations created under the act with respect to real property.

(2) Agency means the Department of Environmental Quality or any other Nebraska or federal agency that determines or approves the environmental response project pursuant to which the environmental covenant is created.

(3) Common interest community means a condominium, cooperative, or other real property with respect to which a person, by virtue of the person's ownership of a parcel of real property, is obligated to pay property taxes or insurance premiums, or for maintenance, or improvement of other real property described in a recorded covenant that creates the common interest community.

(4) Environmental covenant means a servitude arising under an environmental response project that imposes activity and use limitations.

(5) Environmental response project means a plan or work performed for environmental remediation of real property and conducted:

(A) Under a federal or state program governing environmental remediation of real property, including the Petroleum Release Remedial Action Act;

(B) Incident to closure of a solid or hazardous waste management unit, if the closure is conducted with approval of an agency; or

(C) Under a state voluntary cleanup program authorized by the Remedial Action Plan Monitoring Act.

(6) Holder means the grantee of an environmental covenant as specified in subsection (a) of section 4 of this act.

(7) Person means an individual, corporation, business trust, estate, trust, partnership, limited liability company, association, joint venture, public corporation, government, governmental subdivision, agency, or instrumentality, or any other legal or commercial entity.

(8) Record, used as a noun, means information that is inscribed on a tangible medium or that is stored in an electronic or other medium and is retrievable in perceivable form.

(9) State means a state of the United States, the District of Columbia, Puerto Rico, the United States Virgin Islands, or any territory or insular possession subject to the jurisdiction of the United States.

Sec. 4. (a) Any person, including a person that owns an interest in the real property, may be a holder, except that the State of Nebraska, a

municipality, or another unit of local government may not be a holder unless it is the owner of the real property. An environmental covenant may identify more than one holder. The interest of a holder is an interest in real property.

(b) A right of an agency under the Uniform Environmental Covenants Act or under an environmental covenant, other than a right as a holder, is not an interest in real property.

(c) An agency is only bound by any obligation it expressly assumes in an environmental covenant, but an agency does not assume obligations merely by signing an environmental covenant. Any other person that signs an environmental covenant is bound by the obligations the person assumes in the covenant, but signing the covenant does not change obligations, rights, or protections granted or imposed under law other than the act except as provided in the covenant.

(d) The following rules apply to interests in real property in existence at the time an environmental covenant is created or amended:

(1) A prior interest is not affected by an environmental covenant unless the person that owns the interest subordinates that interest to the covenant.

(2) The act does not require a person that owns a prior interest to subordinate that interest to an environmental covenant or to agree to be bound by the covenant.

(3) A subordination agreement may be contained in an environmental covenant covering real property or in a separate record. If the environmental covenant covers commonly owned property in a common interest community, the record may be signed by any person authorized by the governing board of the owners' association.

(4) An agreement by a person to subordinate a prior interest to an environmental covenant affects the priority of that person's interest but does not by itself impose any affirmative obligation on the person with respect to the environmental covenant.

Sec. 5. (a) An environmental covenant must:

(1) State that the instrument is an environmental covenant executed pursuant to the Uniform Environmental Covenants Act;

(2) Contain a legally sufficient description of the real property subject to the covenant;

(3) Describe the activity and use limitations on the real property;

(4) Identify every holder;

(5) Be signed by the agency, every holder, and unless waived by the agency every owner of the fee simple of the real property subject to the covenant; and

(6) Identify the name and location of any administrative record for the environmental response project reflected in the environmental covenant.

(b) In addition to the information required by subsection (a) of this section, an environmental covenant may contain other information, restrictions, and requirements agreed to by the persons who signed it, including any:

(1) Requirements for notice following transfer of a specified interest in, or concerning proposed changes in use of, applications for building permits for, or proposals for any site work affecting the contamination on, the property subject to the covenant;

(2) Requirements for periodic reporting describing compliance with the covenant;

(3) Rights of access to the property granted in connection with implementation or enforcement of the covenant;

(4) A brief narrative description of the contamination and remedy, including the contaminants of concern, the pathways of exposure, limits on exposure, and the location and extent of the contamination;

(5) Limitation on amendment or termination of the covenant in addition to those contained in sections 10 and 11 of this act;

(6) Rights of the holder in addition to its right to enforce the covenant pursuant to section 12 of this act; and

(7) Rights to enforce granted to any person.

(c) In addition to other conditions for its approval of an environmental covenant, the agency may require that those persons specified by the agency who have interests in the real property have signed the covenant.

Sec. 6. (a) An environmental covenant that complies with the Uniform Environmental Covenants Act runs with the land.

(b) An environmental covenant that is otherwise effective is valid and enforceable even if:

(1) It is not appurtenant to an interest in real property;

(2) It can be or has been assigned to a person other than the

original holder;

(3) It is not of a character that has been recognized traditionally at common law;

(4) It imposes a negative burden;

(5) It imposes an affirmative obligation on a person having an interest in the real property or on the holder;

(6) The benefit or burden does not touch or concern real property;

(7) There is no privity of estate or contract;

(8) The holder dies, ceases to exist, resigns, or is replaced; or

(9) The owner of an interest subject to the environmental covenant and the holder are the same person.

(c) An instrument that creates restrictions or obligations with respect to real property that would qualify as activity and use limitations except for the fact that the instrument was recorded before the operative date of this section is not invalid or unenforceable because of any of the limitations on enforcement of interests described in subsection (b) of this section or because it was identified as an easement, servitude, deed restriction, or other interest. The act does not apply in any other respect to such an instrument.

(d) The act does not invalidate or render unenforceable any interest, whether designated as an environmental covenant or other interest, that is otherwise enforceable under the law of this state.

Sec. 7. The Uniform Environmental Covenants Act does not authorize a use of real property that is otherwise prohibited by zoning, by law other than the act regulating use of real property, or by a recorded instrument that has priority over the environmental covenant. An environmental covenant may prohibit or restrict uses of real property which are authorized by zoning or by law other than the act.

Sec. 8. (a) A copy of an environmental covenant shall be provided by the persons and in the manner required by the agency to:

(1) Each person that signed the covenant;

(2) Each person holding a recorded interest in the real property subject to the covenant;

(3) Each person in possession of the real property subject to the covenant;

(4) Each municipality or other unit of local government in which real property subject to the covenant is located; and

(5) Any other person the agency requires.

(b) The validity of a covenant is not affected by failure to provide a copy of the covenant as required under this section.

Sec. 9. (a) An environmental covenant, any amendment or termination of the covenant under section 10 or 11 of this act, and any subordination agreement must be recorded in every county in which any portion of the real property subject to the covenant is located. For purposes of indexing, a holder shall be treated as a grantee.

(b) Except as otherwise provided in subsection (c) of section 10 of this act, an environmental covenant is subject to the laws of this state governing recording and priority of interests in real property.

(c) A copy of a document recorded under subsection (a) of this section shall also be provided to the Department of Environmental Quality if the department has not signed the covenant.

(d) The department shall make available to the public a listing of all documents under subsection (a) of this section or documents under subsection (c) of this section which have been provided to the department.

Sec. 10. (a) An environmental covenant is perpetual unless it is:

(1) By its terms limited to a specific duration or terminated by the occurrence of a specific event;

(2) Terminated by consent pursuant to section 11 of this act;

(3) Terminated pursuant to subsection (b) of this section;

(4) Terminated by foreclosure of an interest that has priority over the environmental covenant; or

(5) Terminated or modified in an eminent domain proceeding, but only

if:

(A) The agency that signed the covenant is a party to the proceeding;

(B) All persons identified in subsections (a) and (b) of section 11 of this act are given notice of the pendency of the proceeding; and

(C) The court determines, after hearing, that the termination or modification will not adversely affect human health or the environment.

(b) If the agency that signed an environmental covenant has determined that the intended benefits of the covenant can no longer be realized, a court, under the doctrine of changed circumstances, in an action

in which all persons identified in subsections (a) and (b) of section 11 of this act have been given notice, may terminate the covenant or reduce its burden on the real property subject to the covenant. The agency's determination or its failure to make a determination upon request is subject to review pursuant to the Administrative Procedure Act.

(c) Except as otherwise provided in subsections (a) and (b) of this section, an environmental covenant may not be extinguished, limited, or impaired through issuance of a tax deed, foreclosure of a tax lien, or application of the doctrine of adverse possession, prescription, abandonment, waiver, lack of enforcement, or acquiescence, or a similar doctrine.

(d) An environmental covenant may not be extinguished, limited, or impaired by application of sections 57-227 to 57-239, 72-301 to 72-314, or 76-288 to 76-298.

Sec. 11. (a) An environmental covenant may be amended or terminated by consent only if the amendment or termination is signed by:

(1) The agency;

(2) Unless waived by the agency, the current owner of the fee simple of the real property subject to the covenant;

(3) Each person that originally signed the covenant, unless the person waived in a signed record the right to consent or a court finds that the person no longer exists or cannot be located or identified with the exercise of reasonable diligence; and

(4) Except as otherwise provided in subdivision (d)(2) of this section, the holder.

(b) If an interest in real property is subject to an environmental covenant, the interest is not affected by an amendment of the covenant unless the current owner of the interest consents to the amendment or has waived in a signed record the right to consent to amendments.

(c) Except for an assignment undertaken pursuant to a governmental reorganization, assignment of an environmental covenant to a new holder is an amendment.

(d) Except as otherwise provided in an environmental covenant:

(1) A holder may not assign its interest without consent of the other parties;

(2) A holder may be removed and replaced by agreement of the other parties specified in subsection (a) of this section; and

(e) A court of competent jurisdiction may fill a vacancy in the position of holder.

Sec. 12. (a) A civil action for injunctive or other equitable relief for violation of an environmental covenant may be maintained by:

(1) A party to the covenant;

(2) The agency;

(3) Any person to whom the covenant expressly grants power to enforce;

(4) A person whose interest in the real property or whose collateral or liability may be affected by the alleged violation of the covenant; or

(5) A municipality or other unit of local government in which the real property subject to the covenant is located.

(b) The Uniform Environmental Covenants Act does not limit the regulatory authority of the agency under law other than the Uniform Environmental Covenants Act with respect to an environmental response project.

(c) A person is not responsible for or subject to liability for environmental remediation solely because it has the right to enforce an environmental covenant.

(d) The Uniform Environmental Covenants Act does not limit the right of any person to recover damages under any other provision of law.

Sec. 13. In applying and construing the Uniform Environmental Covenants Act, consideration must be given to the need to promote uniformity of the law with respect to its subject matter among states that enact it.

Sec. 14. The Uniform Environmental Covenants Act modifies, limits, or supersedes the federal Electronic Signatures in Global and National Commerce Act, 15 U.S.C. 7001 et seq., but does not modify, limit, or supersede section 101 of that act, 15 U.S.C. 7001(a), or authorize electronic delivery of any of the notices described in section 103 of that act, 15 U.S.C. 7003(b).

Sec. 15. Section 76-288, Reissue Revised Statutes of Nebraska, is amended to read:

76-288. Any person having the legal capacity to own real estate in this state, who has an unbroken chain of title to any interest in real estate by ~~himself~~ such person and his or her immediate or remote grantors under a deed of conveyance which has been recorded for a period of twenty-two years or longer, and is in possession of such real estate, shall be deemed to have a marketable record title to such interest, subject only to such claims thereto

and defects of title as are not extinguished or barred by the application of the ~~provisions of~~ Uniform Environmental Covenants Act and sections 25-207, 25-213, 40-104, and 76-288 to 76-298, instruments which have been recorded less than twenty-two years, and any encumbrances of record not barred by the statute of limitations.

Sec. 16. Sections 1 and 18 of this act become operative on January 1, 2005. Sections 2 to 15 and 19 of this act become operative three calendar months after adjournment of this legislative session. The other sections of this act become operative on their effective date.

Sec. 17. If any section in this act or any part of any section is declared invalid or unconstitutional, the declaration shall not affect the validity or constitutionality of the remaining portions.

Sec. 18. Original section 66-1510, Revised Statutes Supplement, 2004, is repealed.

Sec. 19. Original section 76-288, Reissue Revised Statutes of Nebraska, is repealed.

Sec. 20. Since an emergency exists, this act takes effect when passed and approved according to law.

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ATTACHMENT 3-1
REMEDIAL ACTION REPORT CHECKLIST

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Nebraska Department of Environmental Quality

Remedial Action Report Checklist

This checklist should be used when preparing a Remedial Action Report (RAR), which is the applicant's final product of the voluntary cleanup process. This checklist serves two purposes: First, it helps the applicant to develop an appropriate RAR, both in terms of content and format. Second, it supports NDEQ's review of the RAR after the report is received. This checklist is not an all-inclusive list of the information that may be necessary to develop an appropriate RAR. This list is intended as an aid to assist in developing the RAR. NDEQ may request additional data, and some categories of data may not be applicable to every RAR.

Please specify in the boxes opposite each item whether the required information is present (Y), absent (N), or not applicable (NA) and indicate the page number within the RAR where the information is included. Specific information for elements in the RAR are included. Additional general information for the document, including specific formats for tables and figures, are listed at the end of the checklist. Acronyms used throughout the checklist are also included at the end of the checklist.

Applicant Name _____

Site or Property Name _____

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
3.1 EXECUTIVE SUMMARY		
➤ Summary of the RAOs at the site		
➤ Explanation of how and why the RAOs have been met		
➤ Remedial activities completed		
➤ Deviations from the remedial activities described in the RAP		
➤ Future land use at the site and any institutional controls		
➤ Any on-going monitoring at the site		
3.2 SITE SETTING, HISTORY, AND OPERATIONS		
➤ Property name and identification		
• Facility name		
• Street address		
➤ Owner and contractor information		
• Applicant, owner, or designated point of contact, with contact information		
• Contractors or consultants to the applicant or owner, with contact information		
➤ Location and physical setting		
• Location map based on a USGS 7.5-minute quadrangle, with a reference to the quadrangle name and date		
• Brief description of the physical setting, including topography, geology, hydrogeology, and climate		
➤ Operational history		
• Summary of previous ownership, business operations, and dates that the site was active		
• Summary of historical environmental incidents, spills, or releases of hazardous constituents		
➤ Findings of the investigation as reported in the Remedial Action Plan		
• Description of the horizontal and vertical extent of contamination before remedial activities		
• Potential receptors identified		
• Remedial action proposed in the Remedial Action Work Plan portion of the RAP		
➤ Summary of the site's VCP history		
• Date that the application was submitted and date approved		
• Date that the RAP was submitted and date approved		
• Date that remedial activities began		
• Date that remedial activities were completed		
• Dates of any other significant events in the remedial action		
3.3 REMEDIAL ACTION OBJECTIVES		
➤ Statement and explanation of RAOs for the site		
3.4 OVERVIEW OF REMEDIAL ACTIONS		
➤ Table showing chronology of events and remedial actions taken at the site		
➤ Description of soil excavation and removal actions		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
<ul style="list-style-type: none"> • Extent and depth of soil excavated 		
<ul style="list-style-type: none"> • Total volume of soil excavated and removed 		
➤ Description of in situ treatment of soil		
<ul style="list-style-type: none"> • Volumes of treatment chemicals used, materials discharged, and contaminants removed 		
<ul style="list-style-type: none"> • Total volume of soil treated 		
➤ Figure showing areas of excavated soil, treatment points, and/or radius of influence of treatment systems		
➤ Description of active groundwater remediation, including		
<ul style="list-style-type: none"> • Maps of cross-sections showing treatment points or radius of influence of the treatment system 		
<ul style="list-style-type: none"> • Volumes of treatment chemicals used, water discharged, and contaminants removed 		
<ul style="list-style-type: none"> • Total volume of groundwater treated 		
➤ Estimated volumes of contaminants degraded or removed by passive groundwater remediation (e.g., monitored natural attenuation)		
➤ Description of other traditional or innovative remedial technology used at the site		
<ul style="list-style-type: none"> • Total volume of water or soil diverted, treated, and/or disposed 		
<ul style="list-style-type: none"> • Total volume of contaminants removed 		
<ul style="list-style-type: none"> • Maps and cross sections showing locations of excavation, treatment, monitoring, and/or sampling points 		
➤ Description of handling and disposal of RDW, including		
<ul style="list-style-type: none"> • Volume of RDW generated 		
<ul style="list-style-type: none"> • Methods used to characterize RDW 		
<ul style="list-style-type: none"> • Procedures to control or contain RDW onsite 		
<ul style="list-style-type: none"> • Methods of transporting, treating, and disposing of RDW 		
➤ Photographic logs of remedial activities		
➤ Copies of relevant property deeds or other documentation of institutional controls implemented		
3.5 COMPLIANCE WITH REMEDIAL ACTION OBJECTIVES		
➤ Narrative explanation of why analytical results show that the RAOs have been achieved		
➤ Figures and maps showing:		
<ul style="list-style-type: none"> • Sample locations 		
<ul style="list-style-type: none"> • Sample depths 		
➤ Tables summarizing:		
<ul style="list-style-type: none"> • Sample collection methods 		
<ul style="list-style-type: none"> • Sample collection dates 		
➤ Description and illustration of post-remedial action conditions		
<ul style="list-style-type: none"> • Table summarizing maximum concentrations of contaminants at the site after remedial activities 		
<ul style="list-style-type: none"> • Potentiometric surface maps 		
<ul style="list-style-type: none"> • Isoconcentration maps and cross sections of the contaminant plume(s) at the site after remedial actions 		

ELEMENT-SPECIFIC INFORMATION

INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
• Free-product isopach maps at the site after remedial actions		
➤ Reference to soil boring and monitoring well construction logs		
➤ Table containing results of field screening		
➤ Summary of analytical results and reference to laboratory reports for soil and groundwater sampling		
• Chemicals of concern identified		
• Maximum concentration of contamination		
• Background concentrations of chemicals of concern		
• Target compounds		
• Concentrations of compounds detected		
➤ Summary of QA/QC results and reference to attached lab reports		
➤ Reference to table of data validation qualifiers		
➤ Updated Conceptual Site Model (CSM)		
• Description of the updated CSM		
• Description of intended land use		
▪ Location and use of buildings		
▪ Location and depth of below-grade structures or basements		
▪ Description of any potential sensitive populations		
• Location of any remaining contaminants and illustration or description of methods used to contain contamination		
• The impacts that moving of waste may have on human health and the environment		
• Explanation of why/how all exposure or migration pathways at the site have been eliminated		
➤ Reference to previously submitted startup reports and/or monitoring reports		
➤ Other information as appropriate for the implemented remedies to verify that RAOs have been achieved		
3.6 DEVIATIONS FROM THE RAP		
➤ Description and rationale for any changes to the proposed remedial action as described in the RAP		
➤ Attached copies of any correspondence between NDEQ and the applicant concerning changes to the remedial approach		
➤ If no deviations were necessary, state so		
3.7 DEVIATIONS IN PERFORMANCE MONITORING		
➤ Explanation of changes to the monitoring strategy as outlined in the RAP (if necessary)		
• New or modified monitoring objectives		
• New or modified methods		
• Maps showing new or modified monitoring locations		
• Cross sections/diagrams showing new or modified subsurface monitoring and sampling intervals		
• Description of new or modified monitoring schedule		
• Description and tables of new or modified monitoring parameters		
➤ If no deviations were necessary, state so		

ELEMENT-SPECIFIC INFORMATION

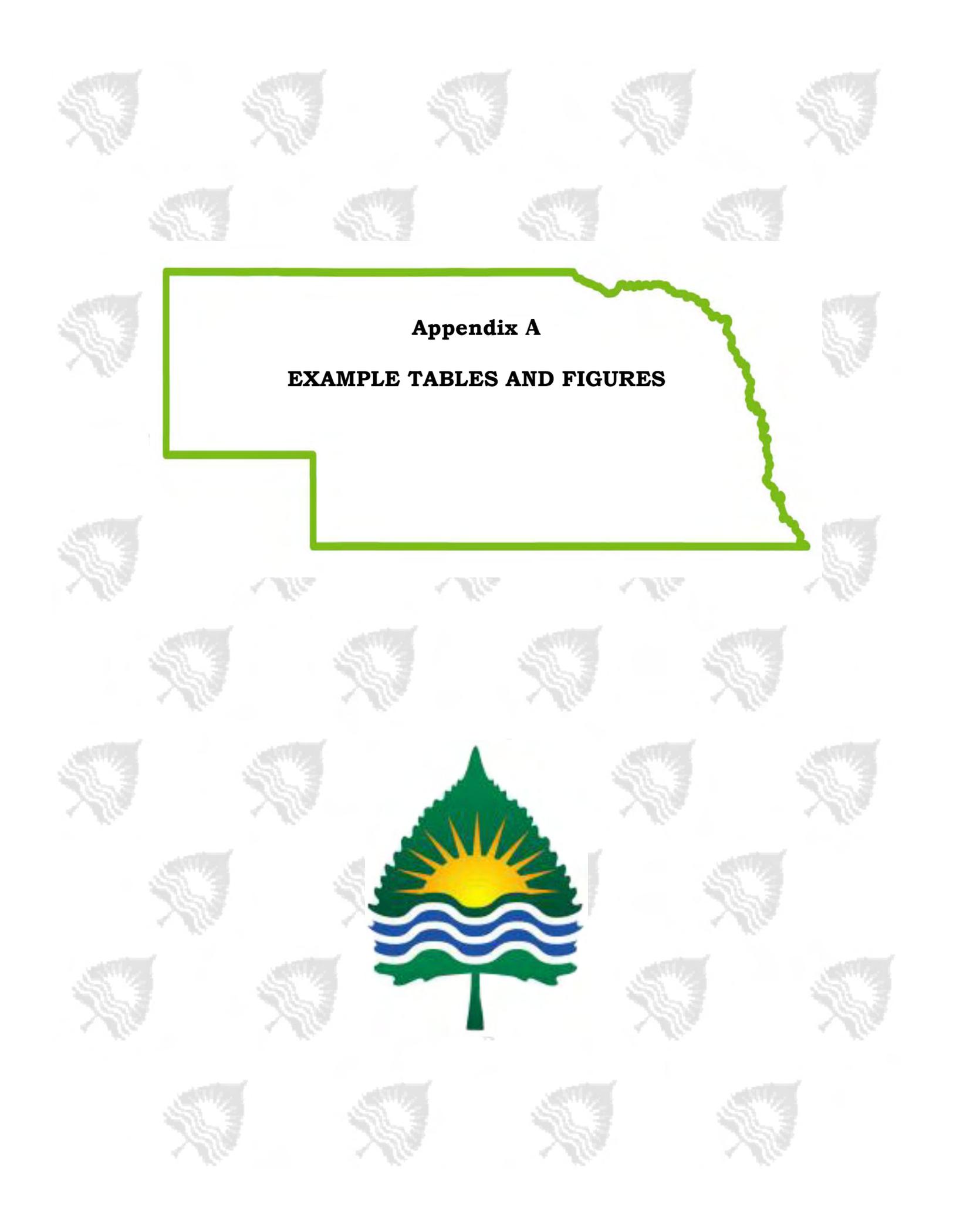
INFORMATION	Y/N/NA	DOCUMENT PAGE NUMBER
3.8 APPENDICES		
➤ As-built diagrams		
• Subsurface structures – tunnels, parking garages, basements, etc.		
• Remedial systems – blowers, piping, utilities, towers		
• Green space, recreational space – picnic areas, gazebos		
• Buildings, surface parking lots		
• Sensitive use areas – Day care, schools, nursing homes		
➤ Maps of site features		
• Ponds		
• Parking lots		
• Buildings		
• Subsurface structures (e.g. parking garages, basements, tunnels)		
• Green space		
➤ Copies of legal documents required for institutional controls		
➤ Other information to verify that RAOs have been met		
• Soil boring and monitoring well construction logs		
• Complete results of field screening		
• Analytical reports for soil gas, groundwater, or soil samples, including quality assurance/quality control results		
• Data validation and usability summary		
• Copies of log books, field sheets, chain-of-custody forms, or other relevant supporting documentation.		

