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| Minnesota Pollution Control Agency (MPCA), 520 Lafayette Road North, St. Paul, MN 55155-4194 | Pilot test work plan  Petroleum Remediation Program  Guidance document 7-05  *Doc Type: Corrective Action Design* |

**Instructions:** Complete this work plan to propose a pilot test for a remediation system or other in situ remediation technology. See [Corrective action design and implementation](https://www.pca.state.mn.us/sites/default/files/c-prp7-01.pdf)for more information and requirements found on the Minnesota Pollution Control Agency’s (MPCA) website at <https://www.pca.state.mn.us/waste/cleanup-guidance>. Do not revise or delete any text or questions from this work plan. Items may be added if they are needed to support the pilot test design. If an item is not applicable, provide a brief explanation.

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| **MPCA Site ID:** | LS00 | **Date (mm/dd/yyyy):** |  |

**Responsible party information**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Individual or corporate name: | | | |  | | | | | |
| Mailing address: | | |  | | | | | | |
| City: |  | | | | | State: |  | Zip code: |  |
| Email: | |  | | | | | | Phone: |  |
| Alternative contact name (if any): | | | | |  | | | Phone: |  |

**Leak site information**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name: | |  | | | | | Phone: |  | |
| Leak site address: | | | |  | | | | | |
| City: |  | | | | State: |  | Zip code: | |  |
| County: | | |  | |  | | |  | |

**Environmental professional information**

*By signing this document, I/we acknowledge that we are submitting this document on behalf of and as agents of the responsible person or volunteer for this leak site. I/we acknowledge that if information in this document is inaccurate or incomplete, it will delay the completion of remediation and may harm the environment and may result in a reduction in Petrofund reimbursement. In addition, I/we acknowledge on behalf of the responsible person or volunteer for this leak site that if this document is determined to contain a false material statement, representation, or certification, or if it omits material information, the responsible person or volunteer may be found to be in violation of Minn. Stat. § 115.075 or Minn. R. 7000.0300 (Duty of Candor), and that the responsible person or volunteer may be liable for civil penalties.*

***By typing/signing my name below,*** *I certify the above statements to be true and correct, to the best of my knowledge, and that this information can be used for the purpose of processing this form.*

**Signatures**

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| **Report author(s)** | | | | |  | **Report reviewer(s)** | | | |
| Signature: | |  | | |  | Signature | |  | |
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| Title: |  | | | |  | Title: |  | | |
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| Signature: | |  | | |  | Signature | |  | |
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| Title: |  | | | |  | Title: |  | | |
| Date (mm/dd/yyyy): | | |  | |  | Date (mm/dd/yyyy): | | |  |
| Name(s) of field technician(s): | | | |  | | | | | |

**Company information**:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Name: | |  | | | | | Phone: | |  |
| Mailing address: | | |  | | | | | | |
| City: |  | | | State: |  | Zip code: | |  | |

**Project manager information**:

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| Name: |  | | | |
| Phone: |  | Email: |  |  |

## Section 1: Site conceptual model update

Include updated cumulative tables and figures from [Investigation report](https://www.pca.state.mn.us/sites/default/files/c-prp4-06.docx) in Appendix A. Include documentation of additional site investigation, site monitoring, and interim corrective actions in Appendix B. Also include copies of tables, figures, or other information from the focused investigation if relevant to the site conceptual model or the pilot test design in Appendix C.

