



Montana Cleanup Guidance for Petroleum Releases

Draft
November 2020

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Referenced documents available at DEQ’s website:

<http://deq.mt.gov/Land/Just/techguidlist>

- MT DEQ Risked-Based Corrective Action Guidance for Petroleum Releases
- MT DEQ Remedial Investigation Guidance
- MT DEQ Remedial Alternatives Analysis Guidance
- MT DEQ Release Closure Plan
- MT DEQ Cleanup Guidance for Petroleum Releases
- MT DEQ Vapor Intrusion (VI) Guidance
- MT DEQ Monitored Natural Attenuation
- MT DEQ Petroleum Release Closure Guidance
- MT DEQ Glossary of Terms

Cleanup Guidance for Petroleum Releases

Montana Department of Environmental Quality (DEQ)
Petroleum Tank Cleanup Section (PTCS)

Overview

This DEQ guidance describes the objectives and expectations required for a cleanup work plan (CWP) to comply with Montana and federal law that addresses petroleum tank releases (Release) overseen by PTCS. These include specific items for a CWP and detailed items for a Cleanup Report (Report). Release in this guidance encompasses all leaks, spills, and overflows of petroleum or petroleum products from petroleum storage tank (PST) systems including but not limited to underground storage tanks (UST), aboveground storage tanks (AST), piping, sumps, and dispensers. The Administrative Rules of Montana (ARM) 17.56.605 states:

“...owners and operators are responsible for submitting a (cleanup) plan that provides adequate protection of human health, safety, and the environment...”

“In order to prepare the cleanup plan, owners and operators must properly evaluate and interpret the field and analytical results of the site or remedial investigation to define the extent and magnitude of free product, adsorbed phase product, dissolved phase plume and vapor phase product.”

Section 1. Objectives

The CWP objective for each Release is to ensure adequate protection of human health, safety, and the environment by implementation of the plan. Additionally, the CWP should be developed based on the results of the remedial investigation (RI), the remedial alternatives analysis (RAA), and/or the release closure plan (RCP) that includes reliable and effective remediation technologies to resolve the Release.

Section 2. Expectations

DEQ expects an owner and/or operator (O/O) of a PST system – including properties that historically had a PST system (Facility) – associated with a Release to accomplish the following:

- Obtain professional environmental consulting services to plan and conduct cleanup actions; the consultant represents the O/O and should be experienced with successful investigations, cleanups, and resolutions of Releases.
- Meet with the O/O’s consultant and DEQ’s project manager to discuss the Release, RI report; RAA and/or RCP, and plan work required to cleanup and resolve the Release.
- Prepare and submit a CWP to DEQ for review and approval.
- Conduct the cleanup according to a DEQ-approved CWP and maintain contact with DEQ. Recommend and discuss CWP modifications required to achieve the cleanup objectives. DEQ will approve agreed upon CWP modifications.
- Submit comprehensive Report(s) that document cleanup work, results, and recommendations.

The cleanup should be conducted using appropriate scientific and engineering principles, technology, and methods to ensure the following are met:

- Design and implement a cleanup method based on site-specific conditions, the RI, RAA, and/or the RCP to remediate known or potential exposure pathways to human health and/or the environment;
- Report on the implementation/installation of the cleanup method, monitoring, and optimization;
- Cleanup petroleum contamination and mitigate all known and probable routes of exposure from the Release to identified receptors;
- Mitigate risks if unexpected conditions are identified that may pose an immediate threat to receptors at any time during the cleanup;
- Identify issues and obstacles that interfere with achieving the CWP objectives, promptly discuss issues with DEQ's project manager, and recommend appropriate modifications that will ensure the CWP objectives are met;
- Assess the effectiveness of the cleanup conducted based upon results obtained from both field work and sample data;
- Determine the extent and magnitude of residual petroleum contamination not addressed by the cleanup via collection and laboratory analysis of soil and/or groundwater samples as specified in DEQ's Risked-Based Corrective Action Guidance for Petroleum Releases (RBCA), and validation of laboratory analytical data;
- Prepare detailed maps, tables, and other necessary figures to illustrate and summarize the site-specific data;
- Update the Release Closure Plan (RCP) using the DEQ-provided form;
- Prepare and submit a Report to DEQ;

Section 3. Cleanup Work Plan and Report Expectations

The CWP and Report expectations discussed in this guidance and detailed below address the issues and expectations for most petroleum releases. Use of this guidance will facilitate preparation and review of documents; ensure that required information is collected to document the impacts and potential impacts on public health and the environment; recommend and choose effective cleanup methods based on completed RI and RAA; and consider reliable closure pathways to resolve the Release.

Owner/Operators (O/Os) and their consultants are encouraged to contact DEQ's project managers to confer on draft work products as they are being prepared for the cleanup, clarify any portion of a CWP request that is not clearly understood, and propose site-specific modifications to CWP tasks necessary to meet cleanup objectives. DEQ will work with the O/Os and their consultants to define the additional CWP tasks and expectations. Only DEQ can approve modifications to the CWP tasks and report expectations in this guidance.