ADDITIONAL REQUIREMENTS

REQUIREMENTS	Y/N/NA
➤ Tables	
• Tables are numbered and titled	
• All abbreviations used in the table or table title are spelled out in table footnotes	
➤ Figures	
• Horizontal and vertical scales on cross-sections	
• Horizontal scale on maps	
• Orientation labels (i.e., north arrow) on maps	
• Date, title, and source of base map	
• Cross-section control points shown on an associated map, with reference to map on cross-section	
• Isoconcentration or potentiometric surface maps compiled from a single sampling event and labeled with the appropriate date	
• All features on maps clearly labeled	
• Site boundaries clearly labeled	
• Photographs scanned and printed at high resolution (300 dpi scanned, 600 dpi printed), preferably in color, including aerial photographs	
OTHER	
➤ Four complete copies of the document submitted to NDEQ, at least one copy in full color	
➤ All pages numbered, including figures, tables, and appendices	
➤ Chemicals identified by consistent names throughout document	
➤ Explanations of inconsistent chemical names in laboratory reports or previous investigations	
➤ All abbreviations spelled out for first use or included in list of abbreviations	

ABBREVIATIONS

CSM	= Conceptual site model
dpi	= dots per inch
N	= Absent/not included
NA	= Not applicable
NDEQ	= Nebraska Department of Environmental Quality
QA/QC	= Quality assurance/quality control
RAO	= Remedial action objective
RAP	= Remedial Action Plan
RAPMA	= Remedial Action Plan Monitoring Act
RAR	= Remedial Action Report
RDW	= Remediation derived waste
USGS	= U.S. Geological Survey
VCP	= Voluntary Cleanup Program
Y	= Present/included



Appendix A
EXAMPLE TABLES AND FIGURES



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Table 1 – Compounds Detected in Groundwater Samples Compared to Screening Levels.

Compound	Maximum Concentration Reported in Previous Investigations (µg/L)	Maximum Concentration in January 2004 (µg/L)	MCL (µg/L)
Volatile Organic Compounds			
Benzene	120	10 J	5
Chlorobenzene	40	12 J	100
1,2-Dichloroethane	45	ND	5
1,1-Dichloroethene	38	ND	7
1,2-Dichloroethene (total)	6,400	860	100
Ethylbenzene	1,600	ND	700
Tetrachloroethene	300	79	5
Toluene	120	ND	1,000
1,1,1-Trichloroethane	260	ND	200
Trichloroethene	260	50	5
Vinyl chloride	2,500	1,400	2
Xylene (total)	5,700	ND	10,000
Semivolatile Organic Compounds			
<i>bis</i> (2-Ethylhexyl)phthalate	42	3 J	6
1,2-Dichlorobenzene	37	ND	600
2-Methylnaphthalene	27	ND	none
Naphthalene	16	ND	none
Pesticides			
Heptachlor epoxide	0.79	NA	0.2
Toxaphene	12	NA	3
Herbicides			
Atrazine	3.1	NA	3
Dichlorophenoxyacetic acid (2,4-D)	NR	NA	70
2,4,5-Trichlorophenoxypropionic acid (2,4,5-TP) (Silvex)	88	NA	50

Notes:

This table is derived from Consulting Geologist (2000a) and EPA (2004). Concentrations in bold exceed the EPA MCL.

EPA = U.S. Environmental Protection Agency

J = estimated

MCL = EPA maximum contaminant level (EPA 2002a)

µg/L = micrograms per liter

NA = not analyzed

ND = not detected

NR = not reported

Table 1 – Well and Piezometer Construction Details

Well Designation	Well Type	Sampling/ Measurement Frequency	Depth To Top Of Screen (ft.)	Depth To Bottom Of Screen (ft.)	Sump Length (ft.)	Depth To Water (ft.)	Depth To Bottom (ft.)	Installation Date
MCA-Da	Monitor	Annually	72.8	75.3	2.0	26.54	77.3	7/88
MCA-S	Monitor	Not sampled	12.4	22.4	2.0		24.4	7/88
MCB-Da	Monitor	Annually	78.8	81.3	1.5	28.33	82.8	6/89
MCB-M	Monitor	Annually	38.8	41.3	1.5	27.11	42.8	6/89
MCB-S	Monitor	Not sampled	20.1	30.1	1.5		31.6	6/89
MCC-D	Monitor	Not sampled	37.9	40.4	1.5		41.9	6/89
MCC-Da	Monitor	Not sampled	76.9	79.4	1.5		80.9	6/89
MCC-S	Monitor	Not sampled	19.7	29.7	1.5		31.2	6/89
MCD-Da	Monitor	Annually	78.3	80.8	1.5	27.33	82.3	6/89
MCD-M	Monitor	Quarterly	38.8	41.3	1.5	27.93	42.8	6/89
MCD-S	Monitor	Quarterly	19.6	29.6	1.5	28.18	31.1	6/89
MCE-M	Monitor	Not sampled	40.0	42.5	1.5 – 2.5		44.0 – 45.0	12/89
MCE-S	Monitor	Not sampled	15.0	25.0	1.5 – 2.5		26.5 – 27.5	11/89
MCF-M	Monitor	Not sampled	27.5	30.0	1.5 - 2.5		31.5 – 32.5	11/89
MCF-S	Monitor	Not sampled	12.5	22.5	2.5		25.0	11/89
MCG-M*	Monitor	Not sampled	32.5	35.0	1.5 – 2.5	28.91	36.5 – 37.5	12/89
MCI-M*	Monitor	Not sampled	35.1	37.6	1.5 – 2.5	25.44	39.1 – 40.1	12/89
MCI-S	Monitor	Not sampled	12.6	22.6	2.5		25.1	12/89
MW-1M	Monitor	Quarterly	39.6	49.6	2.5	24.10	52.1	9/94
MW-2	Monitor	Not sampled	14.9	24.9	2.0		26.9	7/88
MW-3	Monitor	Not sampled	16.4	26.4	2.5		28.9	11/89
MW-4	Monitor	Not sampled	26.0	28.5	1.5		30.0	7/90
MW-5	Monitor	Not sampled	32.5	35.0	1.5		36.5	7/90
MW-5D	Monitor	Quarterly	51.7	54.2	2.5	27.93	59.7	9/94
MW-5Da	Monitor	Not sampled	61.4	63.9	2.5		66.4	12/96
MW-5Db	Monitor	Quarterly	78.8	81.3	2.5	28.32	83.8	1997 - 1998
MW-6	Monitor	Not sampled	27.0	29.5	1.5		31.0	7/90
MW-6D	Monitor	Annually	46.5	51.5	0.0	27.32	51.5	1999
MW-7	Monitor	Not sampled	26.0	28.5	1.5		30.3	7/90
MW-8	Monitor	Quarterly	19.9	34.9	0.0	26.56	34.9	1/95
MW-10	Monitor	Quarterly	14.2	29.2	0.0	28.24	29.2	1/95
MW-11D	Monitor	Quarterly	40.3	45.3	2.0	28.04	47.3	4/95
MW-11M	Monitor	Quarterly	30.0	35.0	2.0	28.22	37.0	4/95
MW-12D	Monitor	Annually	42.8	47.8	2.2	28.28	50.0	1/95
MW-12M	Monitor	Not sampled	30.5	35.5	2.0		37.5	1/95
MW-13Da	Monitor	Annually	47.3	52.3	0.0	27.15	52.3	1999
MW-14Da	Monitor	Annually	49.3	54.3	0.0	28.00	54.3	1999
OB-1	Piezometer	Quarterly	26.5	29.0	1.5	25.55	30.5	7/90
PI-D	Piezometer	Quarterly	52.5	55.0	0.0	27.27	55.0	1/90
PI-M	Piezometer	Quarterly	39.3	41.8	0.0	26.25	41.8	2/90
RW-1	Recovery	Not sampled	38.8	58.8	0.0		58.8	1/90
RW-2	Recovery	Not sampled	40.2	60.2	0.0		60.2	1/90
RW-3	Recovery	Not sampled	28.7	59.7	0.0		59.7	4/96

Notes:

* Although these wells are not sampled regularly, water levels were measured during the March 2002 sampling event. Depth to water measured in March 2002 sampling event. Depth was measured from the top of the well casing.

**Table 1 – Maximum Concentrations of Constituents in Groundwater
Collected from Facility Monitoring Wells**

Chemical of Concern	Relevant Standard or Criteria (µg/L)	Maximum Concentration Detected (µg/L)	Location of Maximum Concentration	Sampling Date	Other Wells above MCL or PRG (2002-2003)
Cadmium	MCL, 5	15	MW-2	Feb-97	
Chloroethane	PRG, 4.6	16.7	MW-17M	Apr-03	
1,2-Dichloroethane	MCL, 5	15.6	MW-20M	Sep-02	MW-18M
1,1-Dichloroethene	MCL, 7	486	MW-20M	Sep-02	MW-8, MW-15M, MW-16, MW-16M, MW-17, MW-17M, MW-18, MW-18M
Lead	Action Level, 15	130	MW-5	Jan-92	
Methylene chloride	MCL, 5	34	MW-16	Sep-02	MW-15M
Nitrate	MCL, 10,000	75,000	MW-2	Feb-95	
Styrene	MCL, 100	5.1	MW-15M	Jan-03	
Tetrachloroethene	MCL, 5	186	MW-8	Jul-03	MW-15M, MW-16M, MW-17M, MW-18M, MW-20M
Toluene	MCL, 1,000	657	MW-16	Apr-03	
1,1,1-Trichloroethane	MCL, 200	328	MW-8	Jul-03	MW-15M
1,1,2-Trichloroethane	MCL, 5	11.9	MW-15M	Jan-03	MW-16
Trichloroethene	MCL, 5	44.6	MW-8	Jul-03	MW-15M, MW-20M
1,2,4-Trimethylbenzene	PRG, 12	96.6	MW-15M	Jan-03	MW-8, MW-16, MW-20M
1,3,5-Trimethylbenzene	PRG, 12	28.6	MW-15M	Jan-03	MW-16
Vinyl chloride	MCL, 2	8.44	MW-15M	Apr-03	MW-17M, MW-18M, MW-20M
Xylene, Total	MCL, 10,000	264	MW-15M	Jan-03	

Notes:

Data provided by NDEQ (1998) and Consulting Geologist (2003b).
Concentrations in bold type exceed the EPA MCL or PRG for drinking water.
EPA U.S. Environmental Protection Agency
MCL EPA maximum contaminant level (EPA 2002a)
µg/L Micrograms per liter
NDEQ Nebraska Department of Environmental Quality
PRG EPA Region 9 preliminary remediation goal (EPA 2002b)

Table 1 – Subsurface Soil VOC Detections – Monitoring Well Installation, August 2002

Boring or Monitoring Well	Maximum Concentration (mg/kg)	Depth (ft bgs)
B-2	2.9	48
B-3	1.3	46
MW-15	1,551	6
MW-15M	355	23
MW-16	3.2	13
MW-16M	153	16
MW-17M	347	23
MW-18	1.4	6
MW-18M	41.4	37
MW-20M	9.0	53

Notes:

VOC Volatile organic compounds
 ft bgs Feet below ground surface

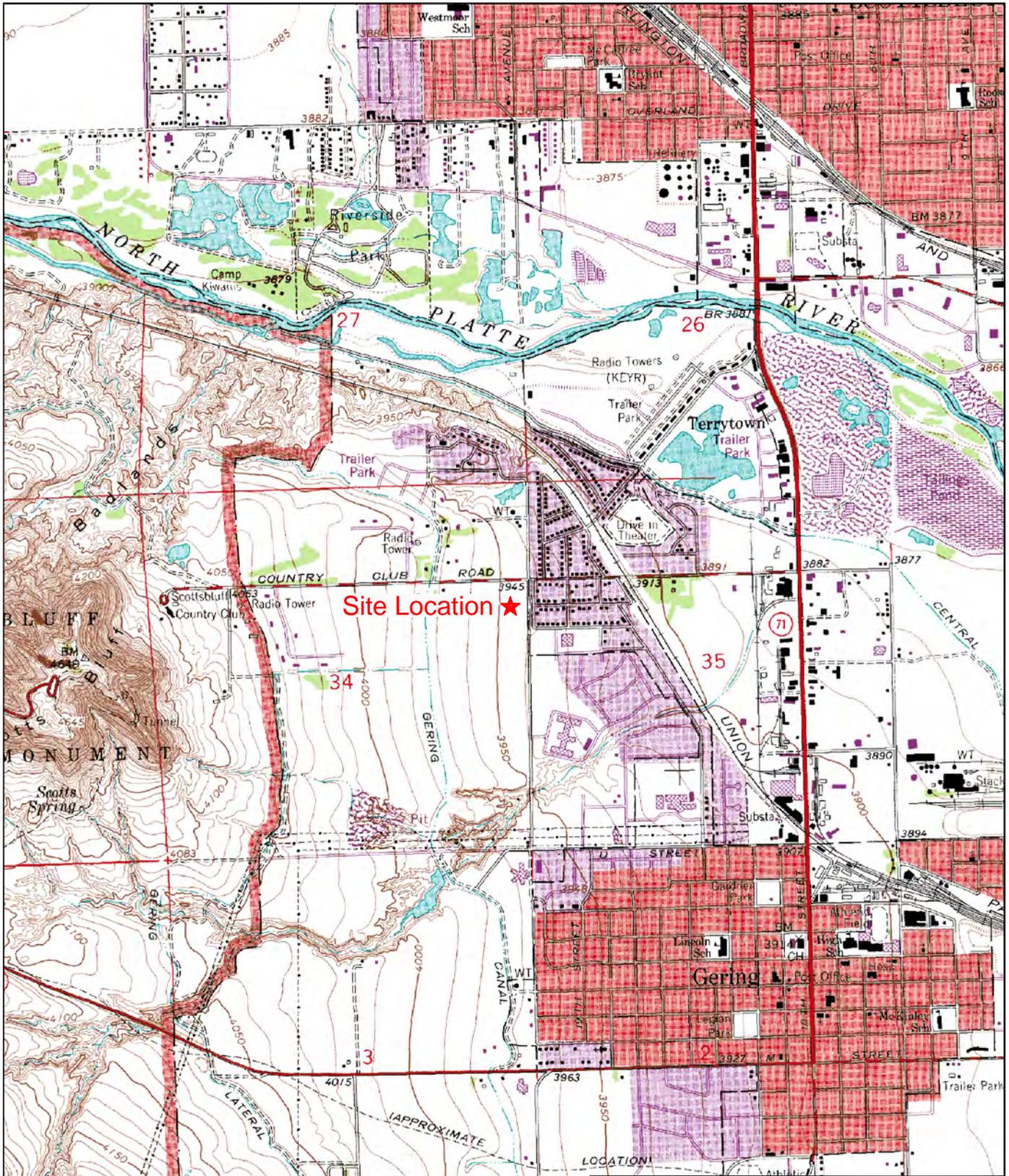
Table 1 – Constituents Detected in Subsurface Soil

Metal	Concentration (mg/kg)	Sample Number	Depth (ft bgs)
Antimony	51.6	B-3	2.5 - 4.33
Arsenic	704.3	B-3	2.5 - 4.33
Arsenic	15.4	B-2	5.5 - 7.5
Arsenic	14	B-2	7.5 - 9.5
Arsenic	<i>11.7</i>	B-3	0.5 - 2.5
Cadmium	10.3	B-3	2.5 - 4.33
Copper	431	B-3	2.5 - 4.33
Lead	9,630	B-3	2.5 - 4.33
Lead	6,919	B-2	2.5 - 4.33
Lead	590	B-2	5.5 - 7.5
Lead	1,633	B-3	5.0 - 7.0
Zinc	240	B-3	2.5 - 4.33

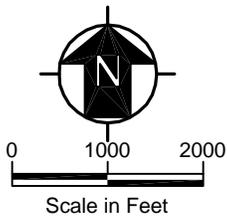
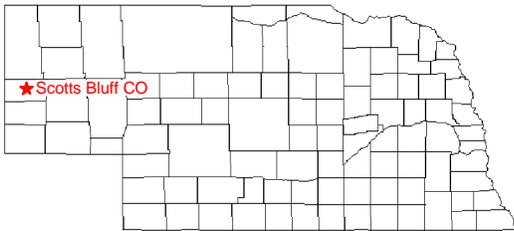
Notes:

Concentrations in bold exceed industrial soil target concentrations. Concentrations in italics exceed residential soil target concentrations.

ft bgs = feet below ground surface
 mg/kg = milligrams per kilogram



Site Location ★

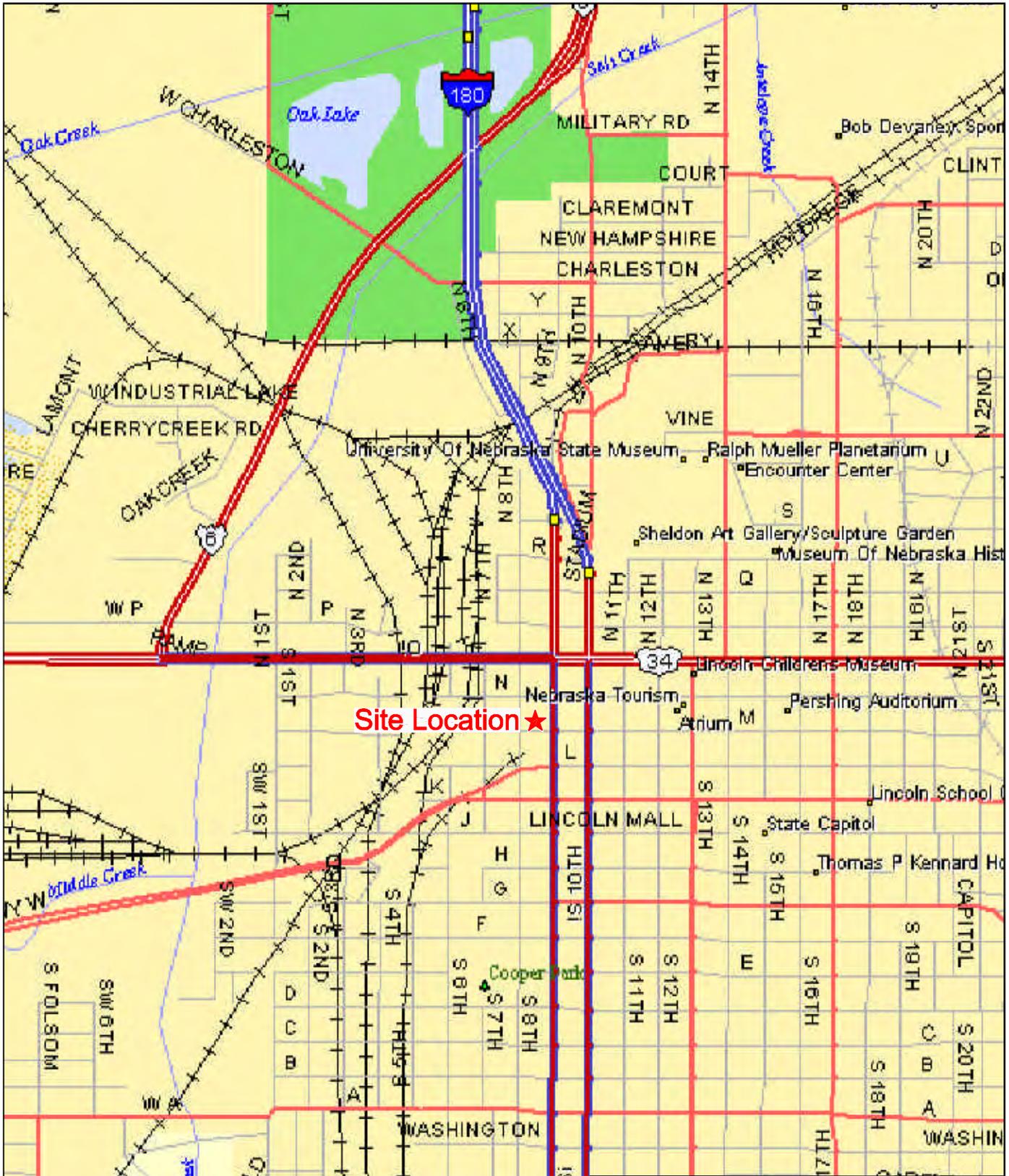


Facility Name
Address
City, State Zip Code

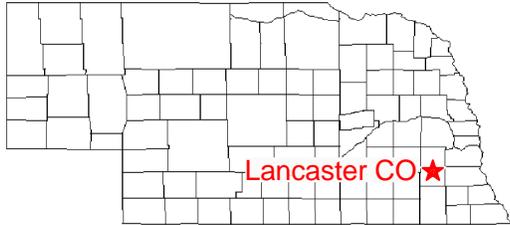
Figure #
Site Topographic Map

ABC Company, Inc.

