

**Questionnaire**

**Permeable Reactive Barriers (PRB)**

**IMPEL Project “Water and Land Remediation 2025-27”**

***Delivery time 1 May 2025 – 30 September 2025***

TABLE OF CONTENTS

[Context 3](#_Toc197343941)

[Introduction 4](#_Toc197343942)

[1. Your contact details 8](#_Toc197343943)

[2. Site background 9](#_Toc197343944)

[3. Laboratory study 15](#_Toc197343945)

[4. Full-scale application 22](#_Toc197343946)

[5. Results 26](#_Toc197343947)

[6. Post treatment and/or Long Term Monitoring 27](#_Toc197343948)

[7. Additional information 28](#_Toc197343949)

Context

Contaminated sites management is a process that proceeds at different speeds in the EU Member States. This is partly due partly to differences in legislation which implies different definitions. Some examples of terms with different definitions are “potentially contaminated sites”, “contaminated sites”, “remediated sites”.

This project aims to speed up contaminated sites management, focusing to the remediation phase that is often the bottleneck. It includes a focus on monitoring parameters specific for each remediation technology, that may clearly show the progress of activities leading towards the remediation target.

Moreover, the project has also the objective to promote sustainable in situ technologies with a clear scheme for their monitoring over time. The resulting documents will contribute to reduce the use of less sustainable remediation technologies like Dig&Dump and Pump&Treat.

The main outcome is the support/exchange of technical experiences, required in Europe in monitoring in situ/on site technologies. This enables those MS in which no monitoring procedure is currently available, to have one reference they may use completely or partially.

Introduction

This questionnaire focuses on case studies where Permeable Reactive Barriers (PRB) were applied at a contaminated site.

The questionnaire for the collection of case studies will remain active in the period between **1 May 2025 to 30 September 2025**. Late submission could be evaluated by the project team.

The purpose of this Questionnaire is to collect specific information on cases of PRB. To this purpose, you are kindly requested to **submit one or more case studies each with a different file**.

In case you cannot fill in the questionnaire, please answer to the last question in order to address the project team your possible remarks, concerns, requests, suggestions.

For each case study may details on the **site location**, details of the **author(s)** and their **affiliation** and **companies** involved are inventoried. This information would help understanding the site, but is **not mandatory**. At least one contact point is mandatory, for possible questions or resolving any potential problem related to the publication.

It is allowed to make reference to registered products and/or patents, but it is necessary to make reference to active species present and eventually by-products or side effects (e.g. pH increase).

**Please note:** data on the costs, on environmental net benefit as well as the sustainability aspects are not included in the Questionnaire and the resulting report.

As previously mentioned, the responses of the completed Questionnaires will be analysed in order to identify criteria for the evaluation of the performance of the remediation technology. The experiences collected may be useful to prepare the monitoring plan of different remediation phases for similar cases.

You are requested to fill out the Questionnaire in Annex I and upload documents in English.

Please copy-paste answers, images, photos, maps, graphs, flowcharts and diagrams in the Questionnaire, that can support a better understanding.

Please send the Questionnaire to [marco.falconi@impel.eu](mailto:marco.falconi@impel.eu).

In case the file of the completed Questionnaire and/or of any useful document attached is too large, please send it/them to via We Transfer (<https://wetransfer.com/>) or Share File (<https://www.sharefile.com/>) or any other preferred internet tool.

**Final note:** The Questionnaire should not only be completed with successful cases of PRB applications, but also with unsuccessful cases. In fact, for those unsuccessful cases, shortcomings and improvement actions will be identified and analysed.

Moreover, feel free to share this questionnaire to inspectors, public officers or any other stakeholders. Participation or consultancies, site owners, environmental service companies are welcomed.

Thank you very much for your collaboration from all the WLR project team.

If you need assistance or clarifications, you may contact:

Mr. Marco Falconi

Email: marco.falconi@impel.eu

Mobile Phone: +39 3471204170

**DISCLAIMER:**

The questionnaire is subject to the Directive 2003/4/EC of the European Parliament and of the Council of 28 January 2003 on public access to environmental information.