DEQ will use this Cleanup Guidance to review submitted CWPs and Reports. DEQ's approval of proposed modifications is required before the work is completed, not after. O/Os and their consultants

may proceed with work plan tasks prior to DEQ's approval of the CWP or modifications; however, there is a risk work completed without DEQ's approval may result in additional or different work.

Section 4. Cleanup Work Plan

When DEQ requests site cleanup be performed, the O/O and their consultant will prepare a CWP in accordance with the expectations for Release Cleanup (refer to CWP Expectations detailed below) and submit the CWP to DEQ for review and approval. DEQ may also provide written site-specific guidance to the O/O for additional items to be included or excluded for Release Cleanup. DEQ will provide a copy of the submitted CWP to the county sanitarian and other local or tribal government officials with jurisdiction over the release for comment. Members of the public directly affected by the planned cleanup activities will be notified. If a Release is eligible for reimbursement from the Petroleum Tank Release Cleanup Fund (PTRCF), the Petroleum Tank Release Compensation Board (PTRCB) staff will also be provided a copy.

After considering comments received from local and tribal governments, DEQ will review and approve the CWP if it meets the detailed Cleanup Work Plan Expectations listed below and site-specific guidance provided by the DEQ project manager. The O/O will be notified of DEQ's approval and the deadline to have the CWP work completed and a report submitted to DEQ. DEQ will determine a reasonable deadline based upon severity of risks posed to human health, safety, and the environment, the amount of prior work completed, and other relevant site-specific factors.

The O/O and their consultant are expected to communicate with DEQ regarding recommendations to modify the CWP to better achieve cleanup objectives and about any issues that are not clearly understood regarding completion of the CWP. If unexpected conditions are identified or encountered that may pose an immediate risk to receptors at any time during the release cleanup, the O/O or their consultant should immediately notify DEQ and take steps to mitigate the risks.

Section 5. Cleanup Report

DEQ expects that each cleanup report (Report) will clearly and comprehensively document the cleanup of the Release (refer to Cleanup Report - Expectations detailed below). If multiple cleanup technologies are necessary as part of a "treatment train" and a phased approach to implementing the cleanup is necessary, the schedule of work and deliverables will need to be submitted as part of the CWP. In some cases, providing additional cleanup information may require the submittal of a supplemental cleanup report.

Upon completion of the CWP implementation (e.g., fieldwork, data collection, analysis, etc.); the O/O should document the results of the cleanup in accordance with the Cleanup Report - Expectations below and site-specific guidance provided by the DEQ project manager. The results of all CWP tasks, conclusions, recommendations, an updated RCP, and all supporting data should be included in the Report. DEQ will evaluate the submitted report based on the detailed Report expectations listed below; if DEQ determines additional information, data, analysis, or corrections are required to meet cleanup objectives, then DEQ will notify the O/O and their consultant in writing of report deficiencies.

Cleanup Work Plan – Expectations

Montana Department of Environmental Quality (DEQ)
Petroleum Tank Cleanup Section (PTCS)

This section describes items to assist owners and operators (O/O) and their consultants to meet the minimum requirements for a cleanup work plan (CWP) by Montana and federal laws. This guidance provides the basic expectations for a CWP before it will be approved by DEQ. It is the O/O's responsibility to confer with the DEQ project manager to determine if, and what, modifications to the CWP will be necessary based on potentially changing conditions at the Facility.

DEQ will evaluate the CWP against the items listed below and site-specific guidance provided by the DEQ project manager. DEQ will approve the CWP if it adequately addresses all the items listed below. If the CWP is not approved, DEQ will notify O/Os and their consultant of deficiencies. The O/O is responsible for correcting the CWP deficiencies.

Section 1. Title Page

Title Page should be no longer than one page and include the following:

- Date
- Responsible party's name, mailing address, and email address
- Name of O/O's contact person, mailing address, and email address (if different from above)
- Subject line with the following information:
 - o Cleanup work plan for the petroleum release at (Facility name, street address, town, county), MT (zip code)
 - o DEQ Facility ID (number), Release Number(s), and Cleanup Work Plan ID(s)
- Consultant's name, mailing address, telephone number, and email address (if not on letterhead)
- Name of person who prepared the cleanup work plan

Section 2. Executive Summary

The executive summary should not exceed one page in length. It should reference DEQ's request for a cleanup work plan and general scope of work to be conducted.

Section 3. Facility Summary and Current Conditions

Provide a brief Facility summary and describe the current conditions. This will be based on information, conclusions, and recommendations detailed in the previously completed remedial investigation (RI) and remedial alternatives analysis (RAA) reports. This section will also describe any changes to the facility use, layout, and other pertinent information that has changed since the RI and RAA Reports were submitted or will change during implementation of the CWP.

Section 4. Objectives of Cleanup Work Plan (CWP)

State the site-specific objectives for the cleanup of this Release.