File Path
Source: USGS Scottsbluff N, NE 7.5 Minute Topo Quad, 1963, PR 1976
USGS Scottsbluff S, NE 7.5 Minute Topo Quad, 1963, PR 1976



Site Location ★

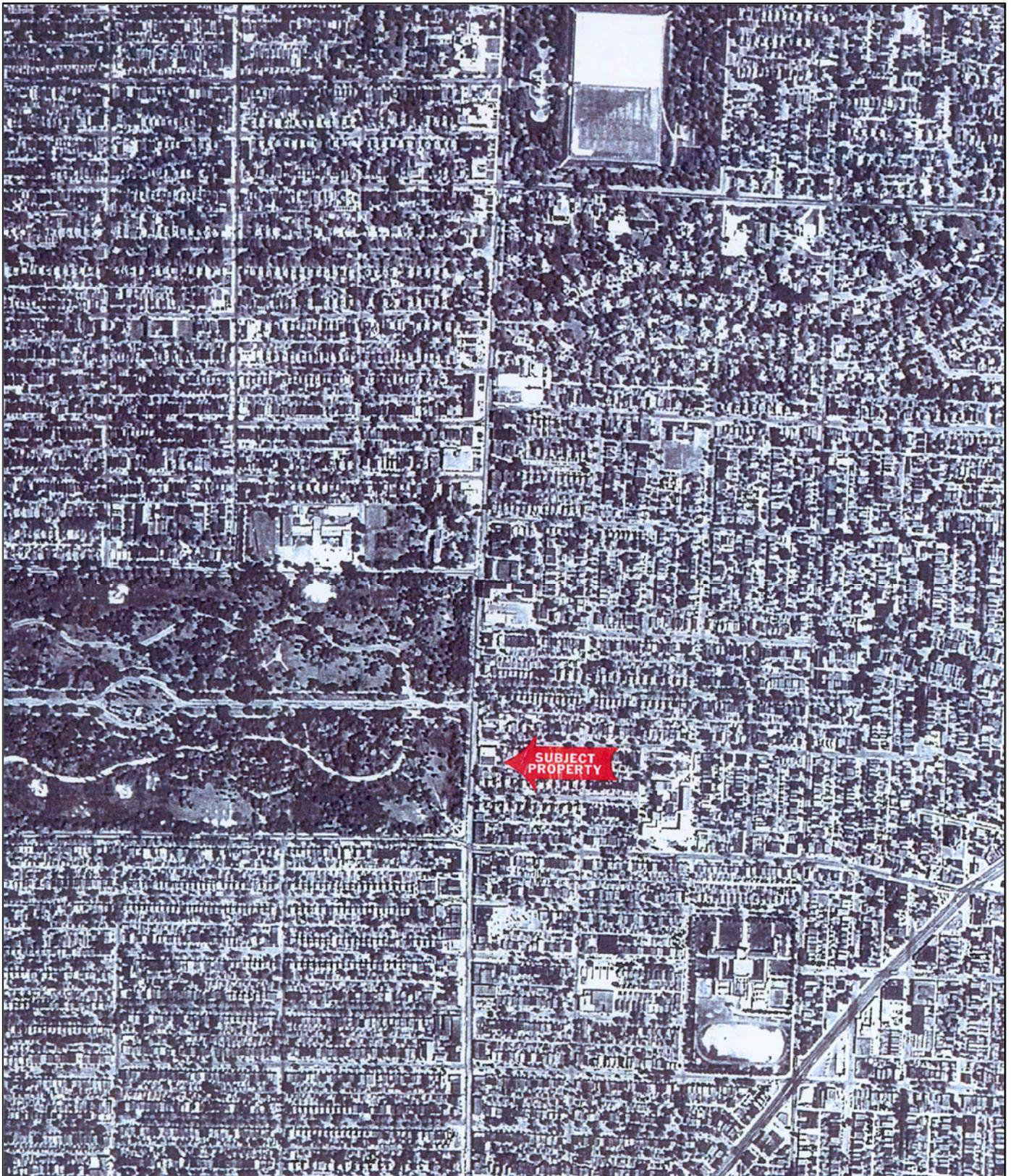


Not to Scale

Facility Name
Address
City, State Zip Code

Figure #
Site Location Map

 **ABC Company, Inc.**



Not to Scale

Facility Name
Address
City, State Zip Code

Figure #
Historical Aerial Photo



ABC Company, Inc.

File Path

Source: E Data Resources, Aerial Photo, 1958

Date: XXX/XX/XX

Drawn By: Your Name

Project No: #####



Not to Scale

Facility Name
Address
City, State Zip Code

Figure #
Most Recent Aerial Photo



ABC Company, Inc.

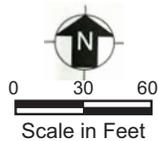
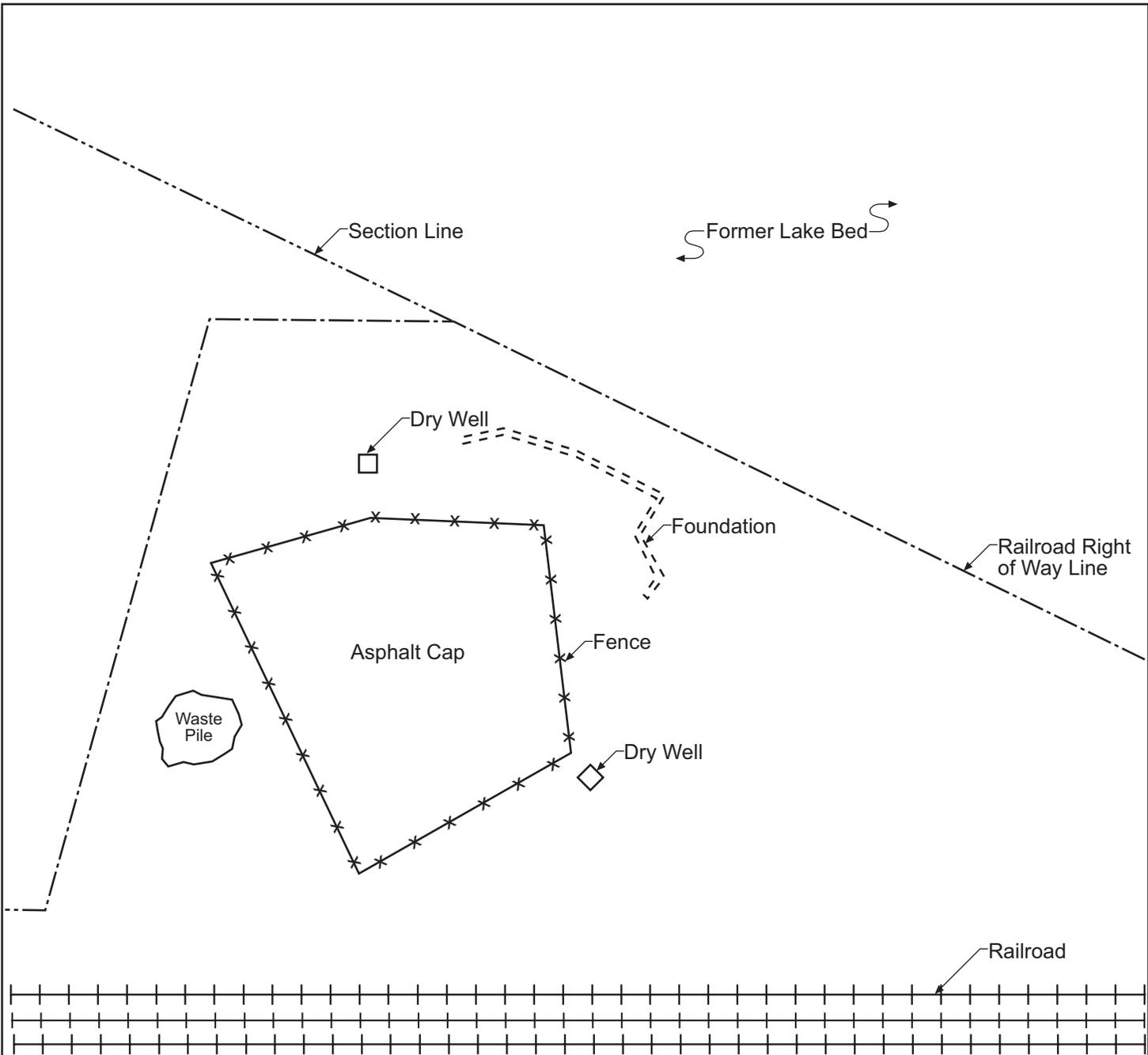
File Path

Source: E Data Resources, Aerial Photo, 1994

Date: XX/XX/XX

Drawn By: Your Name

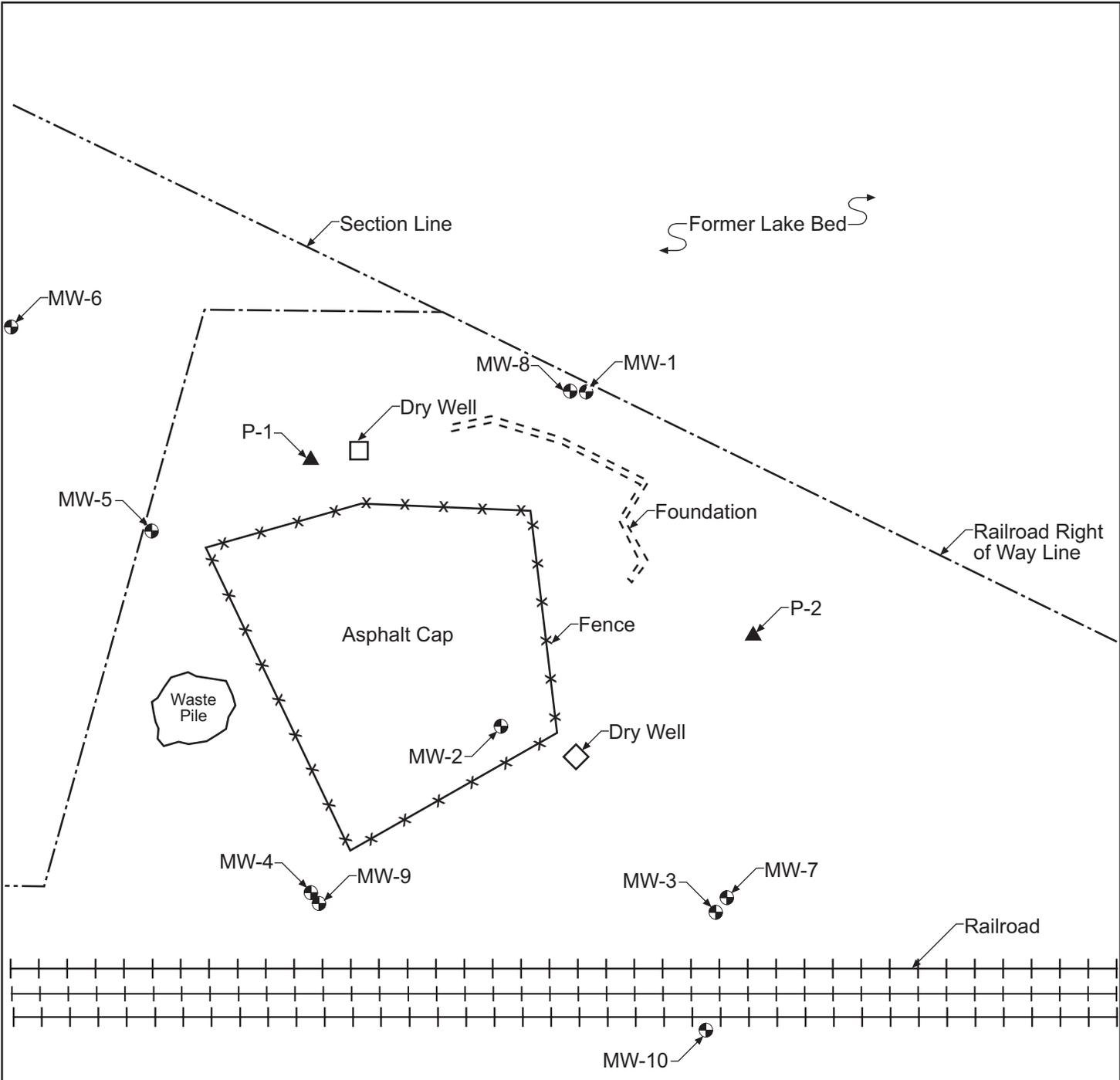
Project No: #####



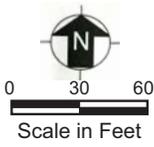
Facility Name Address City, State Zip Code
Figure # Site Layout Map
 ABC Company, Inc.
<small>Date: XXXXXX Drawn By: Your Name Project No: #####</small>

File Path

Base Map Source: Modified from XYZ Company, 2001



- Legend
- Monitoring well location
 - ▲ Piezometer location

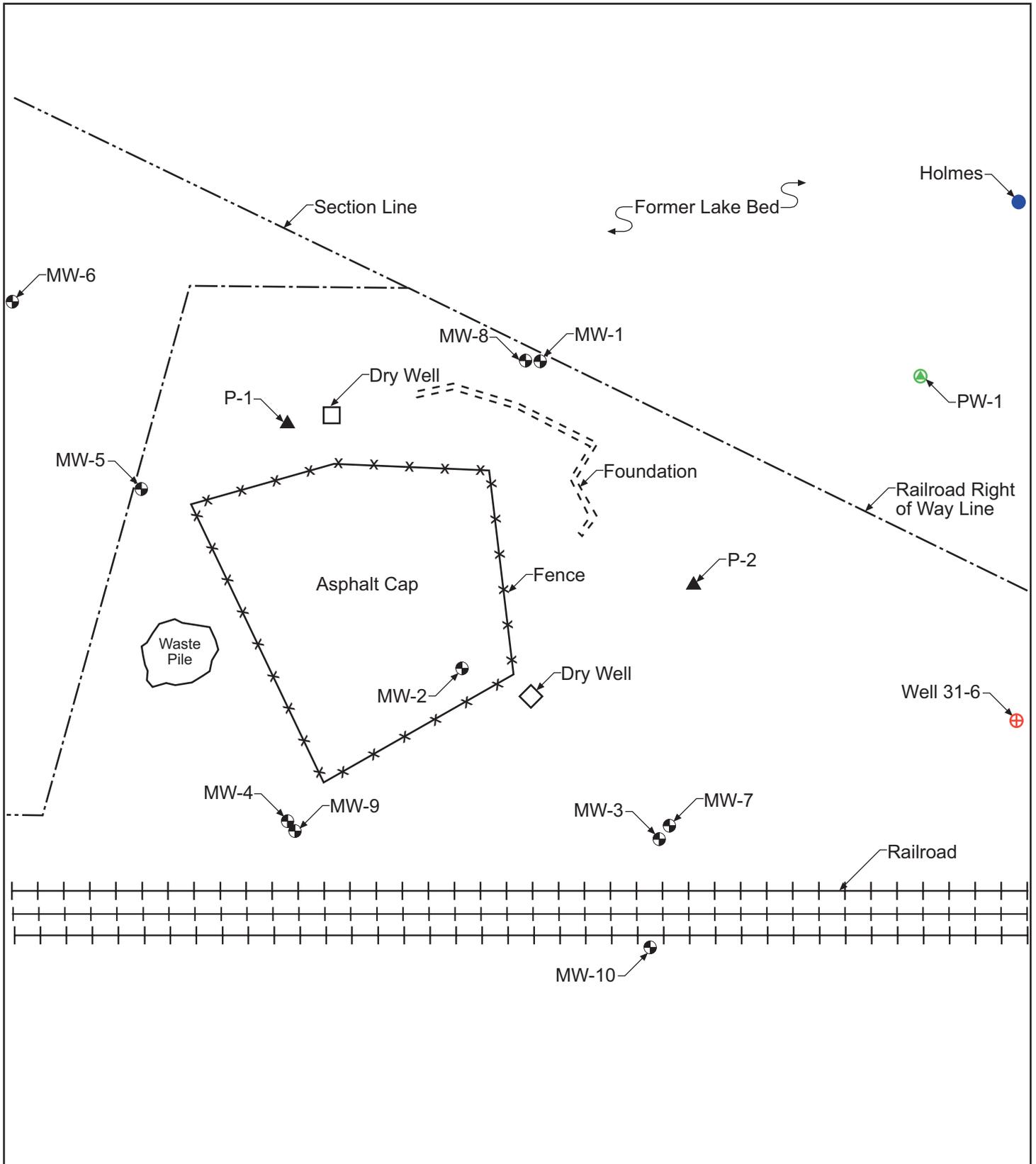


Facility Name
 Address
 City, State Zip Code

Figure #
 Monitoring Well Locations

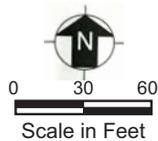
 **ABC Company, Inc.**

File Path



Legend

- Monitoring well location
- ▲ Piezometer location
- ⊕ Municipal well location
- Production well location
- Private residential well location



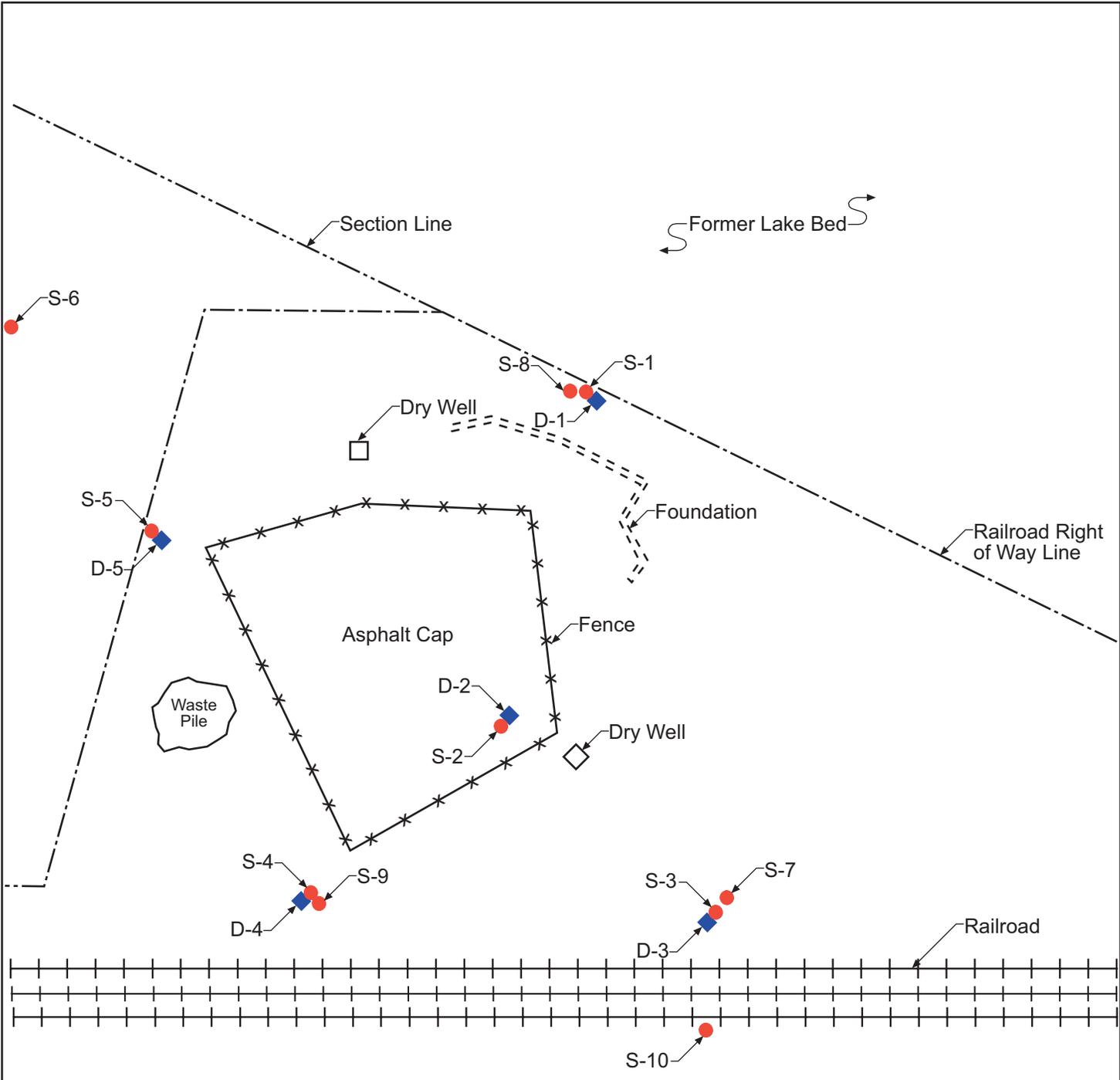
Facility Name
 Address
 City, State Zip Code

Figure #
 Well Location Map

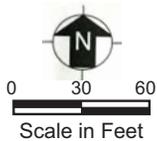
ABC Company, Inc.

