

## MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY SITE CHARACTERIZATION REPORT FORMAT

**General:** This guidance presents the recommended content and format for the Site Characterization Report. **Please note that this guidance is comprehensive and does not segregate report content or format based on the varied media impacted.** Also note that many of the content items are common for all impacted media. The primary difference is whether the contaminated media are soil, sediment, surface water or groundwater only or a combination thereof. This format is designed to advise a person, prior to submitting an application, of the information necessary to achieve the adequate and cost-effective characterization of a Site. The guidance should be used and adapted as appropriate for the specific property being addressed. Strict adherence to this format and inclusion of the suggested contents will lessen the overall review time needed by the Mississippi Department of Environmental Quality (MDEQ) staff.

### **TITLE PAGE**

A Title Page must be provided that includes, at a minimum, the following:

- 1) [PROPERTY] Site Characterization Report
- 2) Date: [DATE]
- 3) Presented on behalf of: [PARTY]
- 4) Prepared by: [CONSULTING FIRM]
- 5) Signature and Seal of the Professional Engineer (PE) and/or Registered Professional Geologist (PG), as necessary.
- 6) Signature and Seal (if applicable) of other Professionals
- 7) Signature of Project Manager

Note: Entries listed above in brackets and capitalized are specific to the Property that is the subject of the Site Characterization Report.

### **TABLE OF CONTENTS**

A Table of Contents listing all required sections and their appropriate page number must be included.

## **SECTIONS**

### **1.0 Executive Summary**

Provide a preliminary summarization of the results of all previous investigation activities. This summary should include specific date(s) of all known separate investigative phases.

### **2.0 Introduction**

Provide a description of the specific objectives for investigation activities including additional objectives established during the implementation of the Work Plan. Document how the objectives were achieved or not achieved.

### **2.1 Property Background**

*If this information was provided in the Work Plan, reference it accordingly.*

#### **2.1.1 Property Location and Demographics**

List the property location, including latitude and longitude, street address, city, county, and describe general demographic information in the vicinity of the Site. Discuss population density, zoning and predominant land usage in the vicinity of the property.

#### **2.1.2 Property History**

Provide a brief history of the property including operations, a list of all chemicals stored, used, produced, discovered or otherwise managed on-site and copies of their [Material Safety Data Sheets \(MSDS\)](#), ownership, facility compliance history, off-site disposal practices, and past property activities. Include a discussion of any known off-site actual or potential sources of contamination.

#### **2.1.3 Mining/Exploration Activities**

Describe the history of mining, oil and gas exploration, and other intrusive activities on or in the vicinity of the Site. Also discuss the potential for mining/exploration activities from mineral interest owners.

#### **2.1.4 Previous Investigation**

Summarize results and conclusions from previous investigations conducted for the property. List the titles of all investigation reports that have been prepared. Copies of all investigation reports must be made available to MDEQ.

### **3.0 Investigative Activities**

Describe in detail **how** all investigative activities were conducted as part of the site characterization relative to the tasks outlined in the Site Characterization Work Plan for the property. NOTE: If a [Site Characterization Work Plan](#) has been conditionally approved by MDEQ, the applicable sections of the Work Plan and the MDEQ conditions may be referenced. Areas that must be specifically addressed are listed below:

#### **3.1 Source Area(s) Characterization**

Describe how the vertical and horizontal extent and degree of contamination for all sources (soil, groundwater, surface water, sediments, air, etc.) that have impacted the site and the physical characteristics of the source area have been investigated.

#### **3.2 Impacted Surface Water and Sediments**

Describe how the vertical and horizontal extent of contamination of surface water and sediments and how the physical characteristics of surface water and sediment have been investigated.

#### **3.3 Property Geology**

Describe how the characteristics of the site specific geology of the property were determined (i.e., thickness of each layer, whether the layers are inter-connected, name of the geological formation, aquitard/aquiclude properties, etc.)