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| 1. | Describe any additional site investigation, site monitoring, and/or interim corrective actions completed since the last submitted report. |
| 2. | Discuss the results of the additional site investigation, site monitoring, and/or interim corrective actions. |
| 3. | Provide an updated and comprehensive site conceptual model. |
| 4. | Provide recommendations for additional site investigation, site monitoring, and/or interim corrective actions to be completed prior to corrective action design approval, including their purpose and schedule for completion. |

## Section 2: Pilot test overview

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| 1. | If the proposed pilot test work is different than requested by the MPCA, identify the differences and explain why. |
| 2. | Identify the person responsible for conducting the pilot test. |
| 3. | Identify the remediation technology being tested and the number of remediation and monitoring points that will be used. |
| 4. | Identify any data gaps or inconsistencies in the site investigation, risk evaluation, and monitoring data and discuss resulting major assumptions that affect the pilot test design. |

## Section 3: Target zone

Illustrate the target zone’s geometry, geology, hydrogeology, preferential flow routes, and flow barriers on a site map and cross sections in Section 16. Include applicable tables and figures from the focused investigation in Appendix C.

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| 1. | Identify the primary contaminant phase targeted by the system and describe its physical and chemical properties as relevant to the remediation strategy. |
| 2. | Describe the geometry, geology, and hydrogeology of the target zone. |
| 3. | Describe the remediation strategy for remediating the target zone in terms of the subsurface physical, chemical, and biological processes that the proposed system will induce and control over time to achieve permanent risk reduction. |
| 4. | If applicable, describe target-zone accessibility issues or subsurface conditions that could act as a barrier to or short-circuit the intended subsurface response and how they are accommodated by the pilot test system design. |

## Section 4: Remediation and monitoring points

Provide a site map showing the locations of all existing and proposed pilot test remediation and monitoring points. Include construction diagrams for each proposed and existing point in Appendix D. If any existing points are to be used, associated boring logs and, if applicable, Minnesota Department of Health (MDH) well and boring records must also be included in Appendix D. Provide an example remediation and monitoring point construction summary table in Appendix E.

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| 1. | Provide a rationale for the location and construction specifications, such as screen interval or distance from source, for each remediation and monitoring point based on the target zone, remediation strategy, and conceptual design of the full-scale system. |
| 2. | Describe the drilling, sampling, and installation methods and procedures to be used for each proposed remediation and monitoring point. |
| 3. | Describe any proposed remediation and monitoring point installation and construction decisions that will be made in the field and what criteria or rationale will be used. |
| 4. | Describe the methods and procedures for developing the remediation and monitoring points. |
| 5. | Discuss the future of each remediation and monitoring point after the test is completed. |

## Section 5: System equipment, process flow, and system controls

Include a process and instrumentation diagram (P&ID) representing the equipment configuration(s) that will be pilot tested and a site map showing where system equipment will be located in Section 16. Use unique identifiers to refer to specific items on the P&ID when describing system equipment, process flow, and monitoring of pilot test system functions. Refer to remediation point construction diagrams, site maps, or other figures as necessary to describe specific system equipment and processes. When describing major equipment or instrumentation, refer to appropriate excerpts from manufacturer- or vendor-supplied manuals included in Appendix F.

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| 1. | Identify the pilot test system’s major equipment and discuss their operation principles, performance specifications, and operating ranges. Discuss the rationale for selecting each piece of major equipment based on anticipated pilot test performance needs relative to the conceptual design of the full-scale remediation system. |
| 2. | Describe how the major equipment will be connected to each other and to the remediation points through conveyance lines and manifold design. |
| 3. | Describe process flow for all gases, liquids, solids, and their mixtures through the system from intake points to discharge points. Identify passive control features such as gravity drainage and backflow prevention. |
| 4. | Identify the locations of process control devices, including those located along conveyance lines from intake points to discharge points and at remediation points. For each location, describe what process the device will control and the purpose for controlling the process at that location. Describe the operation principles for each device, including manual adjustment methods and procedures and logic for automated controls. |
| 5. | Identify the control settings that will be monitored over the course of the test. Describe the measurement units, range, accuracy, and data collection methods and procedures as appropriate for each control setting. |
| 6. | Identify all locations where process material physical parameters, such as flow, pressure, temperature, or fluid levels, will be measured along conveyance lines from intake to discharge points and at active remediation points. For each location, describe what materials and properties are being measured and why they are being measured at that location. Describe the operation principles, measurement units, range, and accuracy of the instruments. Describe data collection methods and procedures for each instrument. Include an excerpt from the airflow measurement instrument’s manual describing how to convert measured flow rates to standard temperature and pressure conditions in Appendix F. |
| 7. | Identify instruments (or methods) that will be used to monitor equipment operation parameters such as equipment run time and on/off cycles. Describe what parameters will be monitored and the purpose for monitoring them. Describe each instrument’s operation principles, measurement units, range, and accuracy. |