Date: XXXXXX Drawn By: Your Name Project No: #####

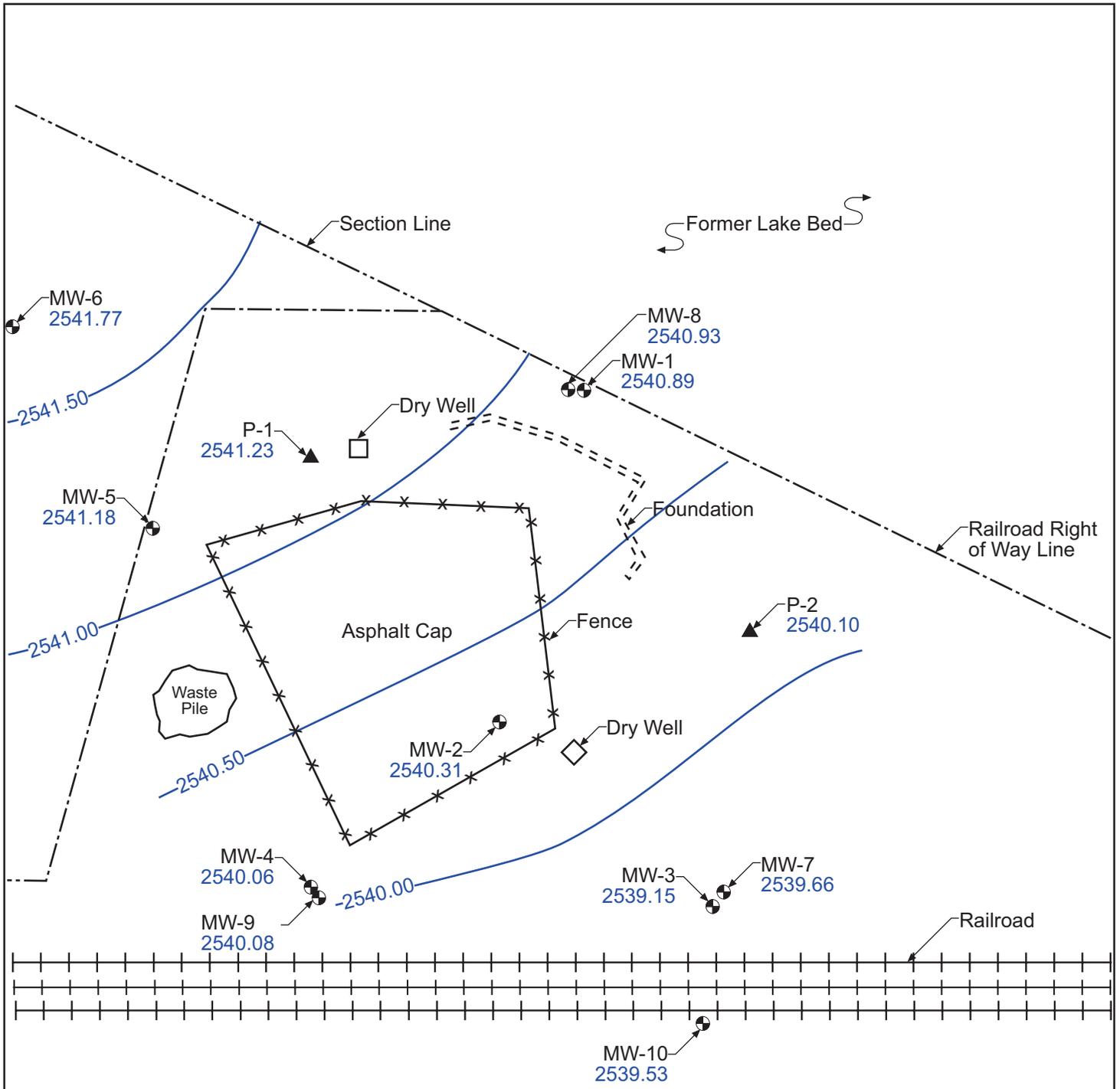
File Path: Base Map Source: Modified from XYZ Company, 2001



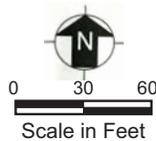
- Legend**
- Shallow soil sample location
 - ◆ Deep soil sample location



Facility Name Address City, State Zip Code
Figure # Soil Sampling Locations
 ABC Company, Inc.
<small>Date: XXXXXX Drawn By: Your Name Project No: #####</small>



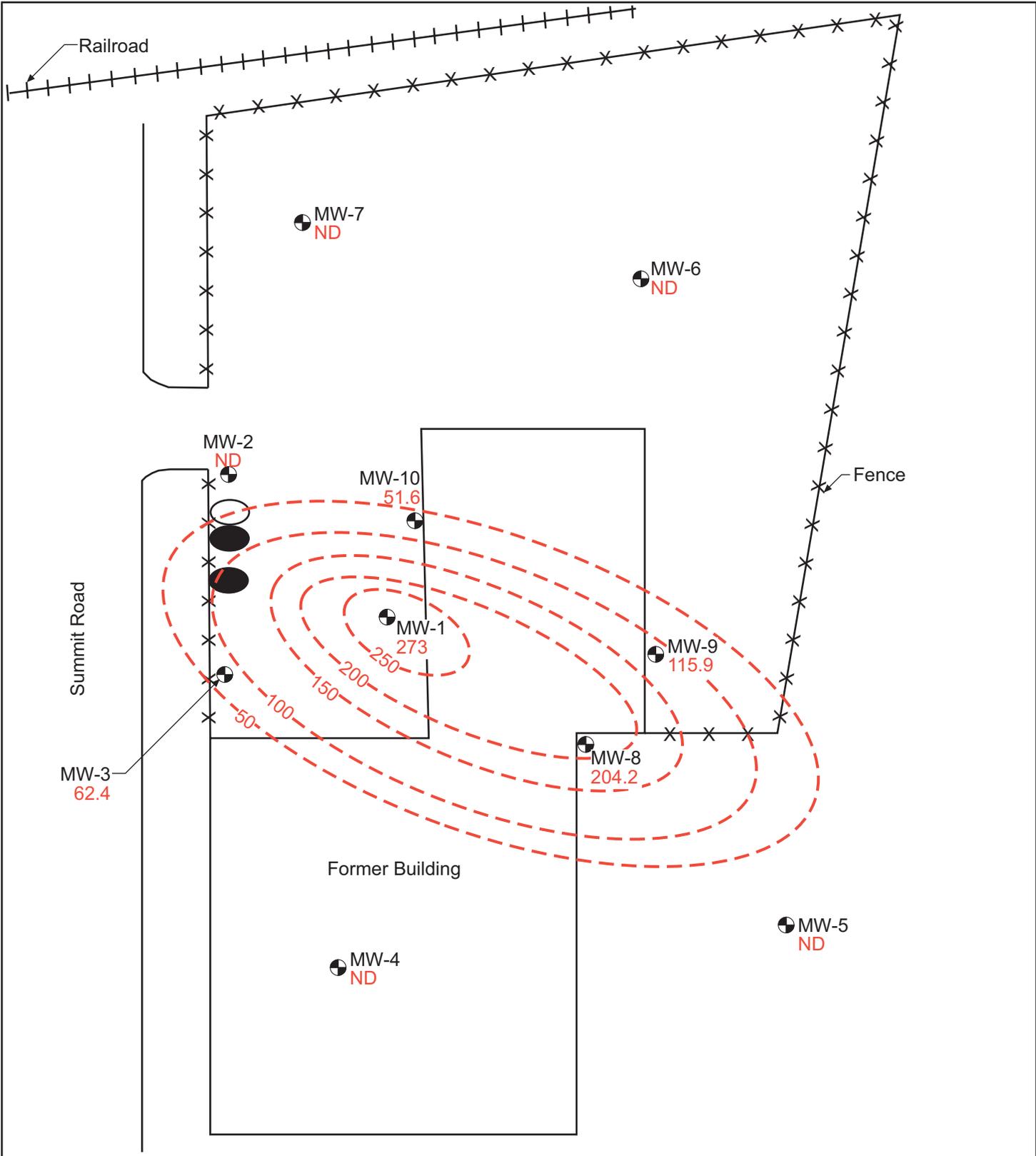
- Legend**
- Monitoring well location
 - Piezometer location
 - Approximate potentiometric surface contour
 - 2540.50 Groundwater elevation(feet above mean sea level)



Facility Name Address City, State Zip Code
Figure # Groundwater Potentiometric Map
ABC Company, Inc.
Date: XXXXXX Drawn By: Your Name Project No: #####

File Path

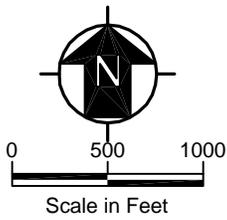
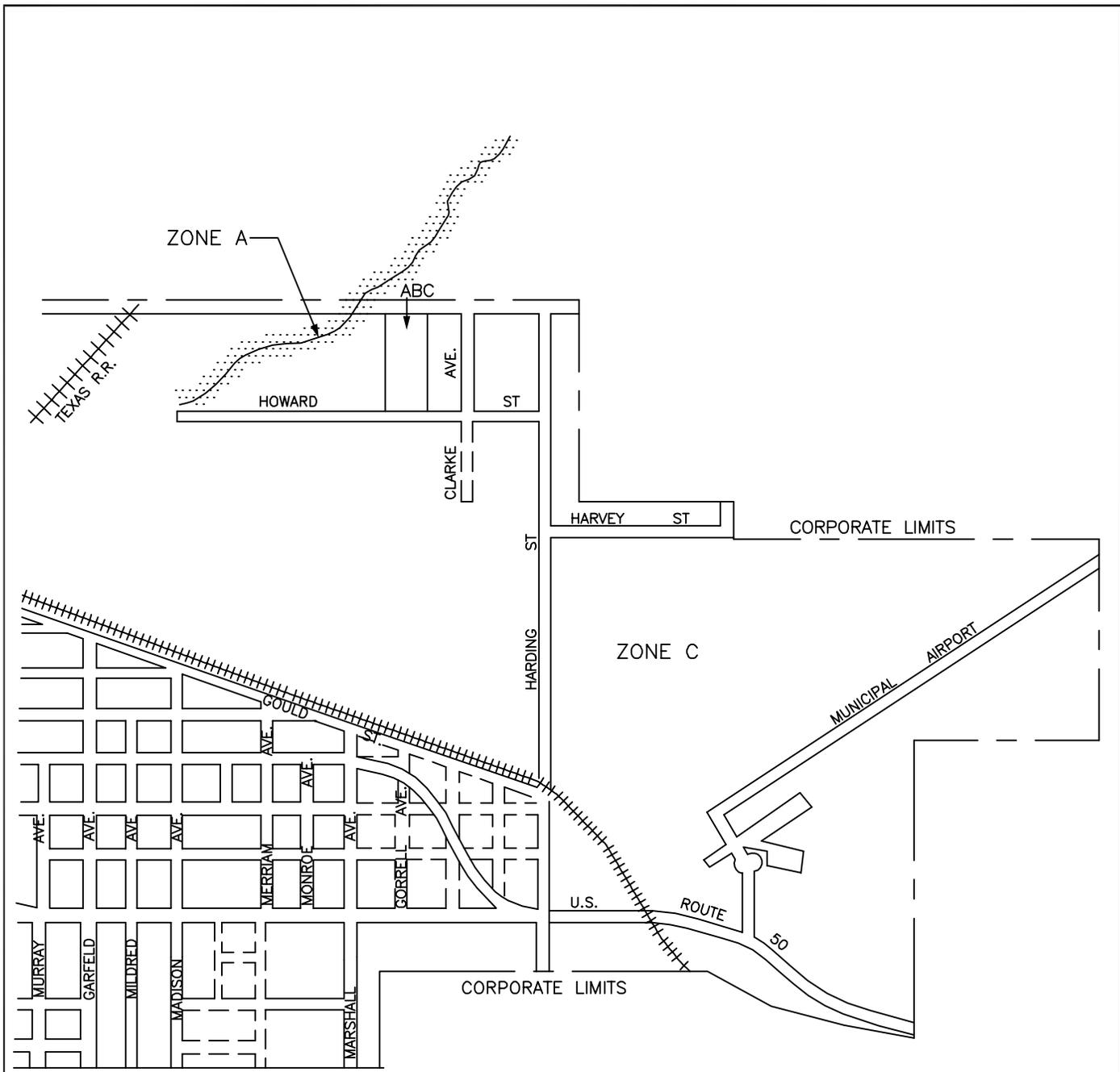
Base Map Source: Modified from XYZ Company, 2001



- Legend**
- Former UST
 - Former AST
 - ⊕ Monitoring well
 - MW-# Monitoring well ID
 - ND Not detected
 - - - Approximate benzene isocontour
 - 999 Benzene concentration

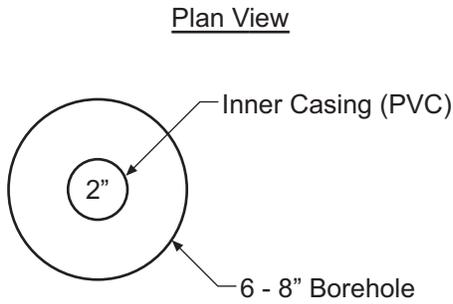


Facility Name Address City, State Zip Code
Figure # Contaminant Plume Isoconcentration Map
ABC Company, Inc.
<small>Date: XXXXXX Drawn By: Your Name Project No: #####</small>



Facility Name Address City, State Zip Code
Figure # Flood Plain Map
 ABC Company, Inc.
<small>Date: XX/XX/XX Drawn By: Your Name Project No: #####</small>

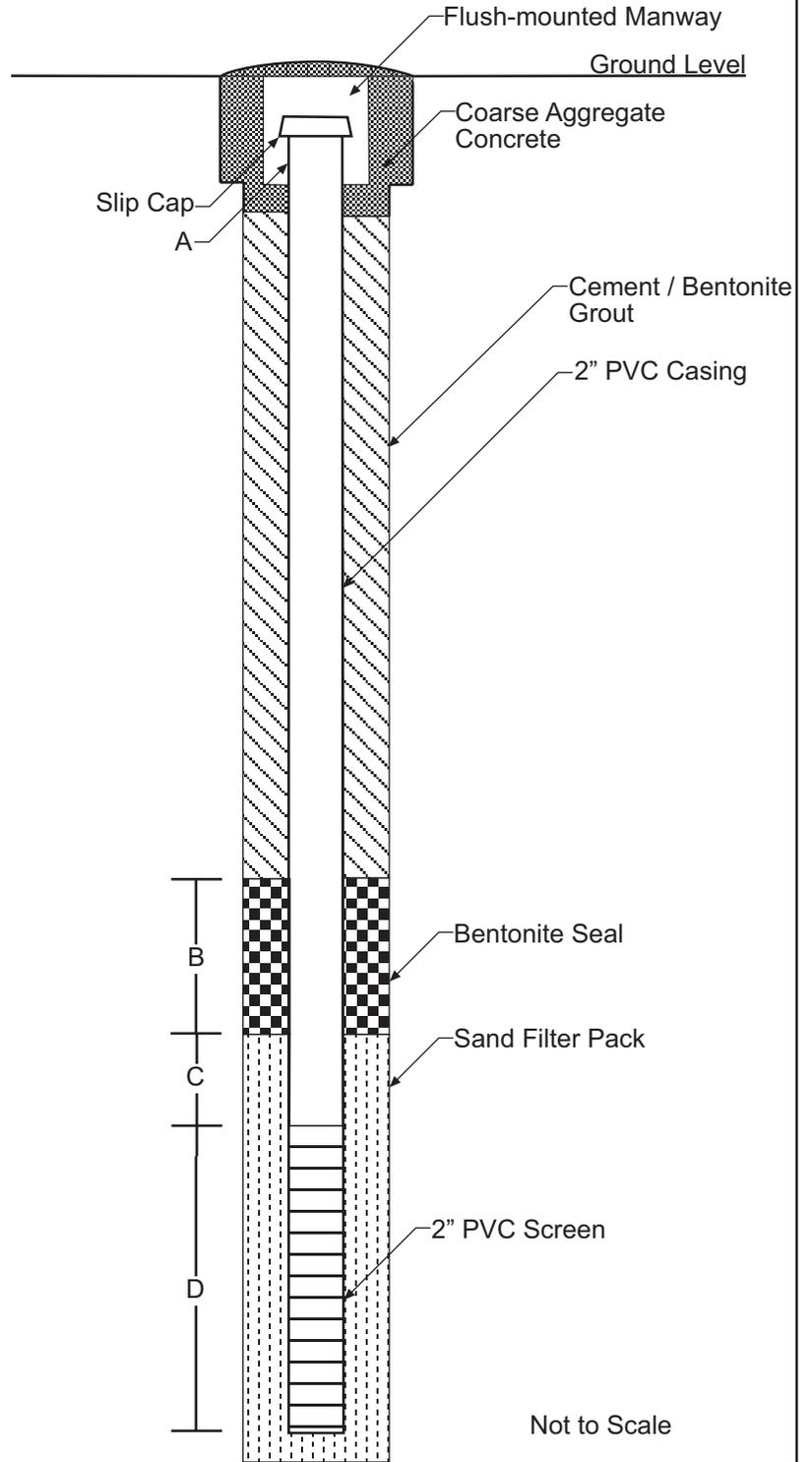
Well Construction Detail



Construction Data

Casing Length: Site Specific
 Casing Diameter: 2 in.
 Casing Material: Schedule 40 PVC
 Screen Size: 0.010 in.
 Sand Size: 10-20
 Screen Material: Schedule 40 PVC
 Continuous Wrap

- A. Casing Elevation: 0 - 6 in. Below Grade
- B. Bentonite Thickness: 3 ft.
- C. Sand Depth Above Screen: 2 ft.
- D. Screen Length: 10 ft.



Facility Name
 Address
 City, State Zip Code

Figure #
 Monitoring Well Construction Detail

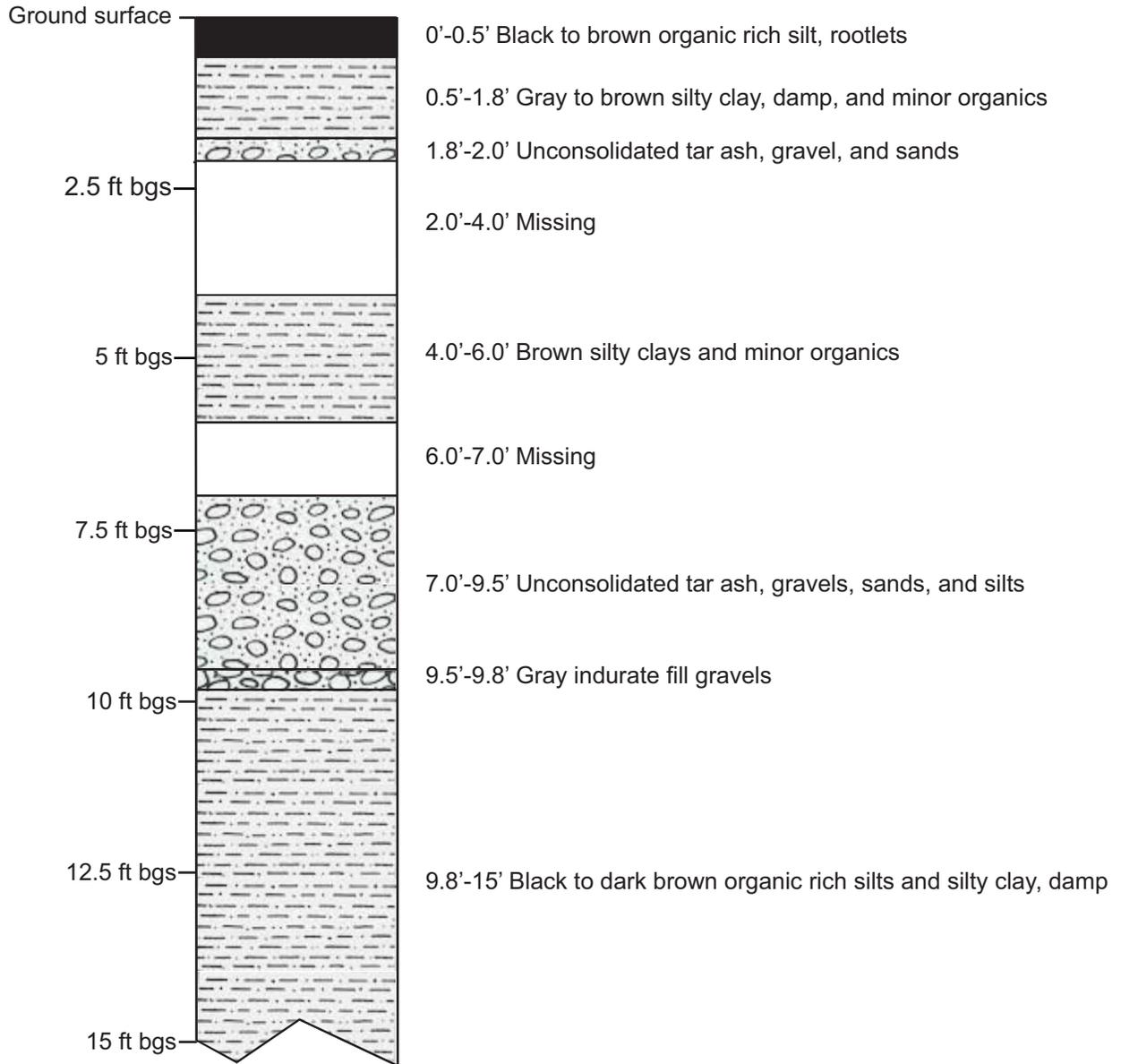


ABC Company, Inc.