#### **3.4 Property Soil and Vadose Zone Characteristics**

Describe how the site specific soil and vadose zone characteristics (i.e., soil moisture content, soil organic carbon, cation exchange capacity, soil texture, dry soil bulk density, pH, etc.), and the nature and extent of contamination in soil have been investigated (i.e., sample collection technique, EnCore<sup>®</sup>, field preservation, hand augering, Photo Ionizing Detector (PID) field screening, etc.) NOTE: If samples have been analyzed for volatile organic compounds, a description of the sample collection techniques must be included and the techniques must be consistent with the ["Guidance for Collecting Low-level Volatile Organic Compounds in Soil."](#)

#### **3.5 Property Ground Water/Aquifer Characteristics**

Describe how the site specific groundwater/aquifer characteristics (i.e., hydraulic conductivity, flow rate, interconnectedness of aquifers, hydraulic gradient, infiltration/recharge, aquifer thickness) and the nature and extent of contamination in groundwater have been investigated (i.e., GeoProbe<sup>®</sup>, permanent wells, purging technique, stabilization technique, preservation, EPA Method(s) selection, etc.). NOTE: Purging techniques must be described and must be consistent with the [EISOPQAM](#), unless otherwise approved by MDEQ-Superfund Branch. If Non-aqueous phase liquids (NAPLs) were encountered, a description of the methods utilized to measure thickness and nature and extent must also be presented.

### **3.6 Human/Target Population Surveys**

Describe how the human/target population surveys were conducted (i.e., residential survey, population density, zoning, empowerment zones, enterprise community zones, etc.)

### **3.7 Area Water Well Surveys**

Describe how the public, industrial, and private water well survey was conducted (i.e., records review, house-to-house survey, etc.). Note that record reviews normally do not identify all of the wells near a site. Also note that all wells discovered should be field verified. Public Water Supply (PWS) and WATSTOR wells provided by MDEQ and the USGS should be used for the initial identification of water wells in the area.

### **3.8 Ecological Target Surveys**

Describe the steps taken to complete the [Ecological Checklist](#).

## **4.0 Property Physical Characteristics**

Provide a detailed description of the physical characteristics of the investigative activities. Results should be provided for investigative areas, as applicable, identified relative to Section 3.0 of this document.

### **4.1 Source Area(s) Physical Characteristics**

Describe the physical characteristics for all sources (soil, groundwater, surface water, sediments, air, etc.) that have been investigated.

### **4.2 Impacted Surface Water and Sediments**

Describe the physical characteristics of surface water and sediments that have been investigated.

### **4.3 Regional Geology**

Describe the regional geology of the area. Discuss whether the characteristics of the site and the vicinity are conducive to mining/exploration (i.e., area is rich in kaolin clay that is mined in the vicinity of the site).

### **4.4 Property Geology**

Describe the site specific geology of the property that has been investigated (i.e., thicknesses of each layer, whether the layers are interconnected, geological formations, aquitard/aquiclude properties, etc.).

#### **4.5 Property Soil and Vadose Zone Characteristics**

Describe the site specific soil and vadose zone characteristics that have been investigated (i.e., soil moisture content, soil organic carbon, soil texture, dry soil bulk density, pH, etc.).

#### **4.6 Property Ground Water/Aquifer Characteristics**

Describe the site specific groundwater/aquifer characteristics that have been investigated (i.e., hydraulic conductivity, flow rate, interconnectedness of aquifers, hydraulic gradient, infiltration/recharge, aquifer thickness).

#### **4.7 Human/Target Population Surveys**

Describe the results from the human/target population surveys that have been investigated (i.e., residential survey, population density, zoning, empowerment zones, enterprise community zones, etc.).

#### **4.8 Area Water Well Surveys**

List the results from the public, industrial, and private water well survey that was conducted (i.e., records review, house-to-house survey, etc.). Each well discovered shall be field verified.

#### **4.9 Ecological Target Surveys**

Provide a copy of the [Ecological Checklist](#) and copies of correspondence with appropriate federal and state authorities, if necessary.

### **5.0 Nature and Extent of Contamination**

Present the **results** of the characterization for the media investigated. Describe in detail the horizontal and vertical extent of contamination identified for the media investigated. Provide reference to specific analytical results obtained, tables and figures. Media potentially addressed include:

#### **5.1 Sources and Source Areas (On-site and Off-site)**

#### **5.2 Soils and Vadose Zone**

#### **5.3 Air**

#### **5.4 Groundwater**

#### **5.5 Surface Water and Sediments**

#### **5.6 Non-aqueous Phase Liquids (Include both DNAPL and LNAPL)**

## 5.7 **Biological samples**

## 6.0 **Contaminant Fate and Transport**

### 6.1 **Potential Migration Routes**

Describe the potential routes of contaminant migration (i.e., air, soil, ground water, surface water, piping/conduits, etc.). Describe the basis for the steps taken to complete the [BASELINE Site Conceptual Exposure Models \(SCEM\)](#).