As a consequence, the information contained in the filled Questionnaire will not be confidential, not only for the information of the intended recipient and may be used, published or redistributed by IMPEL without the prior written consent of the compiler.

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**Annex 1**

**Permeable reactive Barriers (PRB)**

**IMPEL Project “Water and Land Remediation 2025-27”**

***Delivering time 1 May 2025 – 5 September 2025***

1. Your contact details

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| * 1. ***Name and Surname\**** |  |
| * 1. ***Country/Jurisdiction*** |  |
| * 1. ***Organisation*** |  |
| * 1. ***Position*** |  |
| * 1. ***Duties*** |  |
| * 1. ***Email address*** |  |
| * 1. ***Phone number*** |  |

\* If you do need, you can fill the Questionnaire as anonymous. In this case, we kindly ask you to fill just the box no. 1.6, 1.7, that will be used to contact you for any questions related to the publication.

1. Site background

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| **2.1****History of the site** |
| Please describe the history of the site (you may add one or more pictures and cadastral plans that have followed one another over the years)  (your answer) …  -------------------------------------------------------------------------------------------------------------------  EXAMPLE OF ANSWER  The US Coast Guard Support Center is located about 100 km south of Norfolk, Virginia, and 60 km inland from the Outer Banks region of North Carolina. The base is situated on the southern bank of the Pasquotank River, about 5 km southeast of Elizabeth City, North Carolina. A metal plating shop operated for more than 30 years in Hangar 79, which is about 60 m south of the river (Figure 6.1). Following its closure in 1984, soils beneath the shop were found to contain chromium concentrations up to 14,500 mg/kg.    Fig. 1: Site map showing locations of the source, PRB, monitoring wells, and Transect 2.  Subsequent investigations revealed a chromate plume extending from beneath the shop to the river. At that time, the contaminant plume had high (>10 mg/L) concentrations of chromate, elevated sulfate (150 mg/L), and small amounts of volatile chlorinated organic compounds: trichloroethene (TCE), cis-DCE, and vinyl chloride (VC).  In June 1996, a 46 m long, 7.3 m deep, and 0.6 m wide PRB (continuous wall configuration) of zero-valent iron was installed approximately 30 m from the Pasquotank River. The reactive wall was designed to remediate hexavalent chromiumcontaminated groundwater and portions of the larger overlapping plume of volatile chlorinated organic compounds. In 1999, a pilot-scale injection of sodium dithionite was conducted to evaluate the response of the sourcezone hexavalent chromium. On the basis of the success of this test, a full-scale treatment with sodium dithionite was carried out in 2001. The objective of the dithionite treatment was to allow for the reduction of naturally occurring ferric iron-bearing minerals in the aquifer matrix to a reactive ferrous iron state, which drives the reduction of mobile CrVI to the insoluble trivalent (CrIII) state. |