Date: #####

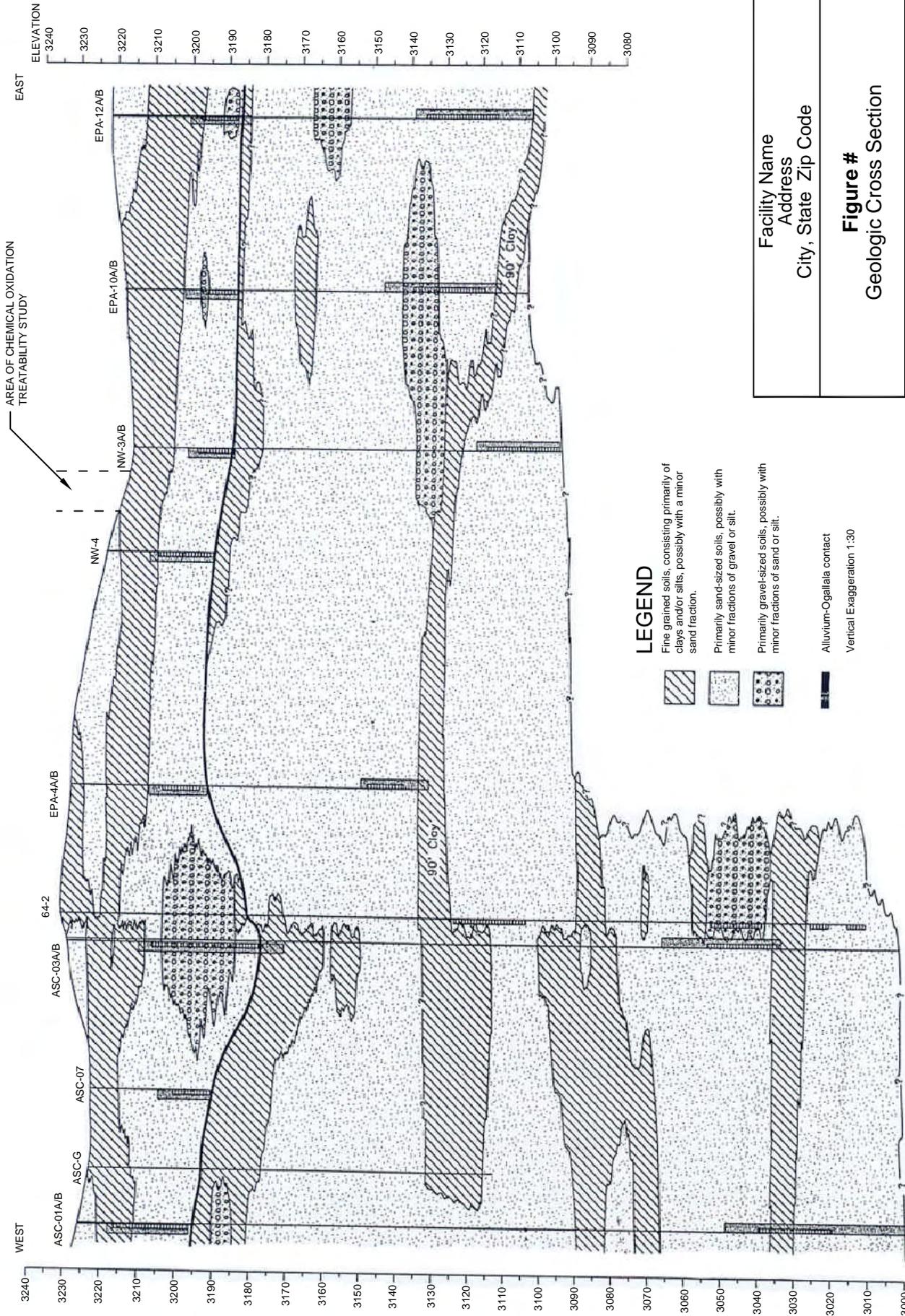
Drawn By: Your Name

Project No: #####



Facility Name Address City, State Zip Code
Figure # Generalized Stratigraphic Column
 ABC Company, Inc.
<small>Date: XXXX/XX</small> <small>Drawn By: Your Name</small> <small>Project No: #####</small>

Note: bgs abbreviation for below ground surface

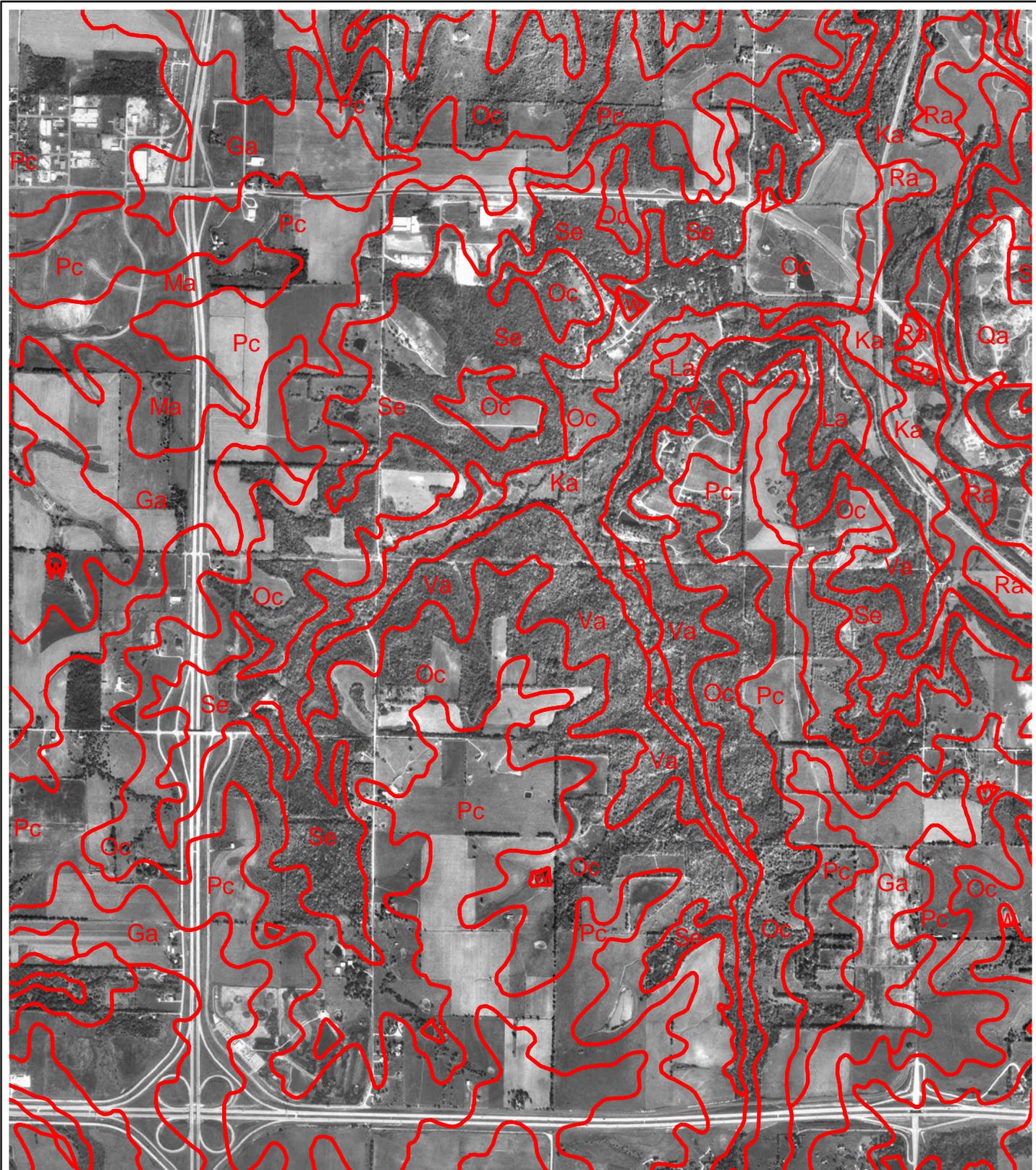


Facility Name
Address
City, State Zip Code

Figure #
Geologic Cross Section

ABC ABC Company, Inc.

Not to Scale

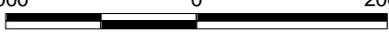


Legend

- Oc Oska-Martin Silty Clay Loam
- Va Vinland-Rock Outcrop Complex
- Pc Polo Silt Loam
- Ma Martin Silty Clay Loam
- Ka Kennebec Silt Loam
- La Ladoqg Silt Loam



2000 0 2000 Feet



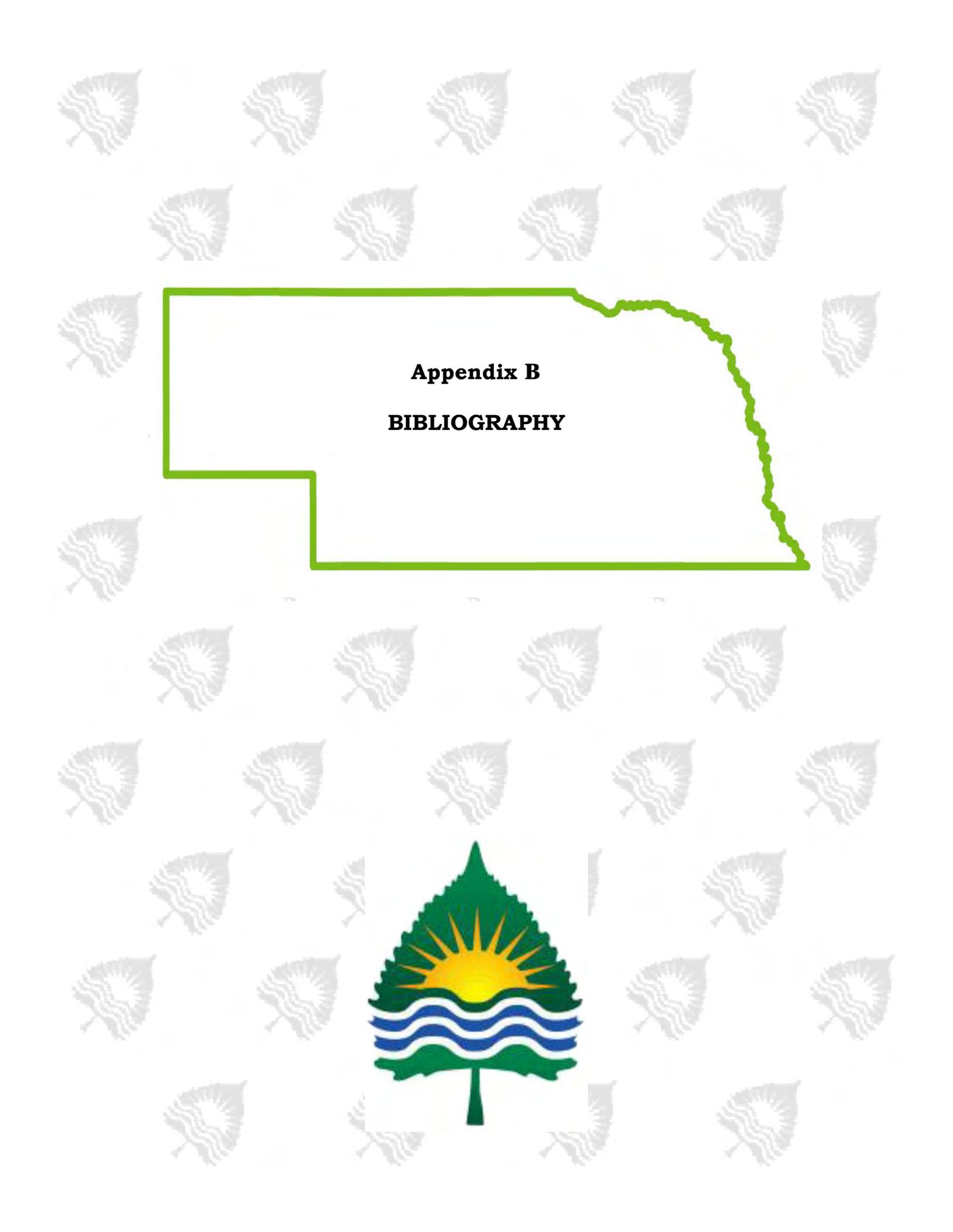
Facility Name
Address
City, State Zip Code

Figure #
Soil Survey



ABC Company, Inc.

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Appendix B
BIBLIOGRAPHY



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BIBLIOGRAPHY

This bibliography is a compilation of resources related to site investigations, risk assessment, remedy selection, and other issues relevant to the Remedial Action Plan Monitoring Act voluntary cleanup program. These references will be useful when preparing the remedial action plan and the remedial action report. However, it is not a comprehensive list of all available resources, and additional reference materials may be needed for some sites. In addition, weblinks are provided for many references as a convenience. Because of the website addresses are subject to change, some of these links may no longer be available. For additional information, contact the author.

GENERAL REFERENCES

This section contains a list of annotated references. The references are organized alphabetically by author, then in reverse chronological order within author.

American Society for Testing and Materials (ASTM). Updated yearly. *Annual Book of Standards*. Philadelphia, PA.

ASTM provides standard methodologies for a large number of site investigation and remediation techniques. Descriptions of methodologies can be purchased for a fee. Listings of individual standards are available on-line under the following remediation-related headings:

- Analytical chemistry (<http://www.astm.org/cgi-bin/softcart.exe/database.cart/marketingcodes/mt1.htm?u+mystore+xkdj0443>)
- Environmental assessment (<http://www.astm.org/cgi-bin/softcart.exe/database.cart/marketingcodes/en2.htm?u+mystore+xkdj0443>)
- Geotechnical engineering (<http://www.astm.org/cgi-bin/softcart.exe/database.cart/marketingcodes/m04.htm?u+mystore+xkdj0443>)
- Laboratory testing (<http://www.astm.org/cgi-bin/softcart.exe/database.cart/marketingcodes/gm3.htm?u+mystore+xkdj0443>)
- Waste management (<http://www.astm.org/cgi-bin/softcart.exe/database.cart/marketingcodes/en5.htm?u+mystore+xkdj0443>)
- Water testing (<http://www.astm.org/cgi-bin/softcart.exe/database.cart/marketingcodes/en6.htm?u+mystore+xkdj0443>)

More information about ASTM can be found at <http://www.astm.org>.

ASTM. 2003. "D5092-04e1 Standard Practice for Design and Installation of Ground Water Monitoring Wells." On-line address: http://www.astm.org/cgi-bin/SoftCart.exe/DATABASE.CART/REDLINE_PAGES/D5092.htm?L+mystore+izay5771+1092893500

This document provides guidelines for designing and installing monitoring wells for the purposes of collecting representative groundwater data and detecting potential contamination in groundwater. Design standards and installation procedures take into consideration the hydrogeology of the intended monitoring zone and are applicable to both detection and assessment monitoring programs.

ASTM. 2003. "E1689-95(2003)e1 Standard Guide for Developing Conceptual Site Models for Contaminated Sites." On-line address: http://www.astm.org/cgi-bin/SoftCart.exe/DATABASE.CART/REDLINE_PAGES/E1689.htm?L+mystore+izay5771+1092893042

This purpose of this guide is to assist in the development of conceptual site models for contaminated sites. The guide describes the major components of conceptual site models and provides examples and an outline for developing new site models. A conceptual site model can be used to integrate technical data from various sources, evaluate the potential risk to human health and the environment, identify data needs, support selection of background sample locations, and guide data collection activities.

ASTM. 2003. "E1912-98(2004) Standard Guide for Accelerated Site Characterization for Confirmed or Suspected Petroleum Releases." On-line address: http://www.astm.org/cgi-bin/SoftCart.exe/DATABASE.CART/REDLINE_PAGES/E1912.htm?L+mystore+izay5771+1092893869

This guide describes a process for rapid and accurate characterization of a site with a confirmed or suspected petroleum release. Users may be responsible parties, contractors, consultants, or regulators wishing to streamline and accelerate the site characterization process or to supplement incomplete characterization data.

ASTM. 2003. "E1943-98(2004) Standard Guide for Remediation of Ground Water by Natural Attenuation at Petroleum Release Sites." On-line address: http://www.astm.org/cgi-bin/SoftCart.exe/DATABASE.CART/REDLINE_PAGES/E1943.htm?L+mystore+izay5771+1092894228

The guide aids the user in evaluating and implementing appropriate remediation by natural attenuation at petroleum release sites, alone or in combination with other remedial actions.

ASTM. 2003. "E2091-00 Standard Guide for Use of Activity and Use Limitations, Including Institutional and Engineering Controls." On-line address: http://www.astm.org/cgi-bin/SoftCart.exe/DATABASE.CART/REDLINE_PAGES/E2091.htm?L+mystore+izay5771

This guide provides the information needed to incorporate controls that are protective of human health and the environment into risk-based remediation programs. The guide explains the purpose of institutional controls and engineering controls and helps users identify, evaluate, implement, and maintain appropriate controls for their sites. The guide also identifies screening and balancing criteria, as well as long-term monitoring and stewardship needs.

ASTM. 2002. *ASTM Standards on Environmental Site Characterization*. 2nd Ed. Philadelphia, Pennsylvania.

The 48 ASTM guides and practices provided in this book provide current standards for site characterization, including those addressing characterization, sampling, and monitoring of soil, vadose zone materials, sediment, surface water, groundwater, and waste.

A list of the standards provided in this book is available at <http://www.astm.org/bookstore/comps/contents/68.html>.

ASTM. 1999. *ASTM Standards on Ground Water and Vadose Zone Investigations: Drilling, Sampling, Geophysical Logging, Well Installation and Decommissioning*. 2nd ed. Philadelphia, PA.

The 75 ASTM standards provided in this book provide techniques for drilling, sampling, installation, and development of wells. New standards cover borehole geophysical logging, direct-push soil and groundwater sampling, and nitrogen laser-induced fluorescence.

A list of the standards provided in this book is available at <http://www.astm.org/cgi-bin/SoftCart.exe/BOOKSTORE/COMPS/CONTENTS/47.html?L+mystore+mflp3671+1033382265>.

ASTM. 1984. “STP 845 Statistics in the Environmental Sciences.”

This paper discusses the development and application of mathematical and statistical techniques to environmental problems. The discussion focuses on the types of analyses available, their usefulness in various scenarios, and the evaluation process prior to application of the technique.

Argonne National Laboratory. 2003. “Adaptive Sampling and Analysis Programs (ASAP).”

Accessed May 5. On-line address:

http://www.ead.anl.gov/project/dsp_topicdetail.cfm?topicid=23

ASAPs are expedited approaches to collecting data in support of hazardous waste site characterization and remediation. ASAPs rely on real-time data collection techniques and in-field decision-making to keep data collection as inexpensive, focused, and efficient as possible. ASAPs are based on dynamic sampling and analysis plans that specify the way sampling decisions are to be made, rather than the exact number and location of samples.

Cherry, J.A. 1992. “Groundwater Monitoring: Some Current Deficiencies and Alternative Approaches.” In *Hazardous Waste Site Investigations: Toward Better Decisions*. Lewis Publishers.

This book focuses on the development and application of innovative technologies for hazardous waste site characterization and remediation, with an emphasis on quality assurance. Innovative technologies are presented for field instrumentation, biomonitoring, surface water and groundwater sampling, chemical sensing, and radiochemical measurements and sensing.

Code of Federal Regulations (CFR), Title 40, Part 300. 2003. “National Oil and Hazardous Substances Pollution Contingency Plan.” Accessed on May 5. On-line address:

<http://frwebgate3.access.gpo.gov/cgi-bin/waisgate.cgi?WAISdocID=86802929436+9+0+0&WAIAction=retrieve>

This plan, commonly referred to as the National Contingency Plan (NCP), outlines federal procedures for responding to oil spills and hazardous substance releases. The NCP promotes overall coordination among the hierarchy of responders and contingency plans. It established a response headquarters and regional and national reactions teams, and it provides a system for accident reporting, emergency response, spill containment, clean up, and emergency removal actions.

An overview of the NCP is available at <http://www.epa.gov/oilspill/ncpover.htm>. Key NCP provisions are available at <http://www.epa.gov/oilspill/ncpkeys.htm>.

Davis, T.S. 2001. *Brownfields: A Comprehensive Guide to Redeveloping Contaminated Property*. 2nd Edition. American Bar Association.

This book provides a stepwise, solution-oriented approach to redeveloping brownfields properties. Topics of discussion include finding new funding sources to finance redevelopment; resolving legal, business, financial, and political issues associated with redeveloping contaminated property; interpreting state and federal laws regarding liability for cleanup of brownfield sites; and evaluating existing state voluntary cleanup programs. The book also provides a detailed analysis of the federal brownfields legislation.

Department of Energy (DOE). 1997. "Site Conceptual Exposure Model (SCEM) Builder."
August 1. On-line address: <http://homer.ornl.gov/oepa/programs/scem.cfm>

U.S. Environmental Protection Agency (EPA) guidance on the preparation of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) scoping documents requires the development of a SCEM as a planning tool for public health and ecological risk assessments. Resource Conservation and Recovery Act (RCRA) corrective actions also require risk assessments to be conducted to determine the potential impacts to public health and the environment. SCEMs are used as a planning tool during the environmental site investigation phase to allocate finite financial and personnel resources to address data gaps, identify sources of contamination, release mechanisms, exposure pathways, and human or ecological receptors. The SCEMs include a visual presentation of site conditions and provide a narrative description of the assumptions used in the model.

Driscoll, F.G. 1986. *Groundwater and Wells*. Johnson Filtration Systems, Inc.: St. Paul, Minnesota.

This book provides a comprehensive reference for developing groundwater resources, with emphasis on water well design, construction, development, and testing. Other topics of discussion include subsurface exploration, drilling methods, and aquifer properties. The book presents information on transmissivity, well yield, storage, and time and distance drawdown for confined and unconfined conditions.

Einarson, M.D. 1995. "Enviro-CoreTM -- A new vibratory direct-push technology for collecting continuous soil cores." In *Proceedings of the 9th National Outdoor Action Conference*. National Ground Water Association, Columbus, OH.

This presentation focused on the Enviro-CoreTM sampling system, a patented dual-tube direct push system with a small-diameter drive casing that prevents the probe hole from collapsing between sample runs. By preventing collapse, the Enviro-CoreTM sampling system eliminates the potential for cross-contamination of soil samples. The Enviro-CoreTM sampling system also allows for soil gas and groundwater sampling, monitoring well installation, and retraction grouting.

Environmental Protection Agency, U.S. (EPA). 2004. "A Citizen's Guide to Cleanup Methods."
Accessed August 18 On-line address: <http://www.clu-in.org/search/t.focus/id/10/>

EPA encourages the selection of innovative treatment technologies for site remedies because they have the potential to be more cost-effective and to provide better and more efficient cleanups. In addition, they are often more acceptable to surrounding communities than established treatment technologies. This document presents a broad overview of approaches for soils. It also refers to other citizens' guides for specific technologies.

EPA. 2004. “Superfund Chemical Data Matrix (SCDM).” January. On-line address:
<http://www.epa.gov/superfund/sites/npl/hrsres/tools/scdm.htm>

The SCDM is a source for factor and benchmark values to be used when evaluating potential NPL sites using the Hazard Ranking System (HRS). Factor values are part of the HRS mathematical equation that determines the relative threat posed by a hazardous waste site and reflect hazardous substance characteristics, such as toxicity and persistence in the environment, substance mobility, and potential for bioaccumulation. Benchmarks are environment- or health-based concentration limits developed by or used in other EPA regulatory programs. SCDM contains HRS factor and benchmark values for hazardous substances that are frequently found at sites evaluated using the HRS, as well as the physical, chemical, and radiological data used to calculate those values. The report also describes how data are selected or calculated for inclusion in SCDM.

EPA. 2004. “Handbook of Groundwater Protection and Cleanup Policies for RCRA Corrective Action.” EPA/530/R-04/030. April. On-line address:
<http://www.epa.gov/epaoswer/hazwaste/ca/resource/guidance/gw/gwhandbk/gwhb041404.pdf>

This document contains the EPA's latest interpretation of policies on such topics as cleanup goals, the role of groundwater use, point of compliance, source control, and monitored natural attenuation. It emphasizes a phased, results-based approach to cleaning up contaminated groundwater.

