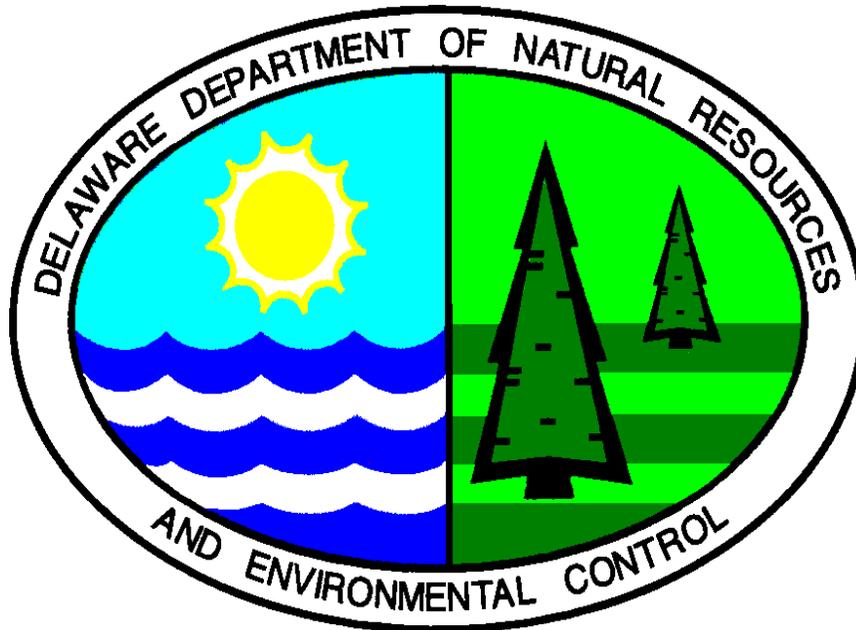


**OPERATION AND MAINTENANCE
GUIDANCE DOCUMENT FOR
HSCA AND VCP SITES**



**STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF AIR & WASTE MANAGEMENT
SITE INVESTIGATION AND RESTORATION BRANCH**

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OPERATION AND MAINTENANCE GUIDANCE FOR HSCA AND VCP SITES

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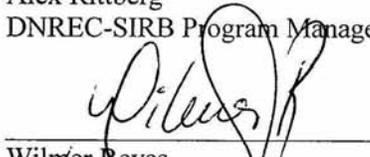
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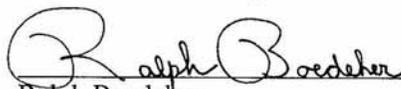
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1.0 INTRODUCTION

1.1 GENERAL

This guidance document, developed by the State of Delaware Department of Natural Resources and Environmental Control, Site Investigation and Restoration Branch (DNREC), establishes the policy for operation and maintenance (O&M) of facilities regulated under 7 Del. C., Chapter 91, the Delaware Hazardous Substance Cleanup Act (HSCA) and the Voluntary Cleanup Program (VCP). This O&M guidance further explains the requirements of the Department and Potentially Responsible Parties (PRPs) as described in the Delaware Regulations Governing Hazardous Substance Cleanup (regulations). By issuing this guidance document, DNREC-SIRB intends to clarify Subsection 8.8(c) of the regulations, which pertains to O&M and compliance monitoring, and Subsection 8.9 of the regulations, which pertains to periodic review of remedies.

The guidance applies to facilities where a Remedial Action (RA) has been implemented and where on-going operation, maintenance and monitoring is required to ensure the long-term integrity of the remedy and to verify that site remedial objectives are being met. This can be accomplished by: 1) the development and implementation of a comprehensive O&M Plan, and 2) periodic remedy evaluations. Periodic remedy evaluations will be performed by DNREC-SIRB until the time that DNREC-SIRB has determined that the contaminants of concern on a site have reached a concentration that ensures that no restrictions on the use of the facility are needed.

Sections 2.0 and 3.0 describe the purpose of an O&M Plan and the components that PRPs should include in the plan. Section 4.0 describes DNREC-SIRB's plan for performing periodic remedy evaluations of sites where a remedy has been implemented, and includes PRP reporting requirements in support of such evaluations. This guidance document was initially developed based on critical review of O&M approaches that are used in other states and/or federal environmental programs. Remedy evaluations have, in part, been modeled, in word and intent, after the Environmental Protection Agency's (EPA's) program for the performance of five-year reviews (OSWER Directive No. 9355.7-02, 1991).

Based on the experience gained and success in the application of this guidance, DNREC-SIRB may update, revise, or propose the guidance for promulgation at some point in the future, if necessary. Any regulatory consideration will be afforded the appropriate level of public comment and participation as required by Delaware law. A draft of the guidance was submitted for public comment in October 2001. No comments were received during the 30-day public comment period.