### 6.2 **Contaminant Characteristics**

Describe the physical and chemical properties of contaminants and provide specifics concerning behavior of these contaminants at the site.

### 6.3 **Contaminant Migration**

6.3.1 Discuss factors affecting contaminant migration for all media (e.g., sorption onto soils, solubility in water, movement of ground water, etc.). Evaluate whether contaminant migration has stabilized and provide analysis supporting stabilization (i.e., predominance of electron acceptors, aerobic environment, time trends, Mass Balance Approach, etc.). If contamination has not stabilized, determine the predictive extent of contamination and reference a figure depicting the predictive extent in Section 11.

6.3.2 If modeling has been used, discuss all modeling methods and results in detail.

## 7.0 **Identification of Potential Receptors**

### 7.1 **Receptors**

Identify any receptors which have been impacted or could potentially be impacted by the contamination. Receptors may include water supply wells, fish or animal populations, human populations, surface water bodies, sensitive ecosystems such as habitat for endangered species, etc.

### 7.2 **Potential Risk**

Describe the potential threat to impacted or potentially impacted receptors. Include discussion concerning toxicity of the contaminant(s) as related to the threat or risk posed, how the receptor has been or may be exposed to the contaminant, and other details to fully identify the risk posed by the contamination.

## **8.0 Quality Assurance Results**

*If this information was provided in the Work Plan, reference it accordingly.*

### **8.1 Key Personnel**

Key personnel or organizations that were necessary for implementing each activity during the investigation, along with their responsibilities, must be defined. Documentation of any required licenses or certifications (i.e., Professional Engineer, Registered Geologist, Licensed Water Well Driller, OSHA Hazardous Materials Technician, etc.) must be presented to MDEQ prior to implementing field activity. All field personnel must meet the OSHA requirements of [49CFR 1910.120](#) for HAZWOPER training and updates, medical monitoring, and other requirements, as necessary.

### **8.2 Quality Assurance Objectives for Data**

The degree of accuracy of sample analysis and how this degree of accuracy has been achieved must be identified. Also include within this section the numbers of, frequency and types of QA/QC samples such as trip blanks, field blanks, equipment blanks, and replicates which have been collected.

### **8.3 Sample Control and Field Records**

Present standard procedures for sample identification, sample control, chain of custody, and field records.

#### **8.3.1 Sample Identification - (See Section 3.2.1 of EISOPQAM)**

#### **8.3.2 Chain of Custody Procedures**

Procedures used to maintain and document the possession of samples from the time of collection until the samples or the data derived from the samples must be presented.

#### **8.3.3 Field Records - (See Section 3.5 of EISOPQAM)**

### **8.4 Analytical Procedures**

What specific laboratory methods have been used for analysis of samples.

### **8.5 Laboratory QA/QC**

A description of the internal QA/QC program of the laboratory conducting the analyses.

## 8.6 Data Validation and Reporting

Describe how laboratory results have been validated to determine whether QA/QC protocol have been met. A summary of the data validation process including discussion describing results from analysis of replicates, laboratory or method blanks, matrix spikes and matrix spike duplicates, trip blanks, field blanks, equipment (rinsate) blanks, and other QA/QC samples must be presented.