## Section 6: Process material chemistry

Refer to the P&ID, and if necessary, other figures and diagrams when describing the location and rationale for where process materials, such as groundwater or air, will be monitored or sampled for chemical parameters.

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| 1. | Identify all monitoring and sampling locations between intake points and discharge points, including remediation points. For each monitoring and sampling location, describe the process material that will be monitored or sampled, the chemical parameters that will be measured, and the purpose for collecting the data at that location. |
| 2. | Describe field monitoring methods and procedures. For each monitoring location, describe monitoring equipment and/or instrumentation, including operation principles, measurement units, range, and accuracy. |
| 3. | For each parameter to be collected for off-site laboratory analysis, describe collection methods and procedures, selected laboratory analytical methods and their rationale, and quality assurance and quality control (QA/QC) measures. |
| 4. | For chemistry data to be used in mass balance calculations or for other reasons requiring associated flow, identify the flow measurement locations and instruments (described in Section 5) associated with respective monitoring or sampling points. |

## Section 7: Waste generation, handling, and disposal

Refer to applicable diagrams and figures when discussing system waste disposal. Include copies of waste disposal documents, permits, and related documentation in Appendix G.

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| 1. | Identify all contaminated materials such as light non-aqueous phase liquid (LNAPL), water, condensate, air, and solid wastes that will be generated during pilot test system operation. Describe expected maximum flow rates and flow rate trends for LNAPL, water, and air. Also describe expected maximum chemicals-of-concern concentrations and trends for water and air prior to any treatment. |
| 2. | Describe how each type of contaminated material will be handled and where it will be disposed of. Identify all contaminated waste collection or discharge points. |
| 3. | Describe how disposal volumes of LNAPL will be measured and documented. |
| 4. | For wastewater discharges, identify the type of permit, approval, or requirements regulating the discharge and the issuer of the permit or approval. Describe discharge quantity and quality limitations. Describe permit/approval compliance monitoring and reporting requirements, including sampling parameters and schedules. |
| 5. | For air emissions, identify the type of permit, approval, or requirements regulating the emissions and the issuer of the permit or approval. Describe emission quantity and quality limitations. Describe permit/approval compliance monitoring and reporting requirements, including sampling parameters and schedules. |

## Section 8: Installation activities

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| 1. | Describe all permits, approvals, and variances needed prior to pilot test system installation and startup; discuss the schedule for acquisition; and identify those that have been applied for or acquired. |
| 2. | Describe major installation activities that must be completed prior to pilot test system startup, including installation of remediation and monitoring points and other remediation equipment. Discuss the schedule for completing these activities. |
| 3. | Describe any wastes that will be generated during pilot test system installation and how they will be handled and disposed of. Specify estimated waste volumes or mass as appropriate to anticipated disposal methods. |

## Section 9: Subsurface response monitoring

For each item below, identify the monitoring points where the system’s effects on the specified target-zone conditions will be measured over the course of the pilot test. Describe the types of data that will be collected at each monitoring point and provide a rationale for collecting each type. Describe data collection methods and procedures including the type, operation principles, measurement units, range, and accuracy of field instruments. Refer to appropriate figures and diagrams to identify measurement locations and to support monitoring methods and procedures.