- Specific goals of this CWP:
 - Media addressed
 - Cleanup levels
 - Evaluation benchmarks
 - Exposure pathways addressed
- Identify and state the purpose and treatment objectives of each task

Section 5. Cleanup Method Chosen

Summarize the cleanup methods evaluated and why this method was chosen. O/O (and/or the responsible party) and their consultant are expected to choose an appropriate remediation technology, or combination of technologies, to adequately address petroleum contamination present at the Facility. The chosen cleanup method(s) depends upon numerous site characteristics which were determined during the RI, RAA, or/and release closure plan (RCP).

Section 6. Cleanup Work Plan Tasks (Minimum)

Describe the tasks required to implement the chosen cleanup method(s). This information should be of sufficient detail to both assess the applicability and effectiveness of the method, and to establish criteria for assessing the performance of the chosen method. The description of implementation should cover all tasks related to the completion of the proposed cleanup.

This section provides expectations for tasks that will be defined, planned, and budgeted in the CWP; however, they are not intended to be performed until the implementation of the DEQ-approved CWP.

- Project management for all tasks related to the CWP.
- Participate in a Cleanup Work Plan Meeting with the O/O and DEQ's project manager to develop a plan for the cleanup, establish treatment effectiveness criteria, and resolve the Release.
- Describe the CWP tasks; and solicit bids as required from subcontractors.
- Prepare a CWP and submit it to DEQ for approval.
- Discuss the cleanup method selected and how it will be implemented.
- Provide sufficient detail in the CWP to explain how data will be collected to meet reporting requirements.
- Describe site infrastructure that may limit or influence accessibility or the extent of cleanup.
- Describe any safeguards that may be necessary to limit exposure of potential receptors during cleanup.
- Describe the expected short- and long-term effects of cleanup.
- Establish the criteria that will be measured to assess the effectiveness of cleanup and optimize the method.

- o Identify the criteria that will be measured, and the goals intended to be achieved that will transition cleanup efforts to the next phase of the treatment train.
- o Discuss potential limitations to the cleanup and efforts to minimize their impacts.
- Mobilization and travel to/from the Facility to conduct onsite CWP tasks.
- Assess each of the following CWP-specified media (soil, water, and vapor).
 - o Submit all samples to an analytical laboratory for analysis of petroleum constituents as outlined by Montana Risk-Based Corrective Action Guidance for Petroleum Releases (RBCA Guidance) and geochemical indicators as requested by DEQ.
 - o Describe method(s) for evaluating the validity of laboratory results (QA/QC methods).
- Monitor the effectiveness of cleanup during implementation and recommend additional work necessary to achieve the Cleanup objectives; DEQ will approve agreed upon CWP modifications. Examples of CWP modifications include the following:
 - o Expansion of planned remediation tasks based upon site conditions or additional contamination encountered. This may include additional system installation or enlargement of an excavation.
- Prepare detailed maps to illustrate the results of CWP tasks (see Cleanup Report - Expectations below).
- Update the release closure plan (RCP) using DEQ's Excel spreadsheet.
 - o O/O should discuss and review the RCP with O/O's consultant and DEQ's project manager prior to Cleanup Report submittal.
- Prepare a detailed cleanup report according to the Cleanup Report - Expectations (below).

Section 7. Cleanup Method Pilot Test (as Required)

If appropriate for the selected cleanup method, a pilot test to evaluate the effectiveness of the proposed cleanup should be conducted. Examples include the following:

- Bench scale simulation of cleanup selection
- Limited scale implementation of the cleanup method at the Facility

Assessment of the performance of the selected Cleanup method pilot test should be evaluated using the standard methods of evaluation for the specific technology.

Section 8. Recurring Operation/Maintenance Reports

If the selected cleanup technology will require periodic operation and/or maintenance (O/M) then a DEQ approved schedule should be established. At a minimum the submitted report should consist of a brief summary of actions performed and updates to the relevant data tables. DEQ may request additional reporting as part of the CWP.

Section 9. Cleanup Plan Maps

Maps used to illustrate the CWP are expected to be to-scale and use currently available base maps. Unless modified requirements have been approved by DEQ, maps based off non-georeferenced aerial photos will not be accepted. Maps should have a North arrow, scale, map legend, and a title including site name. All maps are expected to conform to the examples in the RI Guidance. In addition, include the following items on the map(s) for the CWP:

- Remediation system design, if applicable to method chosen, including piping, equipment, housings, injection/extraction points, sampling locations, etc.
- Excavation boundaries along with sampling locations. The type (e.g. discrete vs. composite) and vertical position of the samples should also be labeled.
- Any facility updates or changes which will need to be completed as part of the release remediation. These can include building demolition, altering the location of utilities, etc.
- Isopleth map of a representative petroleum constituent(s) and proposed location of remediation
- Any additional maps needed to fulfill selected cleanup requirements

Section 10. Schedule and Reporting

The cleanup and risk abatement of the Release and the cleanup report (Report) are expected to be completed within a department approved timeframe. O/O or their consultant is expected to provide sufficient data and information to have a discussion with DEQ's project manager upon the completion of critical tasks such as the following:

- Final design of system, if applicable
- Field work and/or installation of system
- Follow-up monitoring, sampling, evaluation, and optimization
- Receipt of analytical data
- Preparation of the Report
- Other site-specific milestones

Section 11. Appendices for Cleanup Plan

DEQ may require site-specific attachments to the CWP; however, the following appendices for a CWP are expected to be included in the report:

- Quality assurance/quality control (QA/QC) plan
- Standard Operating Procedures (SOPs) for sampling protocols
- Budget detailing costs for each CWP task if the O/O expects to apply for reimbursement from the Petroleum Tank Release Compensation Fund, or upon DEQ's request

Section 12. Supplemental Cleanup Actions (as Required)

If this cleanup plan consists of follow-up actions to an already completed Cleanup Report, additional information provided by this Supplemental cleanup work plan (SCWP) should be included in the previous CWP as an addendum. Therefore, only the following sections need to be completed:

- Section 4: Objectives of Cleanup
- Section 5: Cleanup Method Chosen
- Section 6: Cleanup Work Plan Tasks (Minimum)
- Section 7: Cleanup Method Pilot Test
- Section 8: Recurring Operation/Maintenance Reports
- Section 9: Cleanup Plan Maps
- Section 10: Schedule and Reporting
- Section 11: Appendices for Cleanup Plan

Cleanup Report – Expectations

Montana Department of Environmental Quality (DEQ)
Petroleum Tank Cleanup Section (PTCS)

Cleanup of a petroleum release (Release) from a petroleum storage tank (PST) is required under Montana and federal law to eliminate pathways of contamination exposure to public health and the environment.

This outline provides owners and operators (O/O) and consultants with the basic expectations for a Cleanup Report (Report). It is the O/O's responsibility to stay in contact with the DEQ project manager to determine whether modifications to the CWP will be necessary to complete cleanup objectives.

DEQ will evaluate the Cleanup Report against the detailed Cleanup Report expectations listed below; and if found to adequately document the approved cleanup and address all requirements, the Report will be accepted. If DEQ determines additional information, data, analysis, or corrections are required to meet cleanup objectives then DEQ will notify the O/O and their consultant in writing of report deficiencies.

Note: DEQ expects a certain amount of detail in the CWPs and reports submitted during the cleanup of a Release from a PST system to meet the requirements of Montana and federal laws. DEQ expects all tables, maps, and the Release Closure Plan be updated when additional cleanup is performed.

Section 1. Title Page

- Title of report: Cleanup Report for a Petroleum Release
- Facility name
- Facility address
- DEQ Facility ID Number, Release Number(s), and Cleanup Work Plan ID(s)
- Responsible party's name, mailing address, and phone number
- O/O's name, mailing address, and phone number (if different from above)
- Contact person's name, mailing address, and phone number (if different from above)
- Consultant's name, address, and phone number
- Date report prepared

Section 2. Executive Summary

The executive summary should not exceed one page in length. It should provide a concise summary of the cleanup actions performed, conclusions, and recommendations.

Section 3. Purpose and Objectives of Cleanup

State the site-specific purpose of this cleanup. List the tasks conducted to clean up the Release and briefly describe the objectives of each, along with a concise summary of the results.

Section 4. Cleanup Method(s) Implemented

A detailed evaluation of the cleanup method implemented should be provided. The information supplied will be dependent upon the cleanup method selected; however, general information should be supplied for every cleanup method used as listed below:

- Explanation of field work performed during cleanup.
- Evaluation of cleanup method results compared to expected/designed results as established by the measurement criteria specified in the CWP.
- Achievement of remediation goals established in the CWP and a description of criteria evaluated.
- Evaluation of optimizations, limitations, and impacts of the implemented cleanup method and how they compare to those identified in the CWP.

The following minimum technology-specific details are expected to also be included as outlined below. If applicable, include technical specifications and construction design details including system operation and maintenance schedules. Information for cleanup methods not listed should be discussed with the DEQ Project Manager (PM) and included in the CWP.

- Monitored Natural Attenuation (MNA)
 - o Description of lithologic characteristics of the site and their influence on attenuation.
 - o Description of hydrogeologic characteristics (e.g. hydraulic gradient, groundwater flow velocities and direction) and their influence on attenuation.
 - o Analysis of the primary geochemical indicators to evaluate the contribution of biological and chemical processes in contaminant degradation.
 - o Cumulative groundwater data tables with screened intervals and depths to groundwater.
 - o Graph of contaminant concentrations versus groundwater level.
 - o Other relevant information to complete Tables A.1 and A.2 located in Appendix A.
- Excavation
 - o Number of excavations performed (if applicable).
 - o Amount of soil removed per excavation, if applicable, and total excavated.
 - o Description of field screening techniques and criteria used to segregate soils.
 - o Disposal method of excavated soil.
 - o Dimensions (horizontal and vertical) of excavation(s).
 - o Description of excavation characteristics such as, but not limited to, sidewall samples taken, base samples taken, depths of all samples (from ground surface) estimated amount of contamination left in place along with reason for it being left in place.
 - o Volume of groundwater removed and disposal method (if applicable).
 - o If additional remediation methods are implemented (e.g. Soil Vapor Extraction [SVE], Air Sparging [AS], Oxygen Releasing Compounds [ORC], etc.) the associated technology specific sections will be included.