This guidance is consistent with all provisions of the HSCA regulations and is not intended to replace or contradict any requirements of the regulations. Further, nothing in this document should be viewed as limiting or eliminating the need for the exercise of good professional judgement.

1.2 APPLICABILITY

O&M activities and remedy evaluations shall be performed for HSCA and VCP sites where hazardous substances, pollutants, or contaminants remain at concentrations which exceed regulatory cleanup levels established under Section 9 of the HSCA regulations. This includes sites requiring any engineering controls, or access or land-use restrictions or controls, including remedies that attain protective levels for the current use, but which include restrictions on activities due to limits on possible future exposure. DNREC-SIRB will also review sites, which previously have been issued a “Certificate of Completion of Remedy” which were not remediated to regulatory cleanup levels.

O&M activities and remedy evaluations may be discontinued when hazardous substances, pollutants or contaminants (based on an approved period of confirmation monitoring), are below regulatory cleanup levels, and/or, when ARARs promulgated or modified after DNREC’s “Final Plan of Remedial Action” (FPRA) result in a determination that the remedy is protective. A letter to the PRP by DNREC-SIRB will be issued at the time DNREC-SIRB determines that O&M activities are no longer required at the site.

Situations where a PRP will bear the burden of performing O&M activities include, but are not limited to:

- When a site is zoned residential and contaminants in soil are left in place above unrestricted use standards. In this situation, the FPRA will include both engineering and institutional controls to prevent the public from coming in contact with contaminants.
- When a site is zoned commercial/industrial and contaminants in soil are left in place above restricted use standards. Again, the FPRA will include both engineering and institutional controls to prevent the public from coming in contact with contaminants.
- Any site where groundwater contamination exceeds the Maximum Contaminant Levels (MCLs), including at any point during confirmation monitoring. Confirmation monitoring requirements are discussed in Section 3.0 of this guidance document.

O&M is not required when contaminants in soil and groundwater are below unrestricted use standards

and MCL's, respectively.

2.0 PURPOSE OF AN O&M PLAN

The purpose of an O&M Plan is to provide the information necessary to properly operate and maintain a remedy in order to meet site remedial objectives. The O&M Plan should list activities, technical guidance and regulatory requirements to ensure effective operation of the remedy under both normal and emergency conditions. The O&M Plan should be written to focus on the needs of operating personnel who are not familiar with the history of the project and provide a platform for carry-over of information from the designer to the operating personnel. The plan should aid operating personnel in understanding the site and to set the guidelines for inspection and maintenance procedures. The O&M Plan should be a "stand-alone" document and should be prepared in a manner so that operating personnel, regulatory agencies, and other involved parties have a comprehensive understanding of: 1) site background and regulatory history, 2) site remedial objectives, 3) remedial design intent, 4) site as-built condition, 5) how to successfully operate site systems, 6) how to properly inspect and maintain the site and/or systems, 7) compliance monitoring, 8) how the remedial system is to be periodically evaluated, 9) health and safety issues, and 10) record keeping and reporting requirements.

Depending on the remedy, O&M requirements can vary greatly from site to site in magnitude and in the type of O&M activities that need to be performed. For example, a site whose remedy consists of natural ground-water attenuation would have relatively minor O&M requirements (i.e., periodic water quality monitoring, well maintenance, remedy evaluations, etc.). Conversely, a site whose remedy consists of ground-water extraction with onsite treatment would have significantly more O&M requirements (i.e., operation of systems, inspections, maintenance, compliance monitoring, remedy evaluations, etc.). As a result, site specific O&M Plans can vary in content and magnitude, depending on the remedy initiated.

A "Draft" O&M Plan should be submitted to DNREC-SIRB concurrent with submission of the site's final Remedial Design. A "Final" O&M Plan should be submitted prior to RA substantial completion, incorporating applicable RA data and DNREC-SIRB's comments to the O&M Plan draft submission. DNREC-SIRB defines substantial completion as the time at which remedial construction has progressed to the point where it is sufficiently complete, in accordance with the project documents, so that the remedy is properly functioning and performing as designed. O&M activities described in the O&M Plan should begin either one year after RA construction is completed, or when the remedy is considered substantially complete, whichever occurs earlier. DNREC-SIRB may grant extensions to the one-year period, as appropriate.