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| 1. | Target zone’s physical conditions, such as fluid levels, pressure, or temperature: |
| 2. | Target zone’s chemical conditions, such as organic vapor concentrations, dissolved oxygen, or redox potential, as measured in the field: |
| 3. | Target zone’s chemical conditions, such as volatile organic compounds, gasoline range organics (GRO), or diesel range organics (DRO), as measured by laboratory analysis: |

## Section 10: Pilot test description

Refer to appropriate tables, figures, and appendices when describing system configurations, control adjustments, and data collection locations. Provide example tables and figures that will be used to document baseline and rebound monitoring data in [Pilot test report](https://www.pca.state.mn.us/sites/default/files/c-prp7-06.docx) in Appendix E.

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| 1. | Briefly summarize the pilot test from start to finish, including baseline and rebound monitoring, stages and step tests, and downtime between stages. |
| 2. | Describe any baseline data, such as groundwater elevations or LNAPL thicknesses that will be collected prior to initiating the pilot test. Provide a rationale for the types, locations, and collection frequency of the data to be collected. |
| 3. | Describe baseline data collection methods and procedures, including field equipment and laboratory analytical methods, if applicable. |
| 4. | Describe any remediation and monitoring point testing, such as pressure testing, that will be completed prior to system startup to confirm that they are not short circuiting, leaking, or otherwise compromised and are in hydraulic or pneumatic connection with the target zone. Describe testing methods and procedures. |
| 5. | Describe any conveyance line, manifold, and equipment testing, such as pressure testing that will be completed prior to system startup to confirm that they are not leaking or otherwise compromised. Describe testing methods and procedures. |
| 6. | Describe the equipment configuration and remediation and monitoring points that will be used during each stage of the pilot test in order of stage completion. Provide a rationale for the configuration and order. Describe the transition between stages, including any downtime due to equipment reconfiguration. |
| 7. | Identify the process and/or operation monitoring data that will be used as criteria to determine when a given stage is complete. Estimate the duration of each stage and the overall pilot test duration. |
| 8. | Describe system control adjustments that will or may be necessary over the course of each stage that will affect process flow, including adjustments for step tests. Describe what process flow parameter(s) will be controlled, such as flow rate or pressure, how it will be controlled, and what process and/or subsurface response will be monitored for effect. |
| 9. | If a step test is to be conducted, describe and provide a rationale for the number and sequence of steps. Specify what parameter, such as flow rate or pressure, will be adjusted, how it will be adjusted, and whether it is a step up or step down. |
| 10. | Identify the process and/or operation monitoring data that will be used as criteria to determine when a given step is complete. |
| 11. | Describe any rebound data that will be collected after pilot test completion. Provide a rationale for the types, locations, and collection frequency of the data to be collected. |
| 12. | Describe rebound data collection methods and procedures, including field equipment and laboratory analytical methods, if applicable. |

## Section 11: Operation monitoring plan

Refer to appropriate figures and diagrams to identify measurement and sampling locations. This section is to include mass removal and waste treatment data, if applicable. Provide example tables and figures that will be used to present operation monitoring data in the [Pilot test report](https://www.pca.state.mn.us/sites/default/files/c-prp7-06.docx) in Appendix E.

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| 1. | Describe the types, collection locations, and collection frequency of operation monitoring data, such as system control settings, process material parameters or subsurface response that will be collected during each stage. Identify data that must be collected concurrently. Provide a rationale for collecting each data type at the proposed locations and frequency. |

## Section 12: Data evaluation

Provide example tables and figures that will be used present data evaluation results in the [Pilot test report](https://www.pca.state.mn.us/sites/default/files/c-prp7-06.docx)In Appendix E.