- o Relevant information to complete Tables B.1 and B.2 located in Appendix B.
- Soil Vapor Extraction (SVE)
 - o Number of SVE points, boring logs, and screened intervals.
 - o Total system operating vacuum and individual extraction well vacuums.
 - o Total system extraction air flow rate, average contaminant mass removed during each monitoring period, and cumulative total mass removed.
 - o Complete 'as-built' system design and specifications (including any deviations from the design in the CWP) piping layout, and additional equipment needed.
 - o Performance monitoring results as specified in the CWP.
 - o Radius of influence.
 - o Other relevant information necessary for system installation and optimization.
 - o Relevant information to complete Table C.1 located in Appendix C.
- Air Sparge (AS)
 - o Number of AS points, logs, and depths of points.
 - o Total pressure provided by system and at individual sparging points.
 - o Total system air flow rate and at individual sparging points.
 - o Method of operation (e.g. continuous or pulsed).
 - o Complete 'as-built' system design and specifications (including any deviations from the design in the CWP) piping layout, boring logs, and additional equipment needed.
 - o Performance monitoring results (primary and secondary) as specified in the CWP.
 - o Methods used to evaluate/prevent exposures to receptors and/or plume migration/expansion.
 - o Radius of influence.
 - o Other relevant information necessary for system installation and optimization.
 - o Relevant information to complete Table D.1 located in Appendix D.
- SVE/AS
 - o All information required by the individual SVE and AS sections above.
 - o Completed Tables C.1 located in Appendix C and D.1 located in Appendix D. These tables may be merged together provided that information contained in them is not omitted or altered.

- Biosparging
 - o Number of injection points, logs, depths (and nutrient injection points if used).
 - o Radius of influence.
 - o Microbial population density (if collected).
 - o Total pressure provided by system and at individual injection points.
 - o Total system injection air flow rate.
 - o Nutrient injection composition, concentration, and flowrate (if used).
 - o Complete 'as-built' system design and specifications (including any deviations from the design in the CWP) piping layout, boring logs, well completion logs, and additional equipment needed.
 - o Initial and performance monitoring results (primary and secondary) as specified in the CWP.
 - o Other relevant information necessary for system installation and optimization.
 - o Relevant information to complete.
 - o Completed Table E.1 located in Appendix E.

- Bioventing
 - o Number of extraction points, screened intervals (and nutrient injection points if used).
 - o Radius of influence.
 - o Microbial population density (if collected).
 - o Total system operating vacuum and individual extraction point vacuums.
 - o Total system extraction air flow rate.
 - o Nutrient injection composition, concentration, and flowrate (if used).
 - o Complete 'as-built' system design and specifications (including any deviations from the design in the CWP) piping layout, boring logs, well completion logs, and additional equipment needed.
 - o Initial and performance monitoring results (primary and secondary) as specified in the CWP.
 - o Other relevant information necessary for system installation and optimization.
 - o Relevant information to complete Table C.1 in Appendix C and Tables A.1 and A.2 in Appendix A.

- Enhanced In-Situ Aerobic/Anaerobic Bioremediation
 - o Volume, area, depth range, and stratigraphic description of the treatment interval.
 - o Pre-treatment concentrations of constituents of concern, geochemistry, and nutrients.
 - o Injection (and extraction [if applicable]) well, point, or gallery locations, depth and construction details.
 - o Injectate (electron acceptor and nutrient) type, volume, concentration, etc.
 - o Injection (and extraction [if applicable]) flow rates, pressures, etc.
 - o Area of influence and data observed to determine the area of influence
 - o System maintenance, optimization, repair efforts, and results.
 - o Concentrations and trends of constituents of concern, geochemistry, and nutrients.
 - o Complete 'as-built' system design and specifications (including any deviations from the design in the CWP) piping layout, boring logs, well completion logs, and additional equipment needed; if a permanent system is constructed.
 - o Effectiveness of in-situ groundwater bioremediation, criteria measured to assess effectiveness and frequency of sampling.
 - o Trends of petroleum constituent concentrations and geochemical indicators used to assess the effectiveness of cleanup.
 - o Cleanup objectives and estimated time to meet cleanup objectives.
 - o Relevant information to complete Table F.1 located in Appendix F.
- Dual-Phase Extraction
 - o Number, logs, screened interval, and location of extraction wells.
 - o Determine radius of influence, drawdown, and pumping/extraction rates of the combined SVE and Pump and Treat/Product recovery.
 - o Treatment train for contaminated material disposal/remediation.
 - o Type of system installed.
 - o Complete 'as-built' system design and specifications (including any deviations from the design in the CWP) piping layout, boring logs, and additional equipment needed.
 - o Other relevant information necessary for system installation and optimization.
 - o Relevant information to complete Table G.1 located in Appendix G.