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| **2.2****Geological setting** |
| Please describe the geological setting (you may add one or more pictures)  (your answer) …  -------------------------------------------------------------------------------------------------------------------  EXAMPLE OF ANSWER  The area of investigation consists of a surface layer of concrete which is underlain by gravel and sand fill to a depth of 1,3 m below the ground surface (bgs). Underlying the fill soils are quarternary deposits of gravel and sand colluvium of variable thickness, interbedded with sand and clay layers. Silty clays are encountered below the colluviums between depths of 3,6 to 8,3 m bgs which forms a hydraulic boundary between the overlying quarternary colluvial aquifer and an underlying tertiary (drinking water) aquifer comprising fine to medium sands. The depth to groundwater ranges from 2 to 3 m bgs. |
| **2.3****Contaminants of concern and their distribution** | |
| Please describe the contaminants of concern (mentioning also if there are contaminants with natural background concentrations)  (your answer) …  -------------------------------------------------------------------------------------------------------------------  EXAMPLE OF ANSWER  A detailed delineation monitoring program was undertaken in January, May, and September 2009 in order to characterize the contaminants of interest, to determine their respective concentrations along the proposed PRB location, and to better characterize the local hydrogeological conditions. This program included the installation of four multilevel monitoring wells (MWG87, 88, 89, and 90) directly upgradient of the Damplands Pond and two rounds of groundwater monitoring for volatile organic compounds (VOCs) and nitrate. The January 2009 TCE and nitrate results are presented (in cross-section) in the figures below, respectively.    Fig. 2: TCE concentrations along the proposed PRB alignment    Fig. 3: Nitrate concentrations along the proposed PRB alignment  The results indicate that the TCE and nitrate plumes overlap and are relatively consistent in shape over the year. The concentrations of TCE vary over time, with the maximum concentration in January 2009 being 2 mg/L in comparison with 0.82 mg/L in September 2009. Nitrate concentrations were found to be less variable with the maximum concentrations ranging from 14 mg/L in January 2009 to 19 mg/L in September 2009. It should be noted that nitrate contamination is not associated with the WCS fire and is instead likely to be the result of upgradient septic tank usage or possibly an upgradient livestock sale yard. | |

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| **2.4****Regulatory framework** |
| Please describe the regulatory framework applicable. This should include target values to be reached, , eventual specific approval needed for application of chemicals in the ground   * (your answer) … * EXAMPLE OF ANSWER   Based upon the results of subsurface contamination quantified at the site, the regional environmental regulatory authority ordered that soil and groundwater remediation efforts be implemented at the site to mitigate contaminant impacts on potential environmental receptors. The specific goal of the regulatory clean up order was to “prevent the danger of contaminant exposure to receptors and prevent the long term spreading of contaminants”. In order to achieve this goal, the regulation requires that “applicable remedial measures be applied to minimize or remove contaminants (i.e decontamination) and to prevent or minimize the spread of contaminants i.e. (containment)”.  Risk-based remediation criteria were developed for CHC contaminants at the site whereby a reduction of total CHC concentrations (i.e for PCE, TCE, DCE and VC) of 95% over 3 consecutive monitoring events in source area monitoring wells was required. |

1. Laboratory study

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| **3.1****Column testing** |
| Please describe the column testing that have been performed  (your answer) …  -------------------------------------------------------------------------------------------------------------------  EXAMPLE OF ANSWER  Long-term column tests were run during the current project to simulate several years of operation of the PRBs at former NAS Moffett Field and Lowry AFB. The columns were filled with the same iron used in the field PRBs and groundwater was obtained on a monthly basis from locai site representatives. The objective was to observe the kind of aging ofthe iron that would not be visible in the field PRBs for many years in the future and get some idea about the change in performance of the iron over time (represented by pore volumes of flow).    Figure 3: Plot Showing Stability of pH and ORP After 15 Pore Volumes of Groundwater  About 1,300 pore volumes of groundwater obtained from the site was run through the column that was packed with iron. The flowrate was initially setto 30 ft/day, but shortly thereafter was reduced to 25 ft/day to ensure that the pH and ORP would reach a plateau between the final port within the column, Port D, and the effluent (E). Figure above shows the pH and ORP profile after 15 pore volumes of water had passed through the column and at a flowrate of 25 ft/day. However, subsequent measurements showed that the pH was continuing to climb, indicating that some precipitates may not be getting enough time to form in the column. Also, analysis of filtered and unfiltered samples showed that more of the precipitates were being retained in the column at 12.5 ft/day; at 25 ft/day, colloidal precipitate particles were being washed out of the column.  Therefore, the flowrate was reduced to 12.5 ft/day at 317 pore volumes and was maintained at that level until the end of the test. It is possible that in the first part of the test ( until 317 pore volumes), precipitate formation and retention had not reached their maximum in the column.  A 6 ft/day-flowrate was tested briefly, but did not appear to provide any significant advantage in terms of pH increase or precipitate retention. At the end of the test, the effect of flow velocity on the half-life measurements in the column was checked.  The TCE half-life remained relatively constant at all three flowrates tested (25 ft/day, 12.5 ft/day, and 6 ft/day), indicating that the flowrate did not affect the half-life determination.  However, the half-life increased slowly and monotonically over the duration of the column test, which is believed to be an effect of iron aging. |