## 9.0 Summary and Conclusions

### 9.1 Provide a summary of the results addressing primarily:

#### 9.1.1 Nature and Extent of Contamination

#### 9.1.2 Contaminant Fate and Transport

#### 9.1.3 Identified Receptors/Risk

### 9.2 Conclusions derived from the site characterization, including:

#### 9.2.1 Conclusions/Recommendations

#### 9.2.2 Data Limitations

## 10.0 Remedial Action Evaluation

10.1 Based on conclusions from Section 8.2 prepare a detailed evaluation of remedial options in terms of their relative performance and life-cycle cost to identify the optimal risk management program for the Site. The relative performance of the remedial options should be evaluated on the basis of the following criteria:

- ! **Long-Term Effectiveness:** Magnitude of risk reduction achieved; reliability of controls.
- ! **Reduction of Mobility, Toxicity, or Volume:** Degree to which CoCs in source zone media are irreversibly destroyed, converted to a non-toxic state, or immobilized.
- ! **Near-Term Effectiveness:** Control of workers and community exposure/safety and environmental impacts during period of remedy installation or implementation; time period required to achieve corrective action objectives.
- ! **Implementability:** Ability to construct, operate, and monitor the performance of the remedial option; associated permitting requirements; availability of required equipment and services.
- ! **Cost Efficiency:** Life-cycle capital and operating costs relative to degree of risk reduction achieved.



The evaluation should include remedial options that would meet [Tier 1 Unrestricted and Restricted TRGs](#), and the Tier 2 Remediation Goals (RGs), when appropriate. Utilize the [BASELINE SCEM](#) to define the proposed remedial action in terms of the targeted exposure points and the remedial options to be applied. Remedial options may include, where appropriate, deed restrictions and engineering controls.

- 10.2 Describe the remedial option that has been selected and the rationale for its selection. Complete the [FINAL SCEM](#) and describe the remedial actions that will be taken to minimize and/or eliminate risk to the public health and the environment.
- 10.3 If active remediation or compliance monitoring (i.e., long-term groundwater monitoring to ensure that plume has stabilized and is contained within site boundaries) is necessary, identify the anticipated date that MDEQ will receive a [Corrective Action Plan \(CAP\)](#) to address active remediation and/or a Compliance Monitoring Plan (CMP) to address compliance monitoring will be received by MDEQ.

## 11.0 Tables

Certain data collected during the investigation must be presented in tables in the Report. Specific data must be tabulated. Each table must be presented in the format described in the MDEQ's [Guidance on Presenting Data in the Site Characterization Work Plan, Site Characterization Report, or Corrective Action Plan](#). Required tables include, but are not limited to the following list.

### 11.1 Soil Quality Field Screening

Provide field screening results for soils derived from conducting a soil gas survey, surface soil sampling, soil borings, and/or monitoring well borings. More than one table may be required to include the following types of information:

- 1) sample location identification (soil gas probe, soil boring, surface sample, monitoring well boring, etc.);
- 2) date sample was collected and screened;
- 3) sample interval depth; and
- 4) results from field screening (concentration and units).

### 11.2 Soil Sample Laboratory Analytical Results

The table must include:

- 5) sample location identification;
- 6) date sample was collected;
- 7) sample depth;
- 8) target compounds;
- 9) concentrations of compounds detected; and
- 10) Method Detection Level (MDL) for each compound

### 11.3 Groundwater Screening (Groundwater Survey)

The following information must be included:

- 1) sample location identification;
- 2) date sample was collected and screened;
- 3) sample collection depth;
- 4) screening method used; and
- 5) compounds and concentrations (and units) detected during screening.

### 11.4 Well Completion Information

The following information must be included:

- 1) well identification;
- 2) ground surface elevation;
- 3) surveyed top of casing/measuring point elevation;
- 4) screen length;
- 5) top and bottom of screen elevations;
- 6) top of filtered sand;
- 7) top of bentonite seal;
- 8) total depth of well;
- 9) static water level elevation;
- 10) date of static water level measurement;
- 11) soil classifications; and
- 12) geologist's notes/descriptions (i.e., visibly stained soil at 6-8', odor).

### 11.5 Well Purging Data

The following data collected during purging of wells for sampling must be included:

- 1) date purged;
- 2) odors, sheen or product present;
- 3) volumes purged;
- 4) purge volume or rate; and
- 5) parameter measurement values collected after each purge volume or rate (temperature, pH, conductivity, turbidity, dissolved O<sub>2</sub>, etc. - successive parameter measurements should demonstrate stabilization prior to sample collection).

### 11.6 Ground Water Analytical Results

The following information must be included:

- 1) well identification;
- 2) date sampled;
- 3) target compounds;
- 4) concentrations of contaminants detected;
- 5) Method Detection Limit (MDL) for each compound; and
- 6) appropriate data validation qualifiers.