3.0 COMPONENTS OF AN O&M PLAN

Presented below is a typical outline of an O&M Plan that would be applicable to most HSCA and VCP sites, followed by a brief description of information that is to be provided for each of the components. The outline is presented as a recommended “Table of Contents” for O&M Plans. Although each project may have different requirements, this general outline should be followed for consistency. Adaptations needed to satisfy site/remedy conditions should be included in the sections provided in the general outline.

Typical Table of Contents - (*Example*)
Operation and Maintenance Plan

- I. Introduction
 - A. General
 - B. O&M Organization and Responsibilities
- II. Project Overview
 - A. Project Background
 - B. Applicable, Relevant, and Appropriate Requirements (ARARs)
 - C. Remedial Objectives
- III. Remedial Design and Action Overview
 - A. Design Overview
 - B. Construction Overview
- IV. Operation Requirements
 - A. General
 - B. System Components
 - C. Training Requirements
 - D. Contingent Operations
- V. Inspection and Maintenance
- VI. Compliance Monitoring Requirements
- VII. Health & Safety Considerations
- VIII. Record Keeping and Reporting
 - A. Periodic
 - B. Five-year Remedy Evaluations
- IX. Appendices

A brief description of what information should be provided within each of the above components follows:

I. INTRODUCTION

A. General

Provide a general description and purpose of the O&M Plan. Identify the site for which the O&M Plan has been prepared, who is preparing the document, and for whom the plan has been prepared. Provide a synopsis of subject matter covered in the plan.

B. Organization and Responsibilities

Describe the organization defining the roles and responsibilities involved with the implementation of O&M activities. Provide an organizational chart indicating names, roles, and reporting relationships. Include at a minimum, names of the responsible party contact, project manager, and principal engineer/scientist. Provide current contact information (i.e., address, telephone and fax numbers, and email address, if applicable, etc.).

II. PROJECT OVERVIEW

A. Project Background

- Describe the location and physical setting of the project site and give the relationship to public boundaries such as state, county, and city. Provide a site location map and a site layout map.
- Provide a general description of the project.
- Provide a chronology of the regulatory history of the site, including regulatory actions, orders, notifications, investigations performed (i.e., facility evaluations, remedial investigations, etc.), assessments, and actions initiated, etc. Provide a brief summary, which describes results and/or conclusions, for each item.

An overview of the Remedial Investigation results should be provided including contaminant data summaries and location figures. Contaminants of concern (COCs) shall be clearly identified (i.e., CAS No.) and described for each medium.

B. Applicable, Relevant and Appropriate Requirements (ARARs)

Provide a brief description of all ARARs that apply to the site and their relationship to the remedy. Provide an enhanced description for those ARARs, which affect the remedy O&M, including those that will be used to evaluate compliance, as appropriate.

C. Remedial Objectives

Describe in detail the remedial objectives of the project site as identified by the FPRA, identifying any regulations, orders, and/or studies, which establish the objectives. All performance standards should be described in detail (e.g., MCLs, Risk-Based Concentrations (RBCs), Uniform Risk-Based Standards (URSSs), etc.).

III. REMEDIAL DESIGN AND ACTION OVERVIEW

Describe DNREC-SIRB's FPRA for the site, and then provide an overview of the remedial design and construction as described below.

A. Design Overview

Provide a general overview of the criteria that formed the basis of the remedial design as well as a conceptual description of major and O&M applicable design components of the site. Include the name, address, and telephone number of the design engineer (if not included on the organization chart).

B. Construction Overview

Provide a historical summary of the RA phase of the site. Include start and completion dates of major work components, names, addresses, and telephone numbers of the general contractor, subcontractor(s), resident engineer/scientist, construction manager, DNREC-SIRB's project manager, etc. Describe any implemented variances to the remedial design, and reasons for the variances. Reference a complete set of as-built drawings and specifications and include these in the appendices to the O&M Plan. The as-built drawings and specifications shall incorporate all variances to the remedial design.

IV. OPERATION REQUIREMENTS

In general, this section should cover in detail the operations that are necessary for the functioning of the site and site systems to produce the remedial objectives. The level of operations for HSCA and VCP

facilities can range from little to no operative requirements (i.e., natural ground-water attenuation, landfill caps, ground-water monitoring zones, deed restrictions, etc.) to more extensive operative requirements (i.e., ground-water extraction/treatment systems, air-sparging systems, etc.). If operation requirements are not applicable for a specific site remedy, this section (e.g., Operation Requirements) may be omitted upon concurrence with DNREC-SIRB. Justification for omission of operation requirements shall be submitted to DNREC-SIRB for approval.

This section is to include equipment and/or system layouts complete with functional diagrams, schematics, isometrics, and data to explain the detailed operation and control of each individual piece of equipment and/or system. Descriptions shall be sufficiently detailed to provide system personnel with the understanding necessary to adequately perform system operation activities and to correctly interpret the results of these activities.