Additional information on this document is available at
<http://www.epa.gov/epaoswer/hazwaste/ca/resource/guidance/gw/gwhandbk/gwhndbk.htm>.

EPA. 2003. “Compendium of ERT SOPs [Emergency Response Team Standard Operating Procedures].” Accessed May 10. On-line address:
http://www.ertresponse.com/Response_resrcs/Index.htm

ERT provides standard methodologies for a large number of site investigation and remediation techniques.

EPA. 2003. “Brownfields Cleanup and Redevelopment.” May 7. On-line address:
<http://www.epa.gov/brownfields/>

Brownfields are properties for which expansion, redevelopment, or reuse may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. EPA encourages states and municipalities to streamline the process by which these sites can be cleaned up and returned to economic, ecologic, or recreational usefulness. This website provides links to information about brownfields tax incentive and development grants, investigation and remediation technologies and techniques, and redevelopment success stories. Discussion topics include:

- Pilots and grants (<http://www.epa.gov/brownfields/pilot.htm>)
- Liability and cleanup (<http://www.epa.gov/brownfields/liab.htm>)
- Partnerships and outreach (<http://www.epa.gov/brownfields/partnr.htm>)
- Workforce development (<http://www.epa.gov/brownfields/job.htm>)
- Brownfields tax incentive (<http://www.epa.gov/brownfields/bftaxinc.htm>)
- Insurance and redevelopment (<http://www.epa.gov/brownfields/insurebf.htm>)
- Laws and regulations (<http://www.epa.gov/brownfields/gdc.htm>)
- RCRA brownfields prevention initiative (<http://www.epa.gov/swerosps/rcrabf/index.html>)

- State voluntary cleanup programs (VCP) (http://www.epa.gov/brownfields/state_tribal.htm)
- Underground storage tank (UST) initiative (<http://www.epa.gov/oust/rags/ustfield.htm>)
- Publications (<http://www.epa.gov/brownfields/bfndx.htm>)

EPA. 2003. “Institutional Controls.” May 6. On-line address:
<http://www.epa.gov/superfund/action/ic/index.htm>

Institutional controls are non-engineered instruments, such as administrative or legal controls, that help minimize the potential for human exposure to contamination and protect the integrity of a remedy by limiting land or resource use. Although it is EPA's expectation that treatment or engineering controls will be used to address principle threat wastes and that groundwater will be returned to its beneficial use whenever practicable, institutional controls play an important role in remedies. Institutional controls are used when contamination is first discovered, when remedies are ongoing, and when residual contamination remains onsite at a level that does not allow for unrestricted use and unlimited exposure after cleanup. The NCP emphasizes that institutional controls are meant to supplement engineering controls and that institutional controls will rarely be the sole remedy at a site.

EPA. 2003. “TIO [Technology Innovation Office] Hazardous Waste Cleanup Information.”
 Accessed May 5. On-line address: <http://www.clu-in.org>

The EPA TIO website contains information, internet seminars, guidance on innovative technologies for site characterization, monitoring, and remediation. It also contains case studies, and success stories for sites that have used particular innovative approaches to site cleanup.

EPA. 2003. “Technology Innovation Office [TIO].” April 28. On-line address:
<http://www.epa.gov/tio/>

TIO's website provides information about characterization and treatment technologies for the hazardous waste remediation community. It offers technology selection tools and describes programs, organizations, and publications for a variety of stakeholders. Publication topics include:

- Remediation (<http://www.epa.gov/tio/pubitech.htm>)
- Characterization and monitoring (<http://www.epa.gov/tio/pubichar.htm>)
- Initiatives and partnerships (<http://www.epa.gov/tio/pubipart.htm>)
- Vendor support (<http://www.epa.gov/tio/pubisd.htm>)
- Regulatory information (<http://www.epa.gov/tio/pubiregu.htm>)

EPA. 2003. “Integrated Risk Information System (IRIS).” April 25. On-line address:
<http://www.epa.gov/iris/>

IRIS is a database of human health effects that may result from exposure to various substances found in the environment. IRIS was initially developed for EPA staff in response to a growing demand for consistent information on chemical substances for use in risk assessments, decision-making and regulatory activities. The information in IRIS is intended for those without extensive training in toxicology, but with some knowledge of health sciences.

EPA. 2003. “Superfund Policies and Guidances.” April 24. On-line address:
<http://www.epa.gov/superfund/action/guidance/index.htm>

This website contains information on the Superfund program’s policies and guidance on the following topics:

- Superfund remedy decisions (<http://www.epa.gov/superfund/action/guidance/remedy/index.htm>)
- Risk assessment (<http://www.epa.gov/superfund/programs/risk/tooltrad.htm#gp>)
- Groundwater (<http://www.epa.gov/superfund/resources/gwdocs/index.htm>)
- Remedy selection (<http://www.epa.gov/superfund/resources/rules/index.htm>)
- Reportable quantities (<http://www.epa.gov/superfund/resources/rq/index.htm>)
- Soil screening (<http://www.epa.gov/superfund/resources/soil/index.htm>)
- Redeveloping Superfund sites (<http://www.epa.gov/superfund/programs/recycle/>)
- Contract management (<http://www.epa.gov/superfund/programs/contracts/index.htm>)

EPA. 2003. “Technical Impracticability for Ground Water Cleanups Homepage.” April 7. On-line address: http://www.epa.gov/oerrpage/superfund/resources/gwdocs/tec_imp.htm

This website provides guidance and related documents for the evaluation and implementation of technical impracticability of groundwater restoration at Superfund and RCRA sites.

EPA. 2003. “Tools of the Trade Homepage.” April 7. On-line address:
<http://www.epa.gov/superfund/programs/risk/tooltrad.htm>

This Superfund risk assessment website lists the databases, software, guidance, and policy needed to conduct human health and ecological risk assessments under Superfund. Users can download most of the resources referred to on this site.

EPA. 2003. “Brownfields-related Laws and Regulations Homepage.” March 28. On-line address:
<http://www.epa.gov/swerosps/bf/gdc.htm>

This Brownfields Economic Redevelopment Initiative website provides links to important laws and regulations pertaining to regulations. Information provided includes the title, sponsors, related bills, latest major action, and text downloads.

EPA. 2003. “RCRA Corrective Action Environmental Indicators [EI].” March 10. On-line address: <http://www.epa.gov/epaoswer/hazwaste/ca/eis.htm>

EI checklists are used to summarize and report on site-wide environmental conditions at high priority sites under the RCRA Corrective Action Program. The Human Exposure EI is an assessment of actual, current risks to human health. This EI is typically a qualitative assessment of the completeness of exposure pathways; however, it may include a traditional quantitative risk assessment. The Groundwater EI is a resource-protection measure rather than a direct measure of human risk. In addition to a groundwater assessment, this EI may include an assessment of the impacts of groundwater discharge to surface water and associated ecosystems.

EPA. 2003. “Region 9 Preliminary Remediation Goals [PRG].” March 4. On-line address:
<http://www.epa.gov/Region9/waste/sfund/prg/index.htm>

This website includes information about PRGs maintained by EPA’s Region 9. PRGs are risk-based concentrations derived from standardized equations that combine exposure information assumptions and EPA toxicity data. From this website, the user can access background information, which includes all relevant calculations, PRG tables for a range of contaminants and media, and links to other toxicological and risk assessment information.

EPA. 2003. “Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil.” January. EPA-540-R-03-001 On-line address:
<http://www.epa.gov/superfund/programs/lead/products/adultpb.pdf>

The report provides the methodology and technical recommendations for assessing risks associated with non-residential adult exposures to lead in soil. The focus of this method is estimating fetal blood lead levels in women exposed to lead-contaminated soils. Tools are provided to evaluate risks of elevated blood lead concentrations among exposed adults.

Downloads of the Adult Lead Model spreadsheet in Excel and Lotus 1-2-3 formats can be accessed at <http://www.epa.gov/superfund/programs/lead/products.htm>.

EPA. 2003. “Test Methods for Evaluating Solid Waste.” SW-846. January. On-line address:
<http://www.epa.gov/sw-846/main.htm>

SW-846 provides a unified source of information on sampling and analysis related to compliance with RCRA regulations. This manual provides methodologies for collecting and testing representative samples of waste and other materials to be monitored. Aspects of sampling and testing in SW-846 are discussed in the following chapters:

- Quality control (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap1.pdf>)
- Choosing the correct procedure (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap2.pdf>)
- Inorganic analytes (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap3.pdf>)
- Organic analytes (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap4.pdf>)
- Miscellaneous test methods (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap5.pdf>)
- Properties (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap6.pdf>)
- Characteristics introduction and regulatory definitions (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap7.pdf>)
- Methods for determining characteristics (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap8.pdf>)
- Sampling plan (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap9.pdf>)
- Sampling methods (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap10.pdf>)
- Groundwater monitoring (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap11.pdf>)
- Land treatment monitoring (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap12.pdf>)
- Incineration (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/chap13.pdf>)

EPA. 2002. Health Effects Assessment Summary Tables (HEAST).” EPA/540/R-97/036. December 10.

HEAST tables are for use at both Superfund and RCRA sites. These tables are maintained by EPA’s National Center for Environmental Assessment and provide a comprehensive listing of provisional risk assessment information relative to oral and inhalation routes of exposure for chemicals. In this document,

slope factors are calculated by EPA to assist HEAST users with risk-related evaluations and decision-making at various stages of the remediation process. Because the HEAST tables are not regularly updated, the user should use more recent data where available. HEAST tables do not contain standards.

More information about this document is available at <http://oaspub.epa.gov/eims/eimsapi.detail?deid=2877&partner=ORD-NCEA>.

EPA. 2002. “Dynamic Field Activities.” December 4. On-line address:
<http://www.epa.gov/oerrpage/superfund/programs/dfa/>

This Superfund website contains links to the program’s guidance on dynamic field activities, with the goal of streamlining hazardous waste site activities with real-time data and real-time decisions. The website includes guidance on the following topics:

- Systematic planning (<http://www.epa.gov/oerrpage/superfund/programs/dfa/systplan.htm>)
- Dynamic workplans (<http://www.epa.gov/oerrpage/superfund/programs/dfa/dynwork.htm>)
- Geophysical methods (<http://www.epa.gov/oerrpage/superfund/programs/dfa/geometh.htm>)
- Field-based analytical methods (<http://www.epa.gov/oerrpage/superfund/programs/dfa/fldmeth.htm>)
- Decision support software (<http://www.epa.gov/oerrpage/superfund/programs/dfa/decsupp.htm>)

EPA. 2002. “Region 3 Waste and Chemicals Management Division. Facility Lead Program.” October 15. On-line address: http://www.epa.gov/reg3wcmd/ca/ca_facilitylead.htm

The facility-lead approach encourages facilities to manage their own cleanup, using a streamlined administrative approach. This website includes numerous reference documents for facility-lead sites, as well as example agreements, frequently asked questions, and participating facility descriptions.

EPA. 2002. “Integrating On-Site Decision Making into Field Work at Hazardous Waste Sites: A Guide for Project Managers.” Draft. August 23. On-line address:
<http://www.epa.gov/oerrpage/superfund/programs/dfa/download/guidance/part1.pdf>

This document provides guidance on the use of an on-site decision making process to streamline field investigation work at hazardous waste sites. The process is intended to improve the overall quality of fieldwork by reducing the time and costs required to meet project objectives and by increasing the confidence level of decisions made. The document is intended for EPA staff and may be applied to all Office of Solid Waste and Emergency Response (OSWER) programs, including CERCLA, RCRA, Brownfields, and USTs.

EPA. 2002. "Presumptive Remedies." August 14. On-line address:
<http://www.epa.gov/superfund/resources/presump/index.htm>

Cleaning up abandoned hazardous waste sites has been the charge of EPA's Superfund program since 1980. Over the past 17 years, Superfund has gained considerable experience on hazardous waste cleanup approaches and technologies. As EPA gained experience, they have found that certain sites have similar characteristics that could be used to their advantage to improve the cleanup process. The "presumptive remedy" initiative emphasizes the use of standard remedies for commonly-occurring contamination types. This website contains links to presumptive remedies for the following:

- Contaminated groundwater (<http://www.epa.gov/superfund/resources/presump/gw.htm>)
- Metals in soils (<http://www.epa.gov/superfund/resources/presump/metals.htm>)
- Municipal landfills (<http://www.epa.gov/superfund/resources/presump/landfill.htm>)
- VOCs in soils (<http://www.epa.gov/superfund/resources/presump/vocs.htm>)
- Wood treaters (<http://www.epa.gov/superfund/resources/presump/wood.htm>)
- Grain storage (<http://www.epa.gov/oppsrrd1/op/chlorpyrifos-methyl/hedrra.pdf>)

EPA. 2002. "RCRA, Superfund, and EPCRA [Emergency Planning and Community Right-to-Know] Call Center Training Modules." July 5. On-line address:
<http://www.epa.gov/epaoswer/hotline/modules.htm>

The call center is a publicly accessible service that provides up-to-date information on several EPA programs. It also responds to requests for relevant publications and information resources. The call center also develops training modules as tools to train Call Center Information Specialists. Each module provides an overview of a specific regulatory topic. These modules are useful resources for people wishing to gain a general understanding of Call Center program areas. However, the modules are **not** comprehensive sources of information on the regulations.

EPA. 2002. "RCRA Corrective Action Workshop on Results-Based Project Management." June 25. On-line address: <http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm>

This corrective action workshop illustrates the EPA RCRA program's current approaches to investigation and remediation at RCRA facilities. The on-line workshop is broken into topics, including a brief explanation, references, and web addresses:

- Environmental indicators (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Environmental>)
- Case studies (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Case>)
- Conceptual site models (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Conceptual>)
- Innovative treatment technologies (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Innovative>)
- Managing risks and uncertainties (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Managing>)
- Site conceptual exposure model builders (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Site>)
- Open window communication (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Open>)
- Managing remediation waste (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Remediation>)
- Administrative approaches (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Administrative>)
- Institutional controls (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Institutional>)

- Corrective action results (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Corrective>)
- Final remedy selection (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Final>)
- Remedy completion (<http://www.epa.gov/epaoswer/hazwaste/ca/workshop.htm#Remedy>)

EPA. 2002. “Office of Solid Waste Cleanup.” June 24. On-line address:

<http://www.epa.gov/epaoswer/osw/cleanup.htm>

This website is a starting point for links to all aspects of cleanup for solid waste facilities. It contains links to:

- RCRA Corrective Action (<http://www.epa.gov/epaoswer/hazwaste/ca/index.htm>)
- Superfund (<http://www.epa.gov/superfund/>)
- Office of USTs (OUST) (<http://www.epa.gov/swerust1/index.htm>)
- Brownfields (<http://www.epa.gov/brownfields>)
- TIO (<http://www.epa.gov/tio/>)
- Office of Enforcement and Compliance Assistance (OECA) - Solid and Hazardous Waste Cleanup (<http://www.epa.gov/compliance/>)
- Office of Research and Development - Subsurface Protection and Remediation Division (<http://www.epa.gov/ada/>)

EPA. 2002. “Drinking Water Standards and Health Advisories.” EPA/822/B-00/001. Summer.

On-line address: <http://www.epa.gov/waterscience/drinking/standards/dwstandards.pdf>

Drinking Water and Health Advisory summary tables are prepared semi-annually by EPA, Office of Water and Office of Science and Technology. They contain drinking water standards in the form of non-enforceable concentrations of drinking water contaminants, Maximum Contaminant Level Goals, or Maximum Contaminant Levels (MCL). MCLs are the maximum permissible level of a contaminant in water delivered to users of a public water system. Health Advisories (HA) provide information on contaminants that can cause human health effects and are known or anticipated to occur in drinking water. HAs are guidance values based on non-cancer health effects for different durations of exposure (for example, one-day, ten-day, and lifetime). They provide technical guidance to EPA regional offices, state governments, and other public health officials on health effects, analytical methodologies, and treatment technologies associated with drinking water contamination.

Additional information is available at <http://www.epa.gov/waterscience/drinking/>.

EPA. 2002. “Integrated Exposure Uptake Biokinetic [IEUBK] Model for Lead in Children, Windows[®] Version.” May.

The IEUBK Model for Lead in Children allows users to predict the blood lead levels of children using information on their multimedia exposure to environmental lead. The model is based on a number of other studies, including lead biokinetics, contact rates of children with contaminated media, and data on the presence and behavior of environmental lead. The model provides a central tendency estimate and a probability distribution to characterize predicted blood lead levels.

Downloads of the IEUBK Model for Lead in Children (multiple versions) and accompanying reference manuals are available at <http://www.epa.gov/superfund/programs/lead/products.htm#software>.

EPA. 2002. “Completion of Corrective Action Activities at RCRA Facilities.” Federal Register. Volume 67. No. 39. Pages 9175-9178. February 27. On-line address: <http://www.epa.gov/correctiveaction/complete.pdf>

This document provides federal regions and authorized states with guidance on procedures for acknowledging completion of corrective action activities at RCRA treatment, storage, and disposal facilities. The document distinguishes between “Corrective Action Complete” and “Corrective Action Complete with Controls” determinations, and it discusses completion determinations for portions of facilities.

EPA. 2001. “Supplemental Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway for RCRA Corrective Action Human Environmental Indicators.” Draft for Comment. October 23. On-line address: <http://www.epa.gov/correctiveaction/eis/vapor/vapor.pdf>

This document provides guidance for determining if the subsurface vapor intrusion to indoor air pathway is complete under current site conditions. A complete pathway would result in indoor air exposures above levels of concern. The supplemental guidance document is intended to provide a national benchmark for evaluating this pathway, and is not intended to supercede existing state-specific guidelines or regulations.

EPA. 2001. “RCRA Corrective Action Hazardous Waste Cleanup Program Resources.” October. On-line address: <http://www.epa.gov/epaoswer/hazwaste/ca/resource.htm>

Corrective action resources come from a variety of sources. The resources that are most often requested from EPA are listed on this website. The website also includes a thorough listing of guidance’s that pertain to the cleanup of hazardous waste, Federal Register Notices and citations from the CFR that relate to corrective action, and “RCRA Corrective Action News,” along with several other cleanup newsletters.

EPA. 2001. “Risk Assessment Guidance for Superfund [RAGS], Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim.” EPA/540/R-99/005. September. On-line address: <http://www.epa.gov/superfund/programs/risk/ragse/>

This guidance is intended to assist risk assessors and others in addressing concerns resulting from the evaluation of dermal exposure risk assessment pathways. It proposes a consistent methodology for assessing the exposures from the dermal pathway for Superfund human health risk assessments. RAGS Part E focuses on dermal contact with soil and water, and it does not provide guidance on quantifying dermal absorption of chemicals resulting from exposure to vapors.

EPA. 2001. “Road Map to Understanding Innovative Technology Options for Brownfields Investigation and Cleanup, Third Edition.” EPA 542-B-01-001. September. On-line address: <http://www.clu-in.org/products/roadmap/>

This document provides resources to assist in identifying and selecting innovative site characterization and cleanup technologies for brownfields redevelopment, as well as an outline of the general steps required for the characterization and cleanup of a site slated for redevelopment. This document is applicable regardless whether the brownfield sites are public projects, private developments, or public-private partnerships.

EPA. 2001. “Review of Adult Lead Models: Evaluation of Models for Assessing Human Health Risks Associated with Lead Exposures at Non-Residential Areas of Superfund and Other Hazardous Waste Sites.” EPA 9285.7-46. August. On-line address: <http://www.epa.gov/superfund/programs/lead/products/adultreview.pdf>

This report was developed as a review of and follow-up to the EPA’s “Adult Lead Methodology” (ALM), which was released as an interim EPA report entitled “Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil.” The August 1 document provides an exhaustive evaluation of other currently available modeling approaches and their applicability to assessing non-residential lead risks and exposures. Six lead biokinetic models are evaluated and compared to the ALM with regard to completeness of the exposure model, kinetic performance, utility of model output, and ease of use and flexibility. In addition to the six model summaries, the report recommends whether the existing ALM model should be modified, a superior model is available or should be developed, or the ALM should be retained.

EPA. 2001. “EPA Requirements for Quality Assurance Project Plans [QAPP] (EPA QA/R-5).” EPA/240/B-01/003. March. On-line address: <http://www.epa.gov/quality/qs-docs/r5-final.pdf>

The QAPP is a tool for project managers and planners to use to document the type and quality of data needed for environmental decisions and to describe the methods for collecting and assessing those data.

EPA. 2001 “Guidance on Enforcement Approaches for Expediting RCRA Corrective Action.” January 2. On-line address: <http://www.epa.gov/Compliance/resources/policies/cleanup/rcra/guide-corr-rpt.pdf>

This document describes innovative enforcement approaches for expediting corrective action. Specific regional approaches that enhance the efficiency and effectiveness of corrective action are described, and the guidance offers suggestions on language that can be included in permits, orders, or work plans. Many of the approaches were designed to reduce the administrative overhead traditionally associated with corrective action.

EPA. 2000. “Institutional Controls: A Site Manager’s Guide to Identifying, Evaluating, and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups.” OSWER 9355.0-74FS-P. EPA 540-F-00-005. September. On-line address: http://www.epa.gov/RCRIS-Region-5/ca/Institutional_Controls_Guidance.PDF

This guide provides an overview of commonly used or implemented types of institutional controls and outlines factors for consideration in evaluating and selecting institutional controls as part of a remedy. The guide is designed for site managers, attorneys, and other decision-makers.

EPA. 2000. “Results-Based Approaches to Corrective Action. Draft.” July 26. On-line address: http://www.epa.gov/correctiveaction/resource/guidance/gen_ca/results.pdf

As a part of its on-going effort to improve the corrective action program, EPA has identified several improvements to increase the efficiency and cost-effectiveness of facility cleanups. Results-based corrective action encourages technical and administrative innovation to achieve environmentally protective cleanups on a facility-specific basis. Throughout the years of implementing various cleanup programs, EPA has developed results-based approaches that project managers and owner/operators may use to more efficiently identify releases and risks, and increase the pace of facility cleanup. This document presents an overview of some of the approaches available.