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| 1. | Provide and explain the equation(s) that will be used for converting airflow velocity measurements to volumetric airflow rates and/or volumetric airflow rates to standard temperature and pressure conditions. Describe each equation variable, including its data source, namely instruments, and measurement unit. Provide example calculations using representative example data. |
| 2. | Provide and explain the equations that will be used for calculating mass removal. Describe each equation variable, including its data source and unit of measurement. Provide example calculations using representative example data. |
| 3. | Describe the methods, such as contour maps or graphs, and calculations that will be used to evaluate operation monitoring data and the types of conclusions that will be derived from the evaluation. |
| 4. | Provide a rationale for the data evaluation methods by describing how the data will be used for evaluating technical feasibility and designing a full-scale system. |

## Section 13: Technical feasibility

For each applicable category below, describe the criteria to be used to confirm the technical feasibility of the technology and equipment configuration when employed as the full-scale system envisioned in the conceptual design from Section 5 of [Conceptual corrective action design (CCAD) report](https://www.pca.state.mn.us/sites/default/files/c-prp7-02.docx). If more than one technology will be tested, criteria must be described for each technology. See [Corrective action design and implementation](https://www.pca.state.mn.us/sites/default/files/c-prp7-01.pdf)for examples of criteria.

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| 1. | Subsurface response and control within the target zone |
| 2. | Targeted contaminant phase mass removal or in situ elimination |
| 3. | LNAPL handling, storage, and disposal |
| 4. | Wastewater treatment and/or discharge |
| 5. | Air emissions control |
| 6. | Other elements of the full-scale system’s conceptual design |

## Section 14: Economic feasibility

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| 1. | Discuss the pilot test results that will be used to design specific elements of the full-scale system. |
| 2. | Discuss how the pilot test results could significantly affect the full-scale system life-cycle cost estimate and a re-evaluation of cost effectiveness. |

## Section 15: Pilot test schedule

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| 1. | Propose a schedule for completing all pilot test activities, including submittal of a [Pilot test report](https://www.pca.state.mn.us/sites/default/files/c-prp7-06.docx). |

## Section 16: Figures

Attach new figures specific to this report in order of discussion in the text. All figures must include a north arrow, scale, and legend as applicable. Approximate scales are not acceptable. Figures required in Appendix A should not be included in this section. New figures must include those listed below. Attach additional figures as needed and list below. **Double click checkboxes to select *Checked* and select *OK*.**

|  |  |
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|  | One or more site maps showing (as applicable):   1. Structures 2. Boring and well locations (including any drinking water wells on site) 3. Suspected source(s) of LNAPL 4. Locations and depths of on-site buried utilities 5. All past and present petroleum storage tanks, piping, dispensers, and transfer areas 6. Horizontal extent of LNAPL 7. Horizontal extent of the target zone 8. Remediation and monitoring points, conveyance lines, equipment shed, and waste discharge locations   Distinguish sequential elements of investigations by dates, symbols, etc. in the legend. |
|  | Cross sections depicting target-zone geometry, geology, and hydrogeology and preferential flow routes and barriers to flow |
|  | Process and instrumentation diagram |

## Section 17: Tables

Attach new tables specific to this report in order of discussion in the text and list below. Tables required in Appendix A should not be included in this section.

## Section 18: Appendices

Attach all required or applicable appendices in the following order. Indicate those appendices that are included in this report by marking the check box. All reproduced data must be legible. Attach additional appendices as needed and list below.

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|  | *Appendix A* | Cumulative and updated tables and figures from [Investigation report.](https://www.pca.state.mn.us/sites/default/files/c-prp4-06.docx) |
|  | *Appendix B* | Additional site investigation, site monitoring, and interim corrective action methods and procedures and associated documentation (boring logs, sampling information forms, laboratory analytical reports, etc.). |
|  | *Appendix C* | Focused investigation table, figures, and other information, if applicable. |
|  | *Appendix D* | Boring logs, construction diagrams, and MDH well and boring records for all existing and proposed remediation and monitoring points. |
|  | *Appendix E* | Example data presentation and evaluation tables and figures requested in Sections 4, 10, 11, and 12. Example tables, figures, and/or calculations must include unique identifiers from the P&ID to identify the data source. Include units of measurement. Example tables and figures can be combined as practicable. |
|  | *Appendix F* | Excerpts from manufacturer or vendor-supplied equipment and instrumentation manuals. |
|  | *Appendix G* | Waste handling and disposal documentation and required permit/approval applications and/or acquired permit/approvals. |