A. General

A general description of the operating system should be provided. List the major system components. Process flow and equipment diagrams, process instrumentation diagrams, and interlock diagrams/descriptions should be provided, if applicable. Provide start-up and shutdown procedures. Permit requirements and compliance issues should also be discussed.

B. System Components

In general, the following should be provided in detail for each of the major components of the operating system(s):

- Description and function, including its interrelationship with other functional systems and subsystems;
- Equipment and material specifications (Vender/manufacturer data should be provided in the appendices of the O&M Plan);
- Mechanical and instrumentation overview;
- Operation instructions/specifications; and
- Trouble shooting procedures.

In addition, the control system should be described in detail, including operating instructions. Interlocks should also be described.

All manufacturer warranties of system components should be listed. Copies of warranties should be included in the appendices of the O&M Plan.

C. Training Requirements

Describe the training requirements for the operation of site and/or site systems. Provide manufacturer's/vender's training manuals in the appendices of the O&M Plan.

D. Contingent Operations

If applicable, describe contingent operations to be performed when: 1) a system failure occurs, 2) a permit non-compliance is detected, 3) operations are not sufficient to be protective of human health and the environment, or 4) remedial objectives are not being met.

In addition (if applicable), provide emergency operation plans that cover preparations for, and responses to, project emergency conditions. An outline of the emergency operation records to be maintained and available for inspection is to be provided. Plans should cover: 1) chain of responsibility, 2) emergency communications network, 3) local emergency response assistance such as fire, police, and medical, and 4) state and federal emergency response agencies.

V. INSPECTION AND MAINTENANCE

Inspection and maintenance are necessary to ensure the long-term integrity and success of the remedy. This section should describe the inspection and maintenance details required for the proper care and efficient operation for each of the remedy elements. Regular inspections should be performed to evaluate performance and maintenance needs. Inspections pertaining to institutional controls (i.e., deed restrictions, groundwater management zones, etc.) should also be performed to verify that the controls remain in-place and have not been compromised. DNREC-SIRB inspections will be performed in consultation with the project's sponsor.

An overall inspection and preventative maintenance schedule should be provided that lists inspection and preventative maintenance activities for each of the remedy components. The schedule should also include the frequency at which the activity is to be performed.

Anticipated repair, replacement, and rehabilitation (RR&R) should be also discussed in this section. Repair is considered to entail those activities of a routine nature that maintain the remedy in a well-kept

condition. Replacement covers those activities taken when a worn-out component or portion thereof is replaced. Rehabilitation refers to a set of activities as necessary to bring a deteriorated remedy, or component thereof, back to its original conditions. RR&R actions are to conform to the project as-built plans and specifications unless other arrangements are made with DNREC-SIRB.

Procedures on how to document, correct and/or repair deficiencies observed during inspections should be described.

VI. COMPLIANCE MONITORING REQUIREMENTS

Compliance monitoring during the O&M period measures compliance with remedial objectives, risk reduction goals, and regulatory requirements. Types of compliance monitoring include protection monitoring, performance monitoring and confirmation monitoring. Protection, performance and confirmation monitoring and procedures should be described in detail in this section.

Protection monitoring should be performed to confirm that public health, welfare, and the environment are adequately protected. For example, air monitoring may be required if on-site personnel are performing O&M activities that would expose them to hazardous substances. Protection monitoring should be performed during O&M whenever there is a risk that an event or activity may cause or threaten a release that may represent a danger to on-site personnel, to the public, or the environment. Actions should be taken in accordance with the O&M health and safety contingency plan should a release occur that presents a danger to public health, welfare or the environment. Protection monitoring required by the regulations during RA construction should be included in the RA health and safety plan.

Performance monitoring should be performed to ensure that progress toward attaining clean up standards and, if appropriate, other performance standards, is being achieved. For example, periodic groundwater quality monitoring would be performed to assess the effectiveness of a “pump and treat” system in reducing a plume of groundwater contaminants. The frequency of performance monitoring will depend on the site remedy, site conditions, and risks associated with the site. The actual frequency of performance monitoring will be assessed on a site by site basis by DNREC-SIRB.

Once clean up standards, and/or other performance standards have been attained, confirmation monitoring should be performed over a period of time to confirm the long-term effectiveness of a remedy. The frequency of confirmation monitoring will depend on the site remedy, site conditions, and risks associated with the site. DNREC-SIRB may allow an approach that scales confirmation monitoring back over time, i.e., quarterly for the first two years, semi annually for years 3 to 5, annually for years 6

to 8, etc. The actual frequency of confirmation monitoring will be assessed on a site by site basis by DNREC-SIRB. DNREC-SIRB will bear the responsibility of confirmation monitoring in the situation where a site is zoned commercial/industrial and contaminants in soil are less than the restricted use standards, but greater than the unrestricted use standards.