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| **3.2****Selection of reactive material and prevision of its longevity** |
| Please describe if and which post treatment was installed for the effluent in the full scale application in field   * Zero valent iron * Mulch and Compost * Alternative Organic Amendments * Sand, Gravel, and Limestone * Inorganic Amendments * Other reactive materials * Reaction Kinetics   (your answer) …  -------------------------------------------------------------------------------------------------------------------  EXAMPLE OF ANSWER  Predicting the lifespan of permeable reactive barriers (PRBs) using granular iron is complex due to limited field data, uncertainties in precipitation kinetics, and challenges in simulating long-term groundwater interactions. This study focused on two specific sites—**former NAS Moffett Field and former Lowry Air Force Base**—where PRBs were installed to treat contaminated groundwater. **Key Evaluation Methods** **Groundwater and Iron Core Analysis**   * + Inorganic constituents (e.g., calcium, sulfate, silicate) were measured in influent and effluent water to estimate precipitation within the PRBs.   + Iron core samples from operational barriers (in place for at least two years) were analyzed to assess mineral buildup.   + Discrepancies were found between predicted precipitation (based on water chemistry) and actual deposits on iron, likely due to uneven precipitate distribution.   **Accelerated Column Testing**   * + To simulate long-term performance, columns packed with site-specific iron (Peerless Metal Products iron for Moffett Field, Master Builder iron for Lowry AFB) were flushed with actual groundwater from each location.   + Flow rates were increased (e.g., from 0.5 ft/day in the field to 12 ft/day in the lab) to accelerate exposure while maintaining reaction validity.   Tests confirmed that contaminant degradation rates (e.g., TCE half-life) remained stable despite higher flows, suggesting that iron reactivity could persist over time.**Geochemical Modeling**   * + Equilibrium models helped identify possible precipitation reactions (e.g., carbonate and silicate mineral formation).   + Kinetic models were less useful due to insufficient data on reaction rates.  **Findings and Challenges**  * **Precipitation Distribution:** Lab tests showed that accelerated flows spread precipitates over a longer iron path, potentially delaying reactivity loss compared to field conditions. * **Optimal Flow Rate:** A flow rate of **12 ft/day** was selected to ensure precipitates formed without being washed out as colloids. * **Site-Specific Behavior:** Differences in groundwater chemistry between Moffett Field and Lowry AFB influenced precipitation patterns, reinforcing the need for site-specific testing.   While traditional methods (groundwater monitoring, core analysis, and modeling) provided insights, **accelerated column tests** were critical for estimating long-term iron reactivity. The results suggest that PRBs at these sites could remain effective for extended periods, though further monitoring is needed to validate predictions. |

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| **3.3****Reaction rates (laboratory or prevision), calculation of residence time and wall size** |
| Please describe the calculation made for determining the reaction rates (laboratory or prevision), calculation of residence time and wall size  (your answer) …  -------------------------------------------------------------------------------------------------------------------  EXAMPLE OF ANSWER  CHC and ZVI are commonly used as a typical contaminant and reactive material for the barrier. The reaction kinetics and half-life of contaminants are two of several key parameters that require optimization for the design of an effective barrier. Iron concentrations in the interstitial water within the reactive barrier usually range from 0.5 to 14.8 mg/L. There is a high possibility for the blockage of the barrier due to Fe(III) mineral precipitation at higher pHs under aerobic conditions. Due to inherent very slow GW flow rates, lamina flow conditions are always present at the barrier and this needs consideration when designing the barrier. The commonly used ZVI has grain sizes that vary with construction, shown in Table 3.1. The process involves the simultaneous oxidative corrosion of the reactive iron metal by both water and CHC in the presence of ZVI (Focht et al. 1996) illustrated in Equation below:  Fe0 + RCl + H+ → Fe2+ + RH + Cl−  This is a first-order reaction of the ZVI barrier which acts as a plug flow reactor; it can be represented as in Equation 3.2:  C = C0e−kt    where  C = the outlet concentration  C0 = the initial concentration  k = the reaction kinetic  t = the residence time within the barrier  The reactive ZVI reaction kinetics and formation of byproducts requires investigation by conducting laboratory batch and column experiments, using contaminated GW from the remediation site. Such experiments also help to select an appropriate reactive material for the particular site application. The column experiments acts as a plug flow reactor and mimic the actual GW flow conditions within it. The reaction rate obtained from the column study can be used for sizing the PRB barrier wall thickness. |