- In-Situ Chemical Oxidation (ISCO)
 - o Volume, area, and depth range, and stratigraphic description of the treatment interval.
 - o Pre-treatment concentrations of constituents of concern, geochemistry, and nutrients.
 - o Precautions and safeguards implemented to ensure safety and minimize risks associated with corrosion, vapors, explosive vapors, inducing migration of the contaminant plume, mobilization of naturally occurring metals, etc.
 - o Application well, point, or gallery locations, depth and construction details
 - o Compound type, volume, concentration, etc.
 - o Injection flow rates, pressures, etc.
 - o Area of influence and recorded data used to determine the area of influence.
 - o System maintenance, optimization, repair efforts, and results.
 - o Complete 'as-built' system design and specifications (including any deviations from the design in the CWP) piping layout, boring logs, well completion logs, and additional equipment needed; if a permanent system is constructed.
 - o Concentrations and trends of constituents of concern, geochemistry, and nutrients.
 - o Effectiveness of in-situ chemical oxidation, primary and secondary criteria measured to assess effectiveness and frequency of sampling.
 - o Trends of petroleum constituent concentrations and geochemical indicators used to assess the effectiveness of cleanup.
 - o Cleanup objectives and estimated time to meet cleanup objectives.
 - o If SVE is used in conjunction with in-situ chemical oxidation, complete the necessary work plan and report section to document installation and operation of the SVE system.
 - o Completed Table H.1 located in Appendix H.
- Free Product (LNAPL) Recovery
 - o Number, depths, construction details, and location(s) of extraction point(s).
 - o Criteria used to measure or assess the effectiveness of product recovery and limitations.
 - o Description of equipment used for Free Product recovery.
 - o Summary of treatment or disposal methods for recovered product.
 - o Complete 'as-built' design and implementation diagram indicating location of recovery equipment, any piping or trenches needed, and location of free product disposal or treatment equipment.
 - o Other relevant information necessary for system installation and optimization.
 - o Relevant information to complete Table I.1 located in Appendix I.

- Pump and Treat
 - o Extraction rate.
 - o Number of extraction wells, logs, screened intervals.
 - o Radius of influence of pumping well(s).
 - o Determination of extraction rate on groundwater flow characteristics.
 - o Criteria used to measure or assess the effectiveness of the system and limitations.
 - o Treatment and discharge/disposal of extracted water (Treatment train).
 - o Pump operation (continuous or pulsed).
 - o Complete 'as-built' system design and specifications (including any deviations from the design in the CWP) piping layout, boring logs, well completion logs, and additional equipment needed; if a permanent system is constructed.
 - o Other relevant information necessary for system installation and optimization.
 - o Relevant information to complete Table J.1 in Appendix J.

Section 5. Cleanup Method Evaluation

An assessment of the cleanup method(s) implemented compared to benchmarks established in CWP should be included. This should include evaluation of all cleanup performed, including multiple cleanup types, if appropriate. A discussion of successes and limitations of each cleanup method should also be present.

Section 6. Maps of Cleanup Action(s)

All maps should include a north arrow, scale bar, map legend, and title with the Facility name in the title block. All maps should conform to the examples in the RI Guidance. Site maps should be on a true-scale map (annotated aerial photos which are not georeferenced are not acceptable for these base maps). The site maps should be based on the maps created for the previously completed Remedial Investigation Report; if a Remedial Investigation Report was not created, then other types of maps may be included, provided DEQ has given approval. If site conditions have significantly changed (i.e. PSTs were removed, utility locations changed, onsite buildings destroyed, etc.) an updated map should be supplied reflecting the appropriate conditions. Depending upon the selected cleanup method, as presented in the cleanup plan, differing map information may be needed. The list below indicates the information that should be included based on the selected cleanup method:

- Monitored Natural Attenuation (MNA)
 - o Groundwater contour map.
 - o Groundwater contaminant distribution map.
 - o Dissolved oxygen (and other parameters, if appropriate) in groundwater map (may be combined with contaminant data in single map).
 - o Map of monitoring well network indicating wells to be regularly sampled to assess MNA performance.

- Excavation
 - o Map delineating the excavation boundaries.
 - o Map displaying sampling locations along with type and sample ID corresponding to items listed in sampling results table. If the displayed sample locations will not negatively impact the map of the excavation boundaries, they may be displayed on the same map.
- SVE, AS, SVE/AS, Chemical Oxidation Injection, or Bio-Enhancement Injection
 - o SVE system design including piping, extraction points, equipment, and equipment housings; if present.
 - o AS system design including piping, injection points, equipment, and equipment housings; if present.
 - o Chemical Oxidation system design including piping, injection points, equipment, and equipment housings; if present.
 - o One-Time Chemical Oxidation application locations, if present.
 - o Bio-Enhancement system design including piping, injection points, equipment, and equipment housings; if present.
 - o One-Time Bio-Enhancement application locations, if present.
 - o All equipment, equipment housings, and piping locations should include vertical locations (e.g. aboveground or underground)
- Dual Phase Extraction
 - o Map indicating vapor and liquid extraction points, piping, equipment, equipment housings, and effluent treatment/disposal.
 - o Separate map showing liquid extraction system design including extraction points, piping, equipment, equipment housings, and resulting remediated fluid disposal.