Periodic monitoring should be performed to: 1) confirm that public health, welfare, and the environment are adequately protected, 2) ensure proper operation of the remedy, 3) evaluate compliance with federal, state, and local regulations and permits, 4) evaluate whether remedial objectives are being accomplished, and 5) collect data to assess remedy and formulate recommendations. Accordingly, a comprehensive list of compliance monitoring requirements, frequencies, and procedures should be provided.

A detailed discussion for each of the monitoring activities should be provided and include a discussion on how the data are to be used to assess safety, operative and compliance issues. When monitoring requirements include, but are not limited to, activities such as ground water quality monitoring, influent/effluent quality monitoring, air monitoring, etc., a Sampling and Analysis Plan (SAP) should be developed and included in the appendices of the O&M Plan. The SAP describes the collection of data and the procedures that will be used to ensure its quality, and at a minimum, should be prepared in accordance with DNREC-SIRB's Standard Operating Procedure for Chemical Analytical Programs. The SAP consists of a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP). The FSP should contain information relative to site background, sampling objectives, sampling location and frequency, sample designation, sampling equipment and procedures, sample handling, and analytical protocols and standards. Proposed laboratories(s) should be identified and pre-approved by DNREC-SIRB. The FSP shall include a site map indicating locations of all monitoring points and include monitoring well boring logs and well construction details. The QAPP element of the SAP should present the policies, objectives, and functional activities undertaken to assure the quality of data collected.

VII. HEALTH & SAFETY CONSIDERATIONS

Health and safety issues should be discussed as it relates to all O&M activities. A site specific Health and Safety Plan (HASP) should be prepared in accordance with HAZWOPPER: 29 Code of Federal Regulations (CFR) 1910.120 and included in the appendices of the O&M Plan. A brief summary of the most relevant issues described in the HASP should be provided in this section, including protection monitoring requirements. In addition, any site conditions or O&M activities which could potentially cause a release that presents a danger to public health, welfare or the environment should be described. Actions to be taken, should a potential for a release exist, should be addressed in detail in the HASP contingency plan.

VIII. RECORD KEEPING AND REPORTING

A. Periodic

Provide a procedure for the documentation and reporting of O&M activities. All O&M activities should be documented to provide an accurate record of activities at the project site.

- An O&M field logbook should be maintained for all field activities. As a minimum, entries in the field logbook should include: 1) date and time of starting work, 2) names of personnel at site, 3) purpose of proposed work effort, 4) location of work area, 5) details of work effort, 6) field observations, 7) field measurements, 8) equipment used, and calibration data, 9) health and Safety issues, 10) compliance monitoring performed, 11) samples collected including location, sample number, collection time, etc., 12) problems encountered and action taken, and 13) all other applicable information.
- Photographic documentation should be provided when applicable.
- An inspection and preventative checklist should be developed and used during O&M activities. Any deficiencies identified during inspections and preventative maintenance activities that require attention should be recorded on the checklist and in the field logbook. Measures to correct the deficiencies should also be recorded. Examples of an inspection checklist and means to document deficiencies are provided in Appendix A.

Reports summarizing all O&M activities should be periodically submitted to DNREC-SIRB, and other applicable authorizing government agencies. The frequency of reporting shall be determined by DNREC-SIRB. Typically, reporting frequency will coincide with the frequency of periodic compliance monitoring requirements (i.e., quarterly groundwater monitoring). However, the actual reporting frequency will depend on the site remedy and risks associated with the site.

At a minimum, reports should include, but are not limited to: 1) summary of activities performed since a previous report, 2) copies of applicable pages from O&M logbook, 3) inspection and preventative maintenance check lists, 4) required and implemented RR&R activities, and 5) compliance monitoring results including data collected since the previous report, and a cumulative presentation of data (in tabular form) of all data collected to date. In addition, when applicable, all compliance monitoring data shall be electronically reported to DNREC-SIRB using the Delaware Data Deliverable Model (3DM).

An evaluation of all applicable O&M and compliance monitoring data should be performed and discussed to: 1) confirm that public health, welfare, and the environment are adequately protected, 2) confirm proper operation of the remedy, 3) confirm compliance with federal, state, and local ARARs and permits, and 4) confirm that remedial objectives are being accomplished.