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| **3.4** **Characterization for the design** |
| Please describe if and which post treatment was installed for water in the pilot scale application in field  Hydraulic performance Evaluation   * Geochemistry of GW * Water level measurements * Slug Tests * In situ Flow sensors * Down-hole velocity probes (heat sensors) * Diffusion samplers * Evaluating plume bypass * Tracer tests * Other   (your answer) …  -------------------------------------------------------------------------------------------------------------------  EXAMPLE OF ANSWER  The groundwater flow velocity at the site is extremely variable with depth, with a highly conductive layer at roughly 4.5–6.5 m below ground surface. This layer coincides with the highest aqueous concentrations of chromate. The groundwater table ranges from about 1.5 to 2.0 m below ground surface and the average horizontal hydraulic gradient varies from 0.0011 to 0.0033. Slug tests conducted on monitoring wells with 1.5 m screened intervals between 3 and 6 m below ground surface indicate hydraulic conductivity values between 0.5 and 10 m/day. A multiple borehole tracer test showed groundwater velocities between about 0.10 and 0.20 m/day. |

1. Full-scale application

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| **4.1****Configuration of PRB** |
| Please illustrate the configuration of PRB  Configuration   * *Continuous PRBs* * *Funnel-and-Gate PRBs* * *Reactive Vessels* * *Caissons PRBs* * *Other*   (your answer) …  -------------------------------------------------------------------------------------------------------------------  EXAMPLE OF ANSWER  The Karlsruhe PRB is about 240 m long and 17 m deep, arranged in an almost straight line, along which eight, nearly equidistant gates are positioned.  The funnel consists of sheet piles that were pressed, not driven, into the ground using the “silent-piler-technique” to prevent damage to nearby buildings and gas supply pipelines. The gates consist of specifically perforated, cylindrical steel tubes that were set into the ground by means of largediameter borings. Setting up the gates commenced by driving cylindrical, large-diameter (2.5 m) borehole casings (circular caisson installation) into the ground and excavating them to a final depth of 15–17 m below ground level (0.5 m below the aquifer base). Prefabricated, cylindrical gate segments were connected to each other and the whole construction was lowered into each shaft/borehole (≈ 18 m in length and 1.8 m in diameter). Monitoring wells were installed at the inflow and the outflow of the gates. Pea gravel was used as a filter medium to homogenize the flow of water through the gates, and loaded in front of and behind each gate. The central section of each gate was loaded with GAC. |