Section 7. Recurring Operation/Maintenance (O/M) Report(s)

Depending upon the cleanup method selected, periodic reports summarizing the operation and maintenance of the method may be required. At a minimum, the report should provide a description of system operation, maintenance completed and recommended, optimization efforts, and the appropriate updated table(s) found in the Report Appendices. The recurring reports should be submitted to DEQ at a specified frequency adequate to determine cleanup method progress and effectiveness.

Section 8. Supplemental Cleanup Report(s)

When follow-on cleanup actions are required, Supplemental Cleanup Report(s) (SCR) should be submitted. The report(s) should be based on an approved supplemental cleanup plan (SCWP). The SCR should consist of a description the following sections:

- Section 4: Cleanup Method Implemented
- Section 5: Cleanup Method Evaluation
- Section 6: Maps of Cleanup Actions
- Section 9: Release Closure Plan
- Section 10: Conclusions
- Section 11: Recommendations
- Section 12: Signature Page
- Section 13: Limitations
- Section 14: References
- Section 15: Appendices

Any sections not listed above should not be included. The SCR should be attached to the previously completed Report to document the additional cleanup.

Section 9. Release Closure Plan

The O/O and their consultant should update the Release Closure Plan (RCP) created as part of the RI and RAA reports. The updated RCP should include information obtained as part of the cleanup process; including, but not limited to, receptor surveys, exposure pathways and information regarding any remaining petroleum contamination. The revised RCP should be attached to the Report.

Section 10. Conclusions

Briefly state whether the cleanup objectives have been met for the Release; technical conclusions should be stated with reasonable professional certainty and under the standard of care applicable and should include the following:

- Description of any remaining petroleum-impacted media including location, amount, and extent.
- Any remaining exposure pathways.
- Site-specific cleanup methods.
- Site-specific closure pathways to resolve the Release.

Section 11. Recommendations

State recommendations for additional remediation work required to cleanup, monitor, and close the Release. Technical recommendations should be stated with reasonable professional certainty and under the standard of care applicable and should include the following:

- Make site-specific cleanup recommendations that are consistent with details in the previously completed RI report, the Report, and summarized in the RCP.
- Propose additional site-specific cleanup and its immediacy, if required.
- Propose site-specific monitoring plan, if required.

Section 12. Signature Page should be signed and dated

Section 13. Limitations

Section 14. References

Section 15. Appendices for Cleanup Report

DEQ may require site-specific attachments to the report; however, the following appendices for all Reports are typically required.

- Maps
- Tables summarizing laboratory analytical data and field data for soil, water, and petroleum vapor samples
- RCP
- Sampling methods
- Field sampling sheets (if required)
- Disposal manifests (if applicable)
- Laboratory reports including the following:
 - o Original (or copy of original) analytical result reports
 - o Chain of custody documentation
 - o Sample receipt checklist(s)
 - o QA/QC control report(s)
 - o Chromatograms
 - o Data Validation Report
- QA/QC plan for laboratory data (unless included in CWP)
- Standardized Operating Procedures (SOP) (unless included in CWP)

Appendix A

Monitored Natural Attenuation (MNA) Performance Tables

Well/Sample Information							Intrinsic Biodegradation Indicators								
Well ID	Date	Sample ID	Top of Casing Elevation	DTW	GW Elevation	Screened Interval	Dissolved Oxygen	Temperature	pH	Specific Conductance	ORP	Nitrates/Nitrites	Ferrous Iron	Sulfates	Manganese
			ft	ft	ft	ft	mg/L	°C	SU	µS/cm	mV	mg/L	mg/L	mg/L	mg/L
					0										
					0										

Table A.1: Monitoring Well Field Parameters/IBIs Table

Well/Sample Information			Analytical Data															
Well ID	Date	Sample ID	MTBE	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	1,2 - DCA	EDB	C5 - C8 Aliphatics	C9 - C12 Aliphatics	C9 - C10 Aromatics	TPH	EPH	C9 - C18 Aliphatics	C19 - C36 Aliphatics	C11 - C22 Aromatics
			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
RBSL/Standard			30	5	1,000	700	10,000	100	4	0.017	650	1,400	1,100			1,400	1,000	1,100

Table A.2: Monitoring Well Analytical Table

Appendix B

Excavation Performance Tables

Excavation ID	Excavation Completion Date	Area Name on Figure/Map	In Place Amount Removed	Loose Amount Removed	Average Depth	Footprint Area	Soil Disposal Method
			yd ³	yd ³	ft	ft ²	
Totals			0	0			

Table B.1: Excavation Summary Table

Excavation ID	Sample ID	Date Taken	Name on Figure/Map	Type	Sample Depth	MTBE	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	C5 - C8 Aliphatics	C9 - C12 Aliphatics	C9 - C10 Aromatics	TPH	EPH Screen	C9 - C18 Aliphatics	C19 - C36 Aliphatics	C11 - C22 Aromatics	
					ft	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg

Table B.2: Excavation Sample Table

Appendix C

Soil Vapor Extraction (SVE) Performance Table

Date	SVE Unit Performance					Lab Analysis					Period Mass Removal					
	Operation Time During Period	Vacuum at SVE Unit	Effluent Temperature	System Air Flow Rate	This Period VOC by PID	Benzene	Toluene	Ethylbenzene	Xylenes	Total VOC	VOC Emissions by PID	VOC Emissions by Lab	Benzene	Toluene	Ethylbenzene	Xylenes
	Hours	in H ₂ O	°F	scfm	ppm	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/m ³	lb	lb	lb	lb	lb	lb
											0.00	0.00	0.000	0.000	0.000	0.000
											0.00	0.00	0.000	0.000	0.000	0.000
Totals	0										0.00	0.00	0.000	0.000	0.000	0.000

Table C.1: Soil Vapor Extraction Performance Table

Appendix D

Air Sparge (AS) Performance Table

Date	Operation Time During Period	Positive Pressure at Unit	Total Injection Flow Rate
	Hours	psig	scfm
Total	0		

Table D.1: Air Sparge Performance Table

Appendix E

Biosparging Performance Table

Injection Point	Injection Point Type	Injection Depth	Point Operation Parameters				Air Injection		Nutrient Injection	
			Date	Days in Period	Operation Time During Period	Operational Percentage	Injection Pressure	Injection Air Flow Rate	Nutrient Type	Injection Rate
						#DIV/0!				
						#DIV/0!				
Totals				0	0	#DIV/0!				

Table E.1: Biosparging Performance Table

Appendix F

Enhanced Bioremediation Performance Tables

Application Date	Application Parameters											
	Gas				Liquid/Slurry							
	Injection Point ID	Duration	O ₃ Volume	Injection Pressure	Injection Point ID	Type	Injection Duration for Interval	Injection Pressure	Mass of Oxidizer Injected	Mass of Catalyst Injected	Injection Top Depth	Injection Bottom Depth
		Hr	ft ³	psi			Min	psi	lb	lb	ft	ft
Total		0	0			0		0	0			

Table F.1: Initial Enhanced Bioremediation Application Table

Date	Monitoring Parameters																					
	Field Parameters						Lab Parameters														Additional Site-Specific Parameters	
	DO	Temp.	pH	SC	Turbidity	ORP	MTBE	B	T	E	X	N	TPH	O ₂	CO ₂	Nitrate/Nitrite	Sulfate	Manganese	Ferrous Iron	Methane		
mg/L	°C	SU	µS/cm	NTU	mV	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		

Table F.2: Enhanced Bioremediation Performance Monitoring Table

Appendix G

Dual Phase Extraction Performance Table

Date	System Performance						Groundwater Sample Analysis		Vapor Analysis						Mass Removal					
	Operation Time During Period	Induced Vacuum	Effluent Temperature	System Air Flow Rate	Total Fluid Recovered per Period	Total LNAPL Recovered per Period	Influent Groundwater Concentration	Effluent Groundwater Concentration	Field	Lab					VOC Removed from LNAPL	Field			Lab	
									This Period VOC by PID	Benzene	Toluene	Ethylbenzene	Xylenes	Total VOC		VOC Removed from Vapor	VOC Removed from Groundwater	Total VOC for Period	VOC Removed from Vapor	Total VOC for Period
	Hours	in Hg	°F	scfm	gal	gal	µg/L	µg/L	ppm	ppm	ppm	ppm	ppm	ppm	lbs	lbs	lbs	lbs	lbs	lbs
															0.00	0.00	0.00	0.00	0.00	0.00
															0.00	0.00	0.00	0.00	0.00	0.00
Total	0.00				0.00	0.00									0.00	0.00	0.00	0.00	0.00	0.00

Table G.1: Dual-Phase Extraction Performance Table

Appendix H

Chemical Oxidation Performance Table

Appendix I

Free Product Recovery Performance Table

Well ID	Date	Operational Time	Removal Method	Pre-Treatment LNAPL Thickness	Post-Treatment LNAPL Thickness	Groundwater Extracted	LNAPL Extracted	LNAPL Extracted
		hr		ft	ft	gal	gal	lbs
								0
								0
Totals						0	0	0

Table I.1: Free Product Recovery Performance Table

Appendix J

Pump and Treat Performance Table

Date	System Performance				Influent Samples							Effluent Samples							Mass Removal						
	Operation Time During Period	Pumping Rate	Pumping Rate	Pumping Mode	MTBE	B	T	E	X	N	TPH	MTBE	B	T	E	X	N	TPH	MTBE	B	T	E	X	N	Total TPH
	Hours	Gal/Hr	L/Hr		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	lbs	lbs	lbs	lbs	lbs	lbs	lbs
			0																0	0	0	0	0	0	0
			0																0	0	0	0	0	0	0
Total	0																		0	0	0	0	0	0	0

Table J.1: Pump and Treat Performance Table

Appendix K

Additional Cleanup Specific Information