Proposed or performed corrective action should be described in detail in the event non-conformance(s) has been determined. Plans to modify remedial efforts should be presented in the event remedial objectives are not being met.

Notification to and approval by DNREC-SIRB shall be made prior to initiating any modifications to the remedy, and prior to any proposed development at the site.

B. Five-year Remedy Evaluations

Periodic remedy evaluations will be performed by DNREC-SIRB on HSCA and VCP sites to confirm that the remedy as prescribed in the FPRA remains effective at protecting human health and the environment. In support of DNREC-SIRB's remedy evaluation, the PRP(s) will be required to submit a Remedy Evaluation Report (RER), as described in Section 4 of this guidance document. Performance of the RER by the PRP shall be described in detail in this section of the O&M Plan.

IX. APPENDICES

Appendices to the O&M Plan should include (when applicable), at a minimum, the following:

- As-built Drawings and Specifications;
- Vender Data: A complete set of data, provided by the equipment manufacturer, required for operation, maintenance, and checkout should be included. Vender shop drawings should also be included;
- Warranty Information;
- Training Manuals;
- Sampling and Analysis Plan; and
- Health and Safety Plan.

4.0 REMEDY EVALUATIONS

4.1 DNREC-SIRB EVALUATIONS

Periodic reviews and remedy evaluations will be performed by DNREC-SIRB on HSCA and VCP sites to confirm that the remedy as prescribed in the FPRA remains effective at protecting human health and the environment (i.e., the remedy is operating and functioning as designed, institutional controls are in place and continue to be protective) and, if applicable, to evaluate whether original cleanup levels as established by the FPRA remain protective. The focus of the evaluation would depend on the remedial objectives for the site. For example, if protectiveness is being assured through exposure protection (i.e., containment with a soil or asphalt cover) and institutional controls (i.e., deed restrictions), the evaluation would focus on whether the protection remains effective and the controls remain in-place. For sites where ongoing remedy operations have not yet achieved the remedial clean-up objectives prescribed in the FPRA (i.e., extraction and treatment system), the evaluation would focus on both the effectiveness of the technology implemented, and on specific performance levels established in the FPRA.

Remedy evaluations will be performed for HSCA and VCP sites where hazardous substances, pollutants, or contaminants remain at concentrations which exceed regulatory cleanup levels established under Section 9 of the HSCA regulations. This includes sites requiring any engineering controls, or access or land-use restrictions or controls, including remedies that attain protective levels for the current use, but which include restrictions on activities due to limits on possible future exposure. DNREC-SIRB will also review sites, which previously have been issued a "Certificate of Completion of Remedy" which were not remediated to regulatory cleanup levels. Remedy evaluations will also be performed on sites where an interim remedy has been performed. For these sites, DNREC-SIRB will generally limit the scope of the evaluation to those activities necessary to determine whether the specific actions required by the FPRA are serving the protective purpose for which the interim remedy was intended (i.e., water supply remains in place, plume control, hazardous substances remain contained, etc.).

Remedy evaluations will generally be performed by DNREC-SIRB every five years after initiation of the RA. More frequent reviews may be performed if site conditions warrant it. DNREC-SIRB may terminate remedy evaluations when hazardous substances, pollutants or contaminants (based on an appropriate period of confirmation monitoring), are below regulatory cleanup levels, and/or, when ARARs promulgated or modified after the FPRA result in a determination that the remedy is protective. A letter to the PRP by DNREC-SIRB will be issued at the time DNREC-SIRB determines that O&M activities are no longer required at the site.

4.2 REMEDY EVALUATION REPORTING REQUIREMENTS

This section describes minimum reporting requirements to DNREC-SIRB by the site PRP(s) in support of DNREC-SIRB's evaluation of the site remedy. The PRP(s) shall notify DNREC-SIRB in writing of their intent to perform the remedy evaluation, conveying schedule requirements for submission of a Remedy Evaluation Report (RER). The intent of the RER is to confirm that the remedy as prescribed in the FPRA is operating and functioning as designed, institutional controls are in-place and continue to be protective, and if applicable, to evaluate whether original cleanup levels as established by the FPRA remain protective of human health and the environment. It is recommended that the PRP(s) meet with DNREC-SIRB prior to initiating the RER to perform a joint site visit, review site status, and to discuss DNREC-SIRB's expectations regarding content of the RER.

Presented below is a typical outline of a RER that would be applicable to HSCA and VCP sites, followed by a brief description of the information that is to be provided for each of the components. Although each project may have different requirements, this general outline should be followed for consistency. Adaptations needed to satisfy specific site remedy/conditions should be included in the sections provided in the general outline. The level of detail in the RER will vary depending on the nature and complexity of the remedy. In general, the level of detail in the RER should be such that DNREC-SIRB can adequately determine whether the remedy remains protective of human health and the environment.