EPA. 2000. “Guidance for Data Quality Assessment: Practical Methods for Data Analysis.” EPA QA/G-9. QA00 Update. EPA/600/R-96/084. July. On-line address: <http://www.epa.gov/quality/qs-docs/g9-final.pdf>

This document provides guidance on assessing data quality criteria and on performance specifications for making decisions. The statistical process outlined in the guidance allows managers and planners to determine the type, quantity, and quality of data needed to support decisions and to evaluate the extent to which existing data satisfy that need.

EPA. 2000. “Use of Institutional Controls in the RCRA Corrective Action Program.” March. On-line address: [http://www.epa.gov/RCRIS-Region-5/ca/Institutional Controls Guidance.PDF](http://www.epa.gov/RCRIS-Region-5/ca/Institutional%20Controls%20Guidance.PDF)

This document provides guidance for the use of institutional controls at federal-lead corrective action sites where land-use restrictions are necessary to protect human health and the environment. This document aids project managers in evaluating and selecting appropriate institutional controls, and in ensuring the reliability of the institutional control selected.

EPA. 2000. “Assessing Contractor Capabilities for Streamlined Site Investigations.” EPA 542-R-00-001. January. On-line address: <http://www.brownfieldstsc.org/pdfs/ContractorCap.pdf>

This document promotes the use of innovative methods in brownfields projects, when conducting site characterization, assessing contractors’ capabilities, or suggesting additional considerations for contractors conducting their activities. In CERCLA and RCRA investigations, innovative technologies have been demonstrated to improve project cost, schedule, and effectiveness.

EPA. 2000. “Data Quality Objectives Process for Hazardous Waste Site Investigations.” EPA/600/R-00/007. January. On-line address: <http://www.epa.gov/quality/qs-docs/g4hw-final.pdf>

This guidance document is based upon the principles and steps developed in “Guidance for the Data Quality Objectives Process (QA/G-4),” but is specific to hazardous waste site investigations. This document is also consistent with “Data Quality Objectives Process for Superfund: Interim Final Guidance” and “Soil Screening Guidance: User’s Guide.” The document focuses on applications for CERCLA and RCRA sites, and is applicable to programs at the state and local level.

EPA. 1999. “Directory of Technology Support Services to Brownfields Localities. EPA 542-B-99-005. November. On-line address: <http://www.epa.gov/swertio1/download/misc/bfdirtechsupport.pdf>

This directory contains information about EPA offices, other federal agencies, and nongovernment entities that are funded by EPA that might provide support in the selection of brownfields site characterization and remediation technologies.

EPA. 1999. “Use of Monitored Natural Attenuation [MNA] at Superfund, RCRA Corrective Action, and Underground Storage Tank [UST] Sites.” Final Version. OSWER Directive 9200.4-17P. April 21. On-line address:
<http://www.epa.gov/swerust1/directiv/d9200417.pdf>

This directive clarifies the EPA policy regarding the use of MNA for the remediation of contaminated soil and groundwater at sites regulated under OSWER programs. These include programs administered under Superfund, RCRA, OUST, and the Federal Facilities Restoration and Reuse Office. The directive is intended to promote consistency in how MNA remedies are proposed, evaluated, and approved. As a policy document, it does not provide technical guidance on evaluating MNA remedies. It provides guidance to EPA staff, to the public, and to the regulated community on how EPA intends to exercise its discretion in implementing national policy on the use of MNA.

Additional information on this directive is available at:
<http://www.epa.gov/swerust1/directiv/d9200417.htm>.

EPA. 1999. “National Contingency Plan [NCP] Overview.” March 1. On-line address:
<http://www.epa.gov/oilspill/ncpover.htm>

This website presents an overview of the NCP, which is the federal government’s blueprint for responding to both oil spills and hazardous substance releases. The actual federal register publication contains a preamble that serves as a valuable resource in interpreting EPA’s intent behind the regulations. The NCP Overview website contains links to information on the following related topics:

- National Response Team (<http://www.epa.gov/superfund/programs/er/nrs/nrsnrt.htm>)
- Regional Response Teams (<http://www.epa.gov/superfund/programs/er/nrs/nrsrtr.htm>)
- Clean Water Act of 1972 (<http://www.epa.gov/oilspill/cwaover.htm>)
- CERCLA of 1980 (<http://www.epa.gov/superfund/action/law/cercla.htm>)
- Emergency removal actions (<http://www.epa.gov/superfund/programs/er/hazsubs/index.htm>)
- Oil Pollution Act of 1990 (<http://www.epa.gov/oilspill/opaover.htm>)

EPA. 1998. “Hazardous Waste Identification Final Rule for Contaminated Media.” Final Rule. Federal Register Volume 63, Number 229. November 30. On-line address:
<http://www.epa.gov/epaoswer/hazwaste/id/hwirmdia.htm>

As part a 1994 environmental regulatory reform initiative, EPA issued new requirements for RCRA hazardous remediation wastes treated, stored, or disposed of during cleanup actions. These requirements made five major changes:

- Make permits for treating, storing and disposing of remediation wastes faster and easier to obtain
- Provide that obtaining these permits will not subject the owner and/or operator to facility-wide corrective action
- Create a new kind of unit called a “staging pile” that allows more flexibility in storing remediation waste during cleanup
- Exclude dredged materials from RCRA Subtitle C if they are managed under an appropriate permit under the Marine Protection, Research and Sanctuaries Act or the Clean Water Act
- Make it faster and easier for states to receive authorization when they update their RCRA programs to incorporate revisions to the federal RCRA regulations.

EPA. 1998. “Handbook of Tools for Managing Federal Superfund Liability Risks at Brownfields and Other Sites.” EPA 330-B-98-001. November. On-line address: <http://www.epa.gov/brownfields/liab.htm#handbook>

The handbook provides background information on CERCLA and brownfields, as well as summaries of the statutory provisions, agency regulations, policies, and guidance documents that can be used to manage CERCLA liability risks.

EPA. 1998. “Management of Remediation Waste Under RCRA.” EPA 530-F-98-026. October.

The memorandum summarizes existing guidance on the RCRA regulations and policies that typically affect management of remediation waste. As with other solid wastes, remediation wastes are subject to RCRA Subtitle C only if the remediation waste contains a listed waste or exhibits the characteristics of a hazardous waste.

This memorandum can be accessed by choosing publication 530F98026 at <http://www.epa.gov/cgi-bin/claritgw?op-Display&document=clserv:OSWER:0579;&rank=4&template=epa>.

EPA. 1998. “Introduction to: Statutory Overview of CERCLA.” RCRA, Superfund, and EPCRA Hotline Training Module. EPA540-R-98-024. OSWER9205.5-17A. PB98-963 232. June. On-line address: <http://www.epa.gov/superfund/contacts/sfhotline/over.pdf>

This document provides a brief overview of the CERCLA statute, which provides the legal authority and general framework for Superfund, which is EPA’s hazardous substance release reporting and cleanup program. Information within the document is limited to the CERCLA statute, and it excludes regulations promulgated pursuant to the statute. The statutory overview includes discussions of Titles I through V – Hazardous Substances Releases, Liability, Compensation; Hazardous Substance Response Revenue Act of 1980; Miscellaneous Provisions; Pollution Insurance; and Amendments to the Internal Revenue Code of 1986 – and reauthorization.

EPA. 1998. “Guidelines for Ecological Risk Assessment.” EPA/630/R-95/002F. April. On-line address: <http://oaspub.epa.gov/eims/eimsapi.detail?deid=12460&partner=ord-ncea>

These EPA guidelines are provided to improve the quality and consistency of ecological risk assessments. As a next step in a continuing process of ecological risk guidance development, the guidelines draw from a wide range of source documents including peer-reviewed issue papers and case studies previously developed by EPA’s Risk Assessment Forum. The guidelines expand on and replace the 1992 report “Framework for Ecological Risk Assessment.” These guidelines are not regulations and do not impose any new requirement on the regulated community. Rather, the guidelines are internal guidance for EPA and inform the public and the regulated community regarding EPA’s approach to ecological risk assessment.

EPA. 1998. Groundwater Sampling Procedure. Low Stress (Low Flow) Purging and Sampling. March 16. On-line address: <http://www.epa.gov/Region2/desa/hsw/lowflow.pdf>.

This document is the EPA Region 2 standard method for collecting low stress (low flow) groundwater samples from monitoring wells. Low stress purging and sampling of groundwater monitoring wells results in samples that are representative of groundwater conditions in the geological formation.

EPA. 1997. Memorandum Regarding Withdrawal of Final Draft Guidance for Developing Superfund Memoranda of Agreement [MOA] Concerning State Voluntary Cleanup Programs [VCP]. From Timothy Fields, Acting Assistant Administrator, OSWER, and Steven Herman, Assistant Administrator, OECA. To Regional Administrators. November 26.

This memorandum was written to explain why the Final Draft Guidance, dated 1996, was withdrawn from Federal Register. After receiving comments from stakeholders regarding the guidance, it became apparent that the guidance would not act to streamline the cleanup process in the states. As a result of the withdrawal, state VCPs will be negotiated on a case-by-case basis, supporting EPA's goals of:

- Creating effective state VCPs consistent with previous EPA memoranda
- Facilitating protective cleanup and sustainable redevelopment of brownfields sites
- Ensuring successful implementation of brownfields tax incentives

The memorandum also outlines provisions for federal monetary support of VCP development and enhancement.

EPA. 1997. "Exposure Factors Handbook." EPA/600/P-95/002Fa. August. On-line address: <http://www.epa.gov/ncea/exposfac.htm>

The "Exposure Factors Handbook" provides a summary of the available statistical data on various factors used in assessing human exposure. The handbook is addressed to all exposure assessors, including those outside EPA, who need to obtain data on standard factors to calculate human exposure to toxic chemicals. These factors include: drinking water consumption; soil ingestion; inhalation rates; dermal factors including skin area and soil adherence factors; consumption of fruits and vegetables, fish, meats, dairy products, homegrown foods, and breast milk; human activity factors; consumer product use; and residential characteristics. Recommended values are provided for the general population and also for various segments of the population who may have characteristics different from the general population.

EPA. 1997. "Guidance on Cumulative Risk Assessment: Part 1, Planning and Scoping." July 3. On-line address: <http://www.epa.gov/swerosps/bf/html-doc/cumrisk2.htm>

This guidance directs EPA offices to take into account cumulative risk issues when scoping and planning major risk assessments. Risk assessments should also consider multiple sources, effects, pathways, stressors, and populations for cumulative risk analyses in all cases for which relevant data are available. This assures a more consistent and scientifically complete approach to cumulative risk assessments and better protection of public health and the environment. As it evolves, this guidance is designed to help risk managers and risk assessors plan and document the scope of risk assessments and to consider appropriate participants (that is, technical, advisory, or stakeholder) or information sources to enrich the risk assessment.

EPA. 1997. "Expedited Site Assessment Tools for Underground Storage Tank [UST] Sites: A Guide for Regulators." EPA 510-B-97-001. March. On-line address: <http://www.epa.gov/swerust1/pubs/sam.htm>.

The expedited site assessment process allows rapid characterization of UST site conditions in support of corrective action decisions. This guide provides a comprehensive description of expedited site assessment tools, including surface geophysical methods, soil gas surveys, field methods for the analysis of petroleum hydrocarbons, and direct-push technologies such as the Precision Enviro-Core™ sampling system and the Waterloo Groundwater Profiler.

EPA. 1997. “Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments - Interim Final.” EPA/540/R-97/006. On-line address: <http://www.epa.gov/oerrpage/superfund/programs/risk/ecorisk/ecorisk.htm>

This document provides guidance to site managers and Remedial Project Managers who are legally responsible for the management of a site. It shows how to design and conduct technically defensible ecological risk assessments for the Superfund program.

EPA. 1996. Memorandum Regarding Interim Approaches for Regional Relations with State VCPs. From Elliott Laws, Assistant Administrator, OSWER, and Steven Herman, Assistant Administrator, OECA. To Superfund National Policy Managers. November 14.

This memorandum outlines the six baseline criteria that EPA will use to evaluate a state VCP. These criteria will be used to determine if the state is technically and administratively capable of overseeing investigations and cleanup. The memorandum also clarifies the assurances contained in MOAs between state agencies and EPA. An MOA still allows EPA to conduct investigations or remediations if there is an imminent and substantial threat to human health or the environment.

EPA. 1996. “Soil Screening Guidance: Technical Background Document.” EPA/540/R-95/128. July. On-line address: <http://www.epa.gov/superfund/resources/soil/introtbd.htm>

This document provides the technical background for the development of methodologies described in the “Soil Screening Guidance: User's Guide”, along with additional information useful for soil screening. Together, these documents define the framework and methodology to develop soil screening levels (SSL) for chemicals commonly found at Superfund sites.

EPA. 1996. “Soil Screening Guidance: User’s Guide.” EPA/540/R-96/018. July. On-line address: <http://www.epa.gov/superfund/resources/soil/index.htm#user>

The “Soil Screening Guidance” is a tool developed by EPA to help standardize and accelerate the evaluation and cleanup of contaminated soils at sites on the NPL if future residential land use is anticipated. The User's Guide provides a simple step-by-step methodology for environmental science/engineering professionals to calculate risk-based, site-specific SSLs for contaminants, which may be used to identify areas needing further investigation.

EPA. 1996. “Corrective Action for Releases From Solid Waste Management Units at Hazardous Waste Management Facilities.” Advance Notice of Proposed Rulemaking. Federal Register, Volume 61, Number 85. May 1. On-line address: http://www.epa.gov/epaoswer/hazwaste/ca/resource/guidance/gen_ca/anpr.htm

This notice contains highlights of some successful corrective action approaches pioneered by states and EPA regions and a description of program flexibility. EPA's objectives in improving the corrective action program included: creating a consistent, holistic approach to cleanup at RCRA facilities; establishing protective, practical cleanup expectations; shifting more of the responsibilities for achieving cleanup to those responsible for the contamination; streamlining corrective action and reducing costs; and, enhancing opportunities for timely, meaningful public participation.

EPA. 1996. “RCRA Public Participation Manual.” On-line address:
<http://www.epa.gov/epaoswer/hazwaste/permit/pubpart/manual.htm>

The “RCRA Public Participation Manual” is intended as a user's manual. It explains how public participation works in the RCRA permitting process (including corrective action), and how citizens, regulators, and industry can cooperate to make it work better. It also describes an assortment of activities to enhance public participation and includes several appendices that provide lists of contacts, sources of information, and examples of public participation tools and activities.

EPA. 1995. “Land Use in the CERCLA Remedy Selection Process.” OSWER Directive No. 9355.7-04. May 25. On-line address:
<http://www.epa.gov/oerrpage/superfund/resources/landuse.htm>

This directive presents additional information for considering land use in making remedy selection decisions under CERCLA at NPL sites. EPA believes that early community involvement, with a particular focus on the community's desired future uses of property associated with the CERCLA site, should result in a more democratic decision-making process; greater community support for remedies selected as a result of this process; and more expedited, cost-effective cleanups.

EPA. 1995. “Consistent Implementation of the FY 1993 Guidance on Technical Impracticability of Ground Water Restoration at Superfund Sites.” OSWER 9200.4-14. January 19.

This memorandum provides guidelines for consistent implementation of the 1993 “Guidance for Evaluating Technical Impracticability of Ground-Water Restoration.” The memorandum also clarifies the EPA role in technical impracticability decisions for Superfund sites.

EPA. 1994. “Field Studies for Ecological Risk Assessment.” *ECO Update* Intermittent Bulletin. Vol. 2. No. 3. Publication 9345.0-051. March. On-line address:
<http://www.epa.gov/oerrpage/superfund/programs/risk/ecoup/v2no3.pdf>

This bulletin discusses ecological field studies, or investigations and comparisons of habitats and biota in contaminated areas versus non-contaminated areas. Topics covered in this bulletin include the ecological components in a field study, the elements of field study design, field methods, and field study contributions to ecological risk assessments.

EPA. 1994. “Catalogue of Standard Toxicity Tests for Ecological Risk Assessment.” *ECO Update* Intermittent Bulletin. Vol. 2. No. 2. Publication 9345.0-051. March. On-line address:
<http://www.epa.gov/oerrpage/superfund/programs/risk/ecoup/v2no2.pdf>

This bulletin serves as a companion to “Using Toxicity Tests in Ecological Risk Assessments” (*ECO Update* Vol. 2, No. 1) and consists of an annotated list of standardized aquatic, sediment, terrestrial, and microbial toxicity tests currently used at Superfund sites.

EPA. 1994. "Using Toxicity Tests in Ecological Assessments." *ECO Update Intermittent Bulletin*. Vol. 2. No. 1. Publication 9345.0-051. March. On-line address: <http://www.epa.gov/oerrpage/superfund/programs/risk/ecoup/v2no1.pdf>

This bulletin provides guidance for using toxicity tests in ecological risk assessments. Toxicity tests are used to expose test organisms to contaminated water, sediment, or soil and evaluate the effects of contamination on the survival, growth, reproduction, behavior, and attributes of these organisms. The bulletin outlines situations where toxicity tests may be appropriate, general guidelines for choosing toxicity tests, and the elements of and measurement endpoints for toxicity tests.

EPA. 1993. "Wildlife Exposure Factors Handbook." Volumes I and II. EPA/600/R-93/187. December. On-line address: <http://cfpub.epa.gov/ncea/cfm/wefh.cfm?ActType=default>

The "Wildlife Exposure Factors Handbook" was developed to improve wildlife exposure assessments and support risk estimate quantification. The handbook provides a convenient source of information and a consistent analytical framework for exposure and risk assessments for common wildlife species. An appendix containing a literature review database is provided in Volume II. This handbook is a companion document to the "Exposure Factors Handbook," which contains information on quantifying human exposures.

EPA. 1993. "Solid Waste Disposal Facility Criteria: Technical Manual." EPA 530-R93017. November. On-line address: <http://www.epa.gov/epaoswer/non-hw/muncpl/landfill/techman/>

This technical manual was developed as guidance for owners and operators of solid waste landfills seeking to achieve compliance with the revised Criteria for Municipal Solid Waste Landfills (40 CFR, Part 258). This technical manual is not a regulatory document. The technical guidance provided is not mandatory but is intended to assist the owner or operator in achieving compliance.

EPA. 1993. "Guidance for Evaluating Technical Impracticability of Ground-Water Restoration." Interim Final. OSWER 9234.2-25. EPA-540-R-93-080. September. On-line address: <http://www.epa.gov/oerrpage/superfund/resources/gwdocs/techimp.htm>

This guidance clarifies the EPA evaluation and decision-making process regarding technical impracticability of groundwater restoration at Superfund and RCRA sites. The guidance also discusses what alternative measures are necessary to ensure that the final remedy is protective of human health and the environment, should groundwater restoration be determined to be technically impractical. Topics discussed include technical data requirements, evaluation and decision-making criteria, documentation requirements, and alternative remedial strategies.

EPA. 1992. "RCRA Ground-Water Monitoring: Draft Technical Guidance." EPA/530/R-93/001. PB93-139-350. November. On-line address: http://www.epa.gov/reg3wcmd/ca/pdf/Rcra_gwm92.pdf

This document provides guidance for implementing RCRA groundwater monitoring regulations for regulated units referred to in 40 CFR Part 264, Subpart F and the permitting standards of 40 CFR Part 270. The document also provides guidance for complying with 40 CFR Part 264, Subparts J (tank systems), K (surface impoundments), L (waste piles), N (landfills), and X (miscellaneous units).

EPA. 1992. “Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities.” Addendum to Interim Final Guidance. July. On-line address: <http://www.epa.gov/correctiveaction/resource/guidance/sitechar/gwstats/gwstats.htm#July1992>

The purpose of this document is to assist regional and state personnel in evaluating groundwater monitoring data from RCRA facilities. The document provides guidance for statistical methods and sampling procedures that meet regulatory standards and are protective of human health and the environment. Broad topics of discussion include assumptions for statistical procedures, recommendations for including very low or undetectable concentrations of contaminants in statistical analyses, non-parametric comparison of compliance data to background data, statistical intervals (confidence, tolerance, and prediction), strategies for multiple comparisons, and other topics. Appendices contain look-up tables, information on non-parametric retesting strategies, guidelines for the construction of power curves, references, and GRITS/STAT 5.0 software and documentation.

EPA. 1992. “Developing a Work Scope for Ecological Assessments.” *ECO Update Intermittent Bulletin*. Vol. 1. No. 4. Publication 9345.0-051. May. On-line address: <http://www.epa.gov/oerrpage/superfund/programs/risk/ecoup/v1no4.pdf>

The purpose of this bulletin is to help remedial project managers plan and manage ecological assessments of sites as part of the remedial investigation (RI)/feasibility study (FS) process. The work scope, which specifies the work to be done for the ecological assessment as part of the overall RI, should state the studies and activities to be completed at each assessment phase, including sample collection, data analysis, and reporting.

EPA. 1992. “Guidance for Data Usability in Risk Assessment.” Final. Parts A and B. Publications 9285.7-09A, -09B. PB92-963356, -963362. May. On-line address: <http://www.epa.gov/oerrpage/superfund/programs/risk/datause/parta.htm> and <http://www.epa.gov/oerrpage/superfund/programs/risk/datause/partb.htm>

The “Guidance for Data Usability in Risk Assessment” document is designed to provide data users with a nationally consistent basis to determine the minimum quality and quantity of environmental analytical data needed to support Superfund risk assessment decisions. This guidance is appropriate regardless of the party conducting the investigation. Part A provides guidance applicable to most remedial investigation processes. Part B is specific to radioanalytical issues and should always be used in conjunction with Part A.

EPA. 1992. “Dermal Exposure Assessment: Principles and Applications.” EPA/600/8-91/011B. January. On-line address: <http://www.epa.gov/nceawww1/pdfs/derexp.pdf>

The purpose of this document is to describe the principles of dermal absorption and show how to apply these principles in actual human exposure scenarios. These principles are not official EPA guidance but are offered as a starting point for programs to adopt or modify in light of programmatic considerations.

EPA. 1991. “Ecological Assessment of Superfund Sites: An Overview.” *ECO Update Intermittent Bulletin*. Vol. 1. No. 2. Publication 9345.0-051. December. On-line address: <http://www.epa.gov/oerrpage/superfund/programs/risk/ecoup/v1no2.pdf>

This bulletin provides background on the Superfund program and the components of ecological assessments, including problem formulation, exposure assessment, ecological effects assessment, and risk

characterization. The bulletin also highlights the role of the ecological assessment in the RI/FS and post-RI/FS activities, which support risk-management decision-making.