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| **4.2****Construction and injection technique** |
| Please describe the number and characteristic of contruction and injection techniques in the full scale application   * General layout * Backhoe and Clamshell Trenching Methods * Caisson Excavation Method * Continuous Trenching Method * Biodegradable Slurry (Biopolymer) Trenching Method * Jetting Method * Hydraulic Fracturing Method * Vibrated Beam/Mandrel Methods * Deep Soil Mixing Methods   (your answer) …  -------------------------------------------------------------------------------------------------------------------  EXAMPLE OF ANSWER  The contractor who proposed to install the sequenced PRB system using a biopolymer guar gum slurry. This method is a modified slurry trench technique that temporarily supports the trench excavation below the watertable using a biodegradable polymer instead of bentonite slurry. The slurry is made from a guar bean derivative comprising a mixture of polysaccharides (sugars, i.e., a long-chain carbon polymer), which is relatively stable in solution over a pH range of 5–7. To degrade the guar gum at the end of the PRB installation process, a slurry breaking agent is recirculated by air lifting in temporary wells. The final design of the contract varied from the preliminary design in the following ways: the PRBs were moved away from the original alignment by approximately 4 m to the southeast (for operational reasons), the thickness of the PRBs was increased from 30 to 60 cm, and a clay cap was added to the top of the ZVI PRB. Each PRB took approximately 7 days to install. The ZVI and sand mixture was mixed on surface, wetted and then placed in the trench using a tremmie system. The panels were installed through the use of a removable end stop. The mixture for the denitrification PRB was installed using a conventional progressive displacement technique since using the woodchips had the potential to clog the tremmie. Some sections of the final PRBs were larger than the final design width of 60 cm. This was a result of sections of the trench collapsing due to guar gum stability issues as well as the removal of a number of unanticipated large boulders (large concretions). The geotechnical investigation that was undertaken along the original alignment did not encounter any such obstructions. The additional width resulted in additional costs associated with extra material requirements and manpower time. However, a benefit of the extra width is that the resulting retention times would likely be longer than designed. In one instance, a boulder was encountered at the base of the denitrification PRB. This boulder was left in situ as it was not possible to remove it and the sawdust and sand mixture emplaced around it. |

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| **4.3****Hydraulic/Geochemical/Microbiological design improvements** |
| Please describe any Hydraulic/Geochemical/Microbiological design improvements  (your answer) …  -------------------------------------------------------------------------------------------------------------------  EXAMPLE OF ANSWER  Over the first 3 years of operation, the Karlsruhe PRB cleanup results did not meet remediation goals. The main issues were groundwater bypassing the barrier at its northern edge and insufficient retardation of contaminants at some gates. In early 2004, an overflow of some gates was identified as a major issue, and therefore, all gates were equipped with extensions on their tops to raise the GAC layer above groundwater level, thus avoiding further overflow. That repair could be performed relatively readily because of the high accessibility of the design of the PRB. Shortly after that issue had been fixed, monitoring data revealed a consistently good cleanup performance for the first time. The remediation goal for benzene (1 µg/L) was met. The remediation goal for PAHs excluding naphthalene (0.2 µg/L) was still being exceeded at some gates but overall, since summer 2004, measurements demonstrate a good performance by the entire PRB installation. An overall degradation rate of 99% was achieved in August 2004. Since April 2003, PAH concentrations at the northern edge have been decreasing and reached the remediation target value at the beginning of 2005. A modeling study carried out in 2004 proved that the circumvention of the northern edge of the funnel was caused by drainage measures in the course of a sewer construction 1 km north of the PRB over 2 years. Since April 2004, the cleanup efficacy achieved by the entire system has been close to 100%. A monitoring campaign recently (2007–2010) conducted by the RUBIN R&D program (Birke et al., 2010; Birke and Burmeier, 2012a,b) revealed an ongoing high performance regarding the adsorption of PAHs and BTEX as well as showing, for the first time, that NSO-PAHs were also removed from the groundwater successfully |

1. Results

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| **5.1** **Performance monitoring** |
| Please briefly describe the perfomance monitoring with all or just some of the following information   * Monitoring to Evaluate Performance Objectives * Monitoring Network Design * Monitoring Hydraulic Performance * Concentration-Based Performance Monitoring Approaches * Mass Discharge Approach * Monitoring PRB Geochemistry and Microbiology * Advanced Monitoring Tools * Downgradient Water Quality * Reaction rates * Unintended performance issues   (your answer) …  -------------------------------------------------------------------------------------------------------------------  EXAMPLE OF ANSWER  Monitoring results prove an effective performance of the section over the whole PRB life span since 1998, with an overall degradation efficacy >99.5% while no decrease in reactivity has been indicated. In contrast to the efficient iron sponge section, the section containing a mixture of Gotthart-Maier ZVI and pea gravel showed significantly decreased reactivity only 6 months after installation. Its initial degradation efficacy for PCE was >98% decreasing to approx. 80% 1 year after installation. Since then, the performance has reached a relatively stable level, varying between 70% and 90%. Remediation efficacy is lower than expected from the known material properties and column experiments conducted prior to the setup of the pilotscale PRB. The possible reasons include a flow bypass, fast passivation, or construction problems, namely layers of gravel with only small amounts of iron filling. |