- I. Introduction
- II. Project Overview
 - A. Project Background
 - B. Remedial Objectives
 - C. Organization and Responsibilities
 - D. Applicable, Relevant and Appropriate Requirements (ARARs)
- III. Remedial Design and Action Overview
- IV. Operation and Maintenance Overview
 - A. Summary of inspections, maintenance, and operations
 - B. Summary of compliance monitoring
 - C. Evaluation of operating systems
- V. Remedy Evaluation
- VI. Conclusions and Recommendations

A brief description of what information should be provided within each of the above components follows:

- I. INTRODUCTION, II. PROJECT OVERVIEW, AND III. REMEDIAL DESIGN/ACTION

OVERVIEW

The introduction, project overview, and remedial design and action overview of the RER can essentially be taken from the site O&M Plan (refer to requirements prescribed in Section 3.0), however, these components of the RER should be updated to be inclusive of O&M activities and events.

IV. OPERATION AND MAINTENANCE OVERVIEW

The O&M overview contained within the RER should at a minimum, summarize inspections, maintenance, operation activities performed at the site, and provide a summary of compliance monitoring activities and data. A cumulative presentation of monitoring data (in tabular form) of all data collected to date should be provided. An evaluation of all operating systems and/or remedy components should be presented, including discussion pertaining to any deterioration and/or inefficiencies of the systems and/or remedy components. If deterioration or inefficiencies exist, the need for further repair or further actions should be evaluated.

V. REMEDY EVALUATION

An evaluation of all applicable O&M and compliance monitoring data, new information or considerations relevant to an assessment of protectiveness, and a review and evaluation of newly promulgated ARARs should be performed to determine the degree to which the remedy is performing as intended and the level of protection offered to human health and the environment. The review should:

- Confirm that public health, welfare, and the environment are adequately protected;
- Confirm that the remedy is operating and functioning as designed;
- Confirm compliance with federal, state, and local ARARs and permits;
- Confirm that institutional controls are in-place, in good condition, and continue to be protective;
- Confirm whether original cleanup levels as established by the FPRA remain protective of human health and the environment; and
- Confirm that remedial objectives are being accomplished.

Evaluations as described above should be performed for each component of the remedy. As part of the remedy evaluation, an ARAR review should be performed to provide an evaluation of newly promulgated or modified requirements of federal and state laws to determine if they are applicable ARARs and to determine if they call into question the protectiveness of the remedy. For example, a new federal or state MCL may be promulgated at a more stringent level calling into question the

protectiveness of a ground-water cleanup at the former MCL. A more stringent MCL could also cause additional contaminants to be added to the list of COCs identified in the FPRA. The review should also consider pending changes in zoning or land-uses that would undermine institutional controls and/or exposure protection established as part of the remedy.

DNREC-SIRB recognizes that a review of operating and compliance monitoring data and ARARs will be appropriate for performance of the remedy evaluation for all but a relatively few cases where site-specific circumstances suggest additional data may be needed. For example, the lack of expected change in the level of contaminants, as monitored, might suggest additional source control or sampling, or increased evaluation of remedial components. Another example would be recalculation of risk or performance of additional risk assessments should new COCs be detected, or newly promulgated ARARs trigger such requirements. In the event that further analysis is indicated by site conditions during remedy evaluation (i.e., additional sampling, recalculation of risk assessment, performance of new risk assessment, etc.), the PRP shall notify DNREC-SIRB in writing, describing proposed actions.

For sites where protectiveness is assured, in whole or in part, through exposure protection (i.e., containment) and/or institutional controls (i.e., deed restrictions), the exposure protection features and controls, their intended purpose, condition and current and long-term effectiveness should be evaluated and discussed. For sites where ongoing remedy operations have not yet achieved the remedial cleanup objectives (i.e., extraction and treatment systems), the current and long-term effectiveness of the technology implemented should be evaluated and discussed.

Optimization of the existing remedy should be evaluated and discussed. In some cases, new technologies may be able to accomplish the same remedial objectives as the existing remedy with lower cost and accelerated cleanup times. Evaluation of new technologies are encouraged should evaluations indicate that the current remedy is no longer protective of human health and environment, and/or remedial objectives can be accomplished more efficiently or cost effectively using a different technology.