EPA. 1991. "Risk Assessment Guidance for Superfund [RAGS], Volume I -- Human Health Evaluation Manual (Part C, Risk Evaluation of Remedial Alternatives), Interim." Publication 9285.7-01C. October. On-line address:
<http://www.epa.gov/oerrpage/superfund/programs/risk/ragsc/index.htm>

RAGS Part C provides guidance for evaluations of remedial alternatives in light of human health risk. These evaluations are conducted during the FS, during selection and documentation of a remedy, and during and after remedy implementation. Part C provides general guidance to assist in site-specific risk evaluations and to maintain flexibility in the analysis and decision-making process. This guidance does not discuss the evaluation of ecological effects that takes place during remedy selection and implementation, nor does it discuss the risk management decisions that are necessary at a Superfund site. The potential users of Part C are those involved in the remedy selection and implementation process, including risk assessors, risk assessment reviewers, remedial project managers, and other decision-makers.

EPA. 1991. "Risk Assessment Guidance for Superfund [RAGS], Volume I -- Human Health Evaluation Manual (Part B, Development of Risk-based Preliminary Remediation Goals (PRG))." Publication 9285.7-01B. On-line address:
<http://www.epa.gov/oerrpage/superfund/programs/risk/ragsb/index.htm>

RAGS Part B provides guidance on using EPA toxicity values and exposure information to derive risk-based PRGs for a Superfund site. Initially developed at the scoping phase using readily available information, risk-based PRGs generally are modified based on site-specific data gathered during the RI/FS. This guidance does not discuss the risk management decisions that are necessary at a Superfund site. The potential users of Part B are those involved in the remedy selection and implementation process, including risk assessors, risk assessment reviewers, remedial project managers, and other decision-makers.

EPA. 1990. "Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells." PB90-159807. EPA/600/4-89/034. February.

This document presents field-oriented guidance and technology for use in the design, construction, and installation of groundwater monitoring wells in various hydrogeologic settings. Special attention is given to the criteria that influence groundwater monitoring well design and construction. Topics of discussion follow the monitoring well from the planning stage through installation, development, operation, sampling, maintenance, and abandonment.

EPA. 1989. "Risk Assessment Guidance for Superfund [RAGS], Volume I -- Human Health Evaluation Manual (Part A)." EPA/540/1-89/002. December. On-line address:
<http://www.epa.gov/superfund/programs/risk/ragsa/index.htm>

RAGS Part A provides guidance on the human health evaluation activities that are conducted during the baseline risk assessment. The baseline risk assessment is an analysis of the potential adverse health effects (current or future) caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases. In Superfund investigations, the results of the baseline risk assessment are used to help determine whether additional response action is necessary at the site, modify PRGs, help support selection of the "no- action" remedial alternative, when appropriate, and document the magnitude of risk at a site, and the primary causes of that risk.

Baseline risk assessments are site-specific and therefore may vary in both detail and the extent to which qualitative and quantitative analyses are used. Causes of variability include: the complexity and particular circumstances of the site; availability of applicable or relevant and appropriate requirements; and other criteria, advisories, and guidance. After an initial planning stage, there are four steps in the baseline risk assessment process: (1) data collection and analysis; (2) exposure assessment; (3) toxicity assessment; and (4) risk characterization.

EPA. 1989. “Interim Final RCRA Facility Investigation (RFI) Guidance.” Vol. I-IV. EPA 530/SW-89-031. OSWER Directive 9502.00-6D. May. On-line address: <http://www.epa.gov/epaoswer/hazwaste/ca/resource/guidance/sitechar/rfi.htm>

The purpose of the RFI, the second phase of the RCRA corrective action program, is to collect information to characterize the nature, extent, and rate of migration of releases of hazardous waste or constituents. This information is interpreted to determine whether interim corrective measures or a corrective measures study is necessary. The RFI guidance document provides direction to regulatory agency personnel overseeing the implementation of RFIs at hazardous waste management facilities. The document also provides guidance to facility owners or operators who are developing and performing investigations based on regulatory agency determinations. The RFI Guidance is presented in 4 volumes:

- I - Development of An RFI Work Plan and General Considerations for RFIs
- II - Soil, Ground Water, and Subsurface Gas Releases
- III - Air and Surface Water Releases
- IV - Case Study Examples

EPA. 1988. “Guidance for Conducting Remedial Investigations and Feasibility Studies [RI/FS] Under CERCLA.” EPA/540/G-89/004. OSWER Directive 9355.3-01. October. On-line address: <http://www.epa.gov/oerrpage/superfund/resources/remedy/pdf/540g-89004-s.pdf>

This guidance provides the user with an overall understanding of the RI/FS process. The RI/FS process is the Superfund method of characterizing the nature and extent of risks posed by uncontrolled hazardous waste sites and determining the most appropriate means of remediating those sites. Potential users of this guidance include EPA personnel, state agencies, potentially responsible parties, federal facility coordinators, and consultants contracted to assist with RI/FS activities.

EPA. 1988. “Operation and Maintenance Inspection [OMI] Guide (RCRA Ground-Water Monitoring Systems).” OSWER Directive 9950.3. On-line address: <http://www.epa.gov/Compliance/resources/policies/civil/rcra/rcrainspecguid-rpt.pdf>

This document provides guidance for understanding and completing OMI of RCRA groundwater monitoring systems. An objective of the OMI is determining whether monitoring wells and sampling devices are properly maintained and capable of yielding representative groundwater samples and hydrologic data.

EPA. 1986. “Final RCRA Comprehensive Ground-Water Monitoring Evaluation (CME) Guidance Document.” OSWER Directive 9950.2. December. On-line address: <http://www.epa.gov/Compliance/resources/policies/civil/rcra/frcracmedoc-rpt.pdf>

This document provides guidance for understanding and completing CMEs of RCRA groundwater monitoring systems. An objective of the CME is determining whether a facility has in place a properly designed, operated, and maintained groundwater monitoring system, capable of adequately detecting and monitoring releases of contamination into groundwater.

EPA. 1986. “RCRA Ground-Water Monitoring Technical Enforcement Guidance Document.” OSWER Directive 9950.1. September. On-line address: <http://www.epa.gov/Compliance/resources/policies/civil/rcra/rcragwguiddoc-rpt.pdf>

This guidance details the components of a groundwater monitoring system necessary to comply with RCRA. Discussion primarily is directed toward interim status facilities and covers site characterization; determination of well numbers and locations; well design and construction; development and implementation of groundwater sampling and analysis plans and assessment plans; and statistical analysis of groundwater monitoring data.

Federal Remediation Technologies Roundtable (FRTR). 2003. “FRTR Homepage.” February 12. On-line address: <http://www.frtr.gov>

The FRTR is an interagency working group seeking to build a more collaborative atmosphere among federal agencies involved in hazardous waste site remediation. Members represent agencies that develop and use these technologies, including U.S. Department of Defense, EPA, DOE, U.S. Department of the Interior, and National Aeronautics and Space Administration. In addition to remediation technology updates and FRTR meeting information, this website contains the following tools and references:

- Technology screening tools (<http://www.frtr.gov/scrntools.htm>), including the “Remediation Technologies Screening Matrix” and the “Field Sampling and Analysis Technologies Matrix”
- Technology cost and performance information (<http://www.frtr.gov/costperf.htm>)
- Publications (<http://www.frtr.gov/publib.htm>)

Freeze, R.A., and J.A. Cherry. 1979. *Groundwater*. Englewood Cliffs, New Jersey: Prentice-Hall Publishing Company.

Groundwater provides a detailed and comprehensive presentation of hydrogeology, integrating chemistry, physics, geology, and calculus. Specific attention is given to transport processes, groundwater contamination, well hydraulics, aquifer yield, and analog and numerical modeling. Theoretical concepts are applied to real-world case studies. Mathematical derivations are presented in the appendices.

House of Representatives, Act 2869. 2002. Small Business Liability Relief and Brownfields Revitalization Act. January 11. On-line address: <http://www.epa.gov/brownfields/pdf/hr2869.pdf>

The Small Business Liability Relief and Brownfields Revitalization Act reformed Superfund law by providing liability protection for prospective purchasers, contiguous property owners, innocent landowners, and small business owners who contributed to waste sites. The Act also authorized increased funding for state and local programs that assess and cleanup brownfields.

Additional information on the Small Business Liability Relief and Brownfields Revitalization Act is available at <http://www.epa.gov/brownfields/sblrbra.htm>.

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Bibliography

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Interstate Technology and Regulatory Council (ITRC). 2003. “Regulatory Acceptance for New Solutions.” Accessed May 5. On-line address: <http://www.itrcweb.org>

This website is the homepage for ITRC, a state-led coalition of states, federal agencies, industry participants, and other stakeholders. It works to break down barriers and reduce compliance costs, making it easier to use new technologies and maximize resources. ITRC technical teams develop guidance documents and training courses to meet the information needs of regulatory staff, technology vendors, and environmental consultants. State regulators lead ITRC technical teams, which rely on broad-based participation from federal agencies, industry, academia, and other stakeholders in building collective knowledge and collaborative products. This website provides guidance documents on the following topics:

- Accelerated site characterization
(<http://www.itrcweb.org/common/content.asp?En=TA197873&sea=Yes&set=Both&sca=Yes&sct=Long>)
- Dense non-aqueous phase liquids
(<http://www.itrcweb.org/common/content.asp?En=TA72323&sea=Yes&set=Both&sca=Yes&sct=Long>)
- Diffusion samplers
(<http://www.itrcweb.org/common/content.asp?En=TA473431&sea=Yes&set=Both&sca=Yes&sct=Long>)
- Enhanced in situ bioremediation
(<http://www.itrcweb.org/common/content.asp?en=TA172940&sea=Yes&set=Both&sca=Yes&sct=Long>)
- In situ remediation
(<http://www.itrcweb.org/common/content.asp?en=TA301724&sea=Yes&set=Both&sca=Yes&sct=Long>)
- In situ chemical oxidation
(<http://www.itrcweb.org/common/content.asp?en=TA339169&sea=Yes&set=Both&sca=Yes&sct=Long>)
- Metals in soils
(<http://www.itrcweb.org/common/content.asp?en=TA338040&sea=Yes&set=Both&sca=Yes&sct=Long>)
- Permeable reactive barriers (walls)
(<http://www.itrcweb.org/common/content.asp?en=TA549175&sea=Yes&set=Both&sca=Yes&sct=Long>)
- Phytotechnologies
(<http://www.itrcweb.org/common/content.asp?en=TA863827&sea=Yes&set=Both&sca=Yes&sct=Long>)
- Plasma technologies
(<http://www.itrcweb.org/common/content.asp?en=TA954677&sea=Yes&set=Both&sca=Yes&sct=Long>)
- Policy
(<http://www.itrcweb.org/common/content.asp?en=TA535549&sea=Yes&set=Both&sca=Yes&sct=Long>)
- Radionuclides
(<http://www.itrcweb.org/common/content.asp?en=TA896374&sea=Yes&set=Both&sca=Yes&sct=Long>)

- Technology acceptance and reciprocity partnership
(<http://www.itrcweb.org/common/content.asp?en=TA916744&sea=Yes&set=Both&sca=Yes&sct=Long>)
- Thermal desorption
(<http://www.itrcweb.org/common/content.asp?en=TA305203&sea=Yes&set=Both&sca=Yes&sct=Long>)
- Unexploded ordnance
(<http://www.itrcweb.org/common/content.asp?en=TA600452&sea=Yes&set=Both&sca=Yes&sct=Long>)
- Verification
(<http://www.itrcweb.org/common/content.asp?en=TA174069&sea=Yes&set=Both&sca=Yes&sct=Long>)

Nebraska Department of Environmental Quality (NDEQ). Undated. “Hydrogeologic Characterization for Design of Ground-Water Monitoring Systems and to Support Engineering Design for Municipal Solid Waste Disposal Areas.”

Site characterization, as described in this guidance, has two goals: (1) to acquire enough site-specific and geotechnical data to support the engineering design of a facility and (2) to form a conceptual hydrogeologic model for monitoring well placement. The guidance also outlines the characterization process: the preliminary investigation, the geology and geotechnical field investigation, groundwater flow determination, interpretation and presentation of data, and groundwater monitoring well placement. The regulatory basis for this guidance is found in NDEQ Title 132, Chapter 2, Section 006, and Chapter 6, Section 002.

NDEQ. 2003. “Rules and Regulations Homepage.” Accessed May 5. On-line address:
<http://www.deq.state.ne.us/RuleandR.nsf/Pages/Rules>

This Rules and Regulations website provides links to current rules and regulations under NDEQ, as well as proposed rules and regulations. Information provided includes the title name and number, the effective date of the last title revision, and a link to the title table of contents and chapter text. Current titles included on the website include Titles 114-136 and 194-200.

NDEQ. 2002. “Title 128 – Nebraska Hazardous Waste Regulations.” April 13. On-line address:
<http://www.deq.state.ne.us/RuleAndR.nsf/pages/128-TOC-1>

Title 128 provides the Nebraska hazardous waste regulations. Criteria and variances are provided for identifying solid wastes and for identifying and listing hazardous wastes. Hazardous waste generator requirements are outlined for determination, notification, reporting, and record keeping. Requirements are provided for recyclable materials, specific hazardous wastes, large quantity generators, conditionally exempt small quantity hazardous waste generators, and transporters of hazardous waste

NDEQ. 2002. “Risk-Based Corrective Action (RBCA) at Petroleum Release Sites: Tier 1/Tier 2 Assessments and Reports.” 01-082. February. On-line address:
<http://www.deq.state.ne.us/Publica.nsf/780613fa1854e3b906256ab60068778a/66fdec793aefc4b286256a93005b8db8?OpenDocument>

RBCA is a consistent decision-making process used to assess potential human or environmental exposure risks to petroleum releases. RBCA is also used to determine the remedial actions appropriate in response to such releases. RBCA was developed by the Leaking Underground Storage Tank/Release Assessment

Section of NDEQ and is intended to apply to petroleum release sites potentially eligible for reimbursement under Nebraska Title 200, Rules and Regulations for Petroleum Release Remedial Action Reimbursement Fund; however, portions of this document may be applicable to other petroleum releases, as determined by NDEQ.

NDEQ. 2001. “Title 118 – Groundwater Quality Standards and Use Classification.” June 18. On-line address:
<http://164.119.180.2/862565E10070A920.nsf/0/AC27C31085A06397862568540059D1EC?Open>

Title 118 provides the NDEQ groundwater quality standards and use classification and defines their applicability to state groundwater and regulatory programs. The groundwater standards and classifications are intended to provide a foundation for other groundwater regulatory programs and are to be used in conjunction with such programs, where they exist.

NDEQ. 2000. “Title 132 – Integrated Solid Waste Management Regulations.” May 27. On-line address:
<http://www.deq.state.ne.us/RuleandR.nsf/dd5cab6801f1723585256474005327c8/99449df488e433fd862565e10070b1a9?OpenDocument>

Title 132 provides the Nebraska integrated solid waste management regulations. Requirements for permits, application procedures, and hearings are provided. Criteria and variances also are provided for municipal solid waste, delisted waste, industrial waste disposal areas, and land application units for repeated disposal or treatment of special wastes. Additional criteria are provided for fossil fuel combustion ash disposal areas, construction and demolition waste disposal areas, solid waste processing facilities, transfer stations, materials recovery facilities, solid waste compost sites, and other processing facilities. Financial assurance criteria, fees, rebates are discussed, as are junk accumulation, plastic container markings, and other general provisions. Appendices provide constituents for detection monitoring, lists of hazardous inorganic and organic constituents, and concentration values at the relevant point of compliance.

NDEQ. 1993. “Title 115 – Rules of Practice and Procedure.” August 8. On-line address:
<http://www.deq.state.ne.us/RuleAndR.nsf/pages/115-TOC>

Title 115 provides the NDEQ rules of practice and procedure. Rules and definitions are provided for filings and correspondence, public records availability and confidentiality, public hearings, voluntary compliance, contested cases, emergency proceedings, declaratory rulings, rule making, and variances. A copy of the Certificate of Service before the NDEQ is provided as an appendix.

Nebraska Health and Human Services System (NHHSS). 2003. “Title 178 – Environmental Health, Chapter 12.” Accessed on May 5. On-line address:
http://www.sos.state.ne.us/local/regsearch/Rules/Health_and_Human_Services_System/Title-178/Chapter-12.pdf

Chapter 12 of Title 178 provides the Nebraska regulations governing water well construction, pump installation and water well decommissioning standards, as administered by the NHHSS Department of Regulation and Licensure, Public Health Assurance Division. Topics covered include general requirements, domestic wells, irrigation and industrial wells, dewatering wells, groundwater monitoring wells and recovery wells, observation wells, test holes, groundwater heat pump wells, installation of pumps and pumping equipment, and water well decommissioning.

NHHSS. 2002. “Title 178 – Environmental Health, Chapter 10.” September 16. On-line address: http://www.sos.state.ne.us/local/regsearch/Rules/Health_and_Human_Services_System/Title-178/Chapter-10.pdf

Chapter 10 of Title 178 provides the Nebraska regulations governing licensure of water well and pump installation contractors and certification of water well drilling, pump installation, and water well monitoring supervisors, as administered by the NHHSS Department of Regulation and Licensure, Public Health Assurance Division. Topics covered include issuance of licenses and certificates; disciplinary action and other sanctions; reinstatement of licenses and certificates; and examination of applicants for licensure and certification.

NHHSS. 2002. “Title 179 –Regulations Governing Public Water Supply Systems, Chapter 2.” July 16. On-line address: http://www.sos.state.ne.us/local/regsearch/Rules/Health_and_Human_Services_System/Title-179/Chapter-2/Section-2.pdf

Chapter 2 of Title 179 provides the Nebraska regulations for public water supply systems, as administered by the NHHSS Department of Regulation and Licensure, Public Health Assurance Division. Topics covered include drinking water standards and treatment techniques; variances and exemptions; siting, design and construction of public water supply systems; operation and maintenance of public water supply systems; permits for operating public water supply systems; lead bans; control of lead and copper; filtration and disinfecting; and capacity development for new systems.

Oak Ridge National Laboratory (ORNL). 2003. “Ecological Risk Analysis: Guidance, Tools, and Applications.” February 26. On-line address: <http://www.esd.ornl.gov/programs/ecorisk/ecorisk.html>

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This document provides background information on the development of low-flow groundwater sampling procedures in the support of site assessments and remedial performance monitoring objectives. This document also discusses the application of low-flow sampling procedures under a variety of hydrogeologic settings.

42 U.S. Code (USC), Chapter 82, Sections 6901 et seq. 1976. Resource Conservation and Recovery Act (RCRA). On-line address: <http://www4.law.cornell.edu/uscode/42/ch82.html>

RCRA provided federal agencies with the authority to control hazardous waste from generation through transportation, treatment, storage, and disposal. RCRA also provided a framework for managing non-hazardous wastes. Amendments to RCRA in 1984 and 1986, respectively, required phasing out land disposal of hazardous waste and allowed EPA to address environmental issues related to the storage of petroleum products and other hazardous substances in underground storage tanks. RCRA focuses on active and future facilities. Of particular interest within the Act are Subtitles C, “Hazardous Waste Management,” and D, “State or Regional Solid Waste Plans.”

An overview of RCRA is available at <http://www.epa.gov/region5/defs/html/rcra.htm>. An outline of the Act is available at <http://www.epa.gov/region02/waste/outline.htm>.

42 USC, Chapter 103, Sections 9601 et seq. 1980. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). December 11. On-line address: <http://www4.law.cornell.edu/uscode/42/ch103.html>

CERCLA, commonly known as Superfund, provided federal agencies with the authority to respond directly to releases or threatened releases of hazardous substances capable of endangering human health and the environment. CERCLA also created a tax on the chemical and petroleum industries, which went to a trust fund for cleaning up abandoned, historical, or uncontrolled hazardous waste sites. The Superfund Amendments and Reauthorization Act (SARA) of 1986 reauthorized CERCLA cleanup activities and added technical requirements, enforcement authorities, site-specific amendments, and definition clarifications.

An overview of CERCLA is available at <http://www.epa.gov/superfund/action/law/cercla.htm>.

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ADDITIONAL WEBSITES

In addition to the websites listed above, the following websites are useful for collecting information for site investigations and remedial design. This is not a comprehensive listing of all websites that may be consulted.

Agency for Toxic Substances and Disease Registry ToxFAQs, at <http://www.atsdr.cdc.gov/toxfaq.html>

Federal Emergency Management Agency, Multi-Hazard Mapping Initiative, at <http://www.hazardmaps.gov/atlas.php>

Nebraska Department of Economic Development, at <http://info.neded.org/databook.php>

Nebraska Department of Natural Resources, at <http://www.dnr.state.ne.us/>

Nebraska Department of Roads, at <http://www.dor.state.ne.us/>

Nebraska Game and Parks, at <http://www.ngpc.state.ne.us/homepage.html>

Terraserver, at <http://terraserver.microsoft.com/>

Topozone, at <http://www.topozone.com>

U.S. Army Corps of Engineers, at <http://www.usace.army.mil>

U.S. Census Bureau Maps and Cartographic Products, at <http://www.census.gov/geo/www/maps/>

U.S. Department of Agriculture, Nebraska National Resources Conservation Service Soils, at <http://www.ne.nrcs.usda.gov>

EPA List of Drinking Water Contaminants and MCLs, at <http://www.epa.gov/safewater/mcl.html>

EPA Office of Wetlands, Oceans, and Watersheds, at <http://www.epa.gov/OW/index.html>

EPA Site Assessment portal, at <http://www.epa.gov/superfund/programs/siteasmt/autohome.htm>

U.S. Fish and Wildlife, National Wetlands Inventory, at <http://www.nwi.fws.gov/>

U.S. Geological Survey, at <http://www.usgs.gov/>

U.S. National Aeronautics and Space Administration, Earth Observing System Data and Information System, Socioeconomic Data and Applications Center, Geographic Correspondence Engine, at <http://plue.sedac.ciesin.org/geocorr/>

University of Nebraska – Lincoln, Conservation and Survey Division, at <http://csd.unl.edu>