1. Post treatment and/or Long Term Monitoring

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| **6.1** **Post treatment and/or Long Term Monitoring** |
| Please describe the monitoring parameters for post treatment and long term monitoring, sampling method and sampling frequency *(your answer) …*  (your answer) …  -------------------------------------------------------------------------------------------------------------------  EXAMPLE OF ANSWER  Monitoring results over 4 years of operation indicated an effective removal of cVOCs at 92.4%–97.5%. However, the continuous loss of porosity due to mineral precipitation was identified as a significant problem, given the high concentrations of calcium, which may significantly decrease the hydraulic performance of the PRB and may consequently limit its longevity to about 10 years only (Lo et al., 2003, Lai et al., 2006). A detailed monitoring campaign over 7.5 years after the barrier’s erection showed very efficient removal (>99%) for the most important cVOCs (PCE, TCE, and 1,1,1-TCA). However, significant formation of cis-DCE within the PRB resulted in an overall insufficient removal of cis-DCE (≈ 80%). High concentrations of both TCE and cis-DCE upstream the PRB along with the significant formation of cis-DCE inside the PRB which gave rise to significant concentrations of cis-DCE downstream the PRB. This finding was not acceptable from a regulatory perspective and further remedial action was needed to remove the cis-DCE plume discharging into a small creek located about 100 m downstream the PRB. Another PRB located on the downstream side of the existing PRB (only treating the very narrow cis-DCE plume) was a possible solution. On the basis of the concentrations observed on the downstream side of the PRB, a relatively thick barrier was needed to meet target criteria of 10 μg/L. Enhanced NA by augmenting with cis-DCE degrading bacteria (Dehalococcoides species) in the downstream aquifer was another option |

1. Additional information

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| **7.1****Lesson learnt** |
| Please describe Key findings and lessons learned about this site. Difficulties and weaknesses, successes and strengths, keystones, shortcomings and rooms for improvement. Please give your opinions as regard to 1) methodology and procedures, 2) technical aspects 3) legislative, organizational aspects.  (your answer) …  ------------------------------------------------------------------------------------------------------------------- |

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| **7.2****Additional information** |
| Given the clues and the evidence found in the specific case, can you suggest criteria for the determination of clues and evidence referable to the success of remediation?  (your answer) …  ------------------------------------------------------------------------------------------------------------------- |

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| **7.3****Training need** |
| Please give your opinion as regard to the training needs from the technical, procedural, organizational point of view and which training tool you think is effective (workshops, training on-the job, webinars, e-learning, etc.).  (your answer) …  ------------------------------------------------------------------------------------------------------------------- |

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| **7.4** **Additional remarks** |
| Please feel free to give any additional information, remarks, concerns, requests, suggestions  (your answer) …  ------------------------------------------------------------------------------------------------------------------- |

Glossary of Terms A glossary will help a you to maintain the level of precision necessary for key terms and maintain consistency across the text. We found out that sometimes terms that sounds similar like “contaminated” and “polluted” are used in the same way as synonyms in some country, while in other they have different meanings (due to legislation or for other reasons). So fill in this glossary for your key elements and of course for acronyms.

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| **Term (alphabetical order)** | **Definition** |
| VOC | Volatile organic compounds (VOCs) are organic chemicals that have a high vapor pressure at ordinary room temperature |
| .... | ..... |
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