VI. CONCLUSIONS AND RECOMMENDATIONS

Conclusions resulting from the remedy evaluation should be summarized in this section. A statement on whether the remedy remains protective of human health and the environment should be provided. Recommendations and plans to correct any deficiencies noted in the remedy evaluation should be described in detail, including (if applicable), optimization recommendations, recommended changes in system components, recommended changes in O&M activities, recommended changes to compliance monitoring program, recommended additional studies and recommended alternative technologies. Plans

to modify remedial efforts should be presented in detail in the event remedial objectives are not being met.

If it has been concluded during the remedy evaluation that site cleanup levels, and other appropriate regulatory standards, have been attained, then recommendations regarding subsequent confirmation monitoring should be described in detail. Recommended confirmation monitoring should adequately confirm the long-term effectiveness of the remedy.

5.0 REFERENCES

Environmental Protection Agency, *Structure and Components of Five-Year Reviews*, OSWER Directive No. 9355.7-O2, May 23, 1991.

State of Delaware, Department of Natural Resources and Environmental Control Superfund Branch, *Hazardous Substance Cleanup Act Guidance Manual*, October 1994.

State of Delaware, Department of Natural Resources and Environmental Control, *Standard Operating Procedure for Chemical Analytical Programs*.

State of Delaware, Department of Natural Resources and Environmental Control, Division of Air and Waste Management, Site Investigation and Restoration Branch, *Delaware Regulations Governing Hazardous Substance Cleanup*, September 1996.

Additional references applicable to O&M of HSCA and VCP sites are included in Appendix B of this guidance document. Other appropriate references are also applicable.

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APPENDIX A

EXAMPLE INSPECTION CHECKLISTS

**HEALTHWAYS SITE OPERATION & MAINTENANCE
FIELD INSPECTION REPORT**

Date(s):	Time Arrived:	Time Departed:
Weather:		Page ____ of ____

Field Personnel:

Equipment Utilized On-site:

Inspection Activity	Yes	No	N/A	Inspection Details/Deficiencies
Reviewed O&M and H&S Plans	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Mowing Required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Mowed Vegetative Cover	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Bare Spots Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Vector Penetrations Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Intrusive Vegetation Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Erosion Problems Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Exposed Liner Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Drainage Swale Problems Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Clogging of Inlets/Outlets Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Bench Integrity Problems Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Settlement/Ponding Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Slope Instability Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Debris/Dumped Material Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Guardrail Problems Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Entrance Gates Problems Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Gas Vent Problems Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Monitoring Well Problems Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Distress to Site Trees Observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Performed Gas Vent Monitoring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	See Reverse Side for Points Monitored
Performed Ground-Water Sampling	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	See Reverse Side for Well Nos. Sampled
DNR Written	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	DNR No.:

DNR Description:

**HEALTHWAYS SITE O&M
DEFICIENCY NOTICE REPORT**

DNR No.:

Inspection Report Date:

Inspector:

Date of DNR Submission:

Date Deficiency Corrected:

Date of Final Inspection:

Location:

Description of Deficiency:

Action Taken:

Contractor:

Equipment Utilized On-site:

Materials Used On-site:

Sketches/Details:

APPENDIX B

ADDITIONAL APPLICABLE REFERENCES

Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media, U.S. EPA Office of Policy, Planning, and Evaluation, EPA 230/02-89-042, Washington DC, 1989.

Methods for Evaluating the Attainment of Cleanup Standards, Volume 2: Ground Water, U.S. EPA Office of Policy, Planning, and Evaluation, PB94-138815, Washington DC, July 1992.

Statistical Methods for Evaluating the Attainment of Cleanup Standards, Volume 3: Reference-Based Standards for Soils and Solid Media, EPA Office of Policy, Planning, and Evaluation, PB94-176831, Washington DC, July 1992.

Test Methods for Evaluating Solid Waste, SW-846 Volume II: Field Methods, U.S. EPA Office of Solid Waste Management Division, 3rd edition, November 1985.

Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Interim Final Guidance, U.S. EPA Office of Solid Waste Management Division, 3rd edition, April 1989.

Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance, U.S. EPA Office of Solid Waste Management Division, 3rd edition, June 1992.

Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water, U.S. EPA Office of Research and Development, EPA/600/R-98/128, September 1998.

Remedial Process Optimization Handbook/Long-Term Monitoring Optimization Guide, U.S. Air Force Center for Engineering Excellence (AFCEE), Environmental Restoration, 2001, available from: <http://www.afcee.brooks.af.mil/er/rpo.htm>.

Remedial Process Optimization/Remedial System Evaluation, Federal Remediation Technologies Roundtable, 2001, various guidance and publications, available from: <http://www.frtr.gov/optimization>.

Remedial System Evaluation (RSE) Checklists, U.S. Army Corps of Engineers, 2001 available from: <http://www.environmental.usace.army.mil/library/guide/rsechk/rsechk.html>.