### **11.7 Comparison of Analytical Results to Regulatory Cleanup Values**

Tabulate the results that exceed the unrestricted and restricted [Target Remediation Goals \(TRGs\)](#) values separately for each media (soil, surface water, sediment, groundwater) investigated. Method Detection Limits (MDL) that exceed the TRGs must also be presented.

### **11.8 Unsaturated and/or Saturated Zone Hydrogeological Testing Results**

Tabulate the results from vadose zone and/or aquifer testing.

### **11.9 Adjacent/Impacted Property Information**

Tabulated information pertaining to the adjacent properties and impacted properties must be included. The table must include the following information:

- 1) Property Owner (Name, Address, Telephone, if available)
- 2) History of Site Activities, if available
- 3) Known or suspected releases that may impact the Site

## **12.0 Figures**

The following items must be included in the Report.

### **12.1 Site Location (Topographical) Map**

Include a figure based on a USGS 7.5" Quadrangle depicting the property location. Surface water bodies and topography should be identified and the map must include North Arrow, Scale, and Map Source labels.

### **12.2 Adjacent/Impacted Property Map**

Include a figure depicting the adjacent and impacted properties that has been cross-referenced with the tabulated data in Section 10.8. Show local land use, including schools, hospitals, retirement homes, residential areas, commercial areas, etc., and any drinking water supply wells. Indicate areas of ecological interest and include North Arrow, Scale, and Map Source labels.

### **12.3 Site Plan View**

Include a Site Map that depicts the entire property, including property boundaries, buildings, buried tanks, conduits, surrounding properties, potential source areas, potentially impacted receptors, and other pertinent features. The map must include North Arrow, Scale, and Map Source labels.

#### **12.4 Sample Location Map(s)**

Include a sampling location map that depicts locations of monitoring wells; soil borings; soil gas and ground water survey probe locations; surface soil sampling locations; etc. Prepare separate maps for sampling locations, if necessary, to make map legible; e.g., separate maps for monitoring well locations versus ground water survey probe locations. The map(s) must include North Arrow, Scale, and Map Source labels.

#### **12.5 Potentiometric Surface Map**

Include a Potentiometric Surface Map. Control points must be labeled. Data such as static water level elevations at control points must be depicted on the map. The map must include North Arrow, Scale, and Map Source labels.

#### **12.6 Geologic Cross Sections**

Include Geologic Cross Sections that show site stratigraphy through full depth of potentially impacted water-bearing units, including underlying confining layer. Prepare a minimum of three cross-sections per site (i.e., one parallel to groundwater flow direction and two perpendicular to flow direction). Indicate contaminant location, monitoring wells depicting their screened intervals, and subsurface conduits/piping, etc. depicting the subsurface of the property. The cross sections should be oriented longitudinally and transversely with respect to the orientation of soil and/or ground water contaminant plumes. The potentiometric surface should be depicted on the cross section. The map must include North Arrow, Scale, and Map Source and Contaminant Concentration Unit labels.

#### **12.7 Soil Contamination Extent Maps**

Include Isocontour maps of soil analytical data with, at a minimum, isocontours labeled for Restricted and Unrestricted contaminant concentration levels. The maps must be plan views and cross-sectional views of the site. The map must include North Arrow, Scale, and Map Source and Contaminant Concentration Unit labels.

#### **12.8 Groundwater Contamination Isoconcentration Maps**

Include Isoconcentration maps depicting the extent and degree of ground water contamination. It may be necessary to prepare an isocontour map for each contaminant, suite of contaminants, and total contamination. Include at least three isocontour labels for each contaminant. One of the isocontours must be the groundwater Target Remediation Goal for each contaminant. The map must include North Arrow, Scale, and Map Source and Contaminant Concentration Unit labels.

## 12.9 **Separate Phase Product Isopach Map**

If separate phase product is encountered, a map depicting product extent and thickness must be provided. The map must include North Arrow, Scale, and Map Source labels.

## 12.10 **Groundwater Plume Trends** (if more than one set of data are available)

Show trend of relevant contaminants detected in groundwater wells as a function of time. The figure must be an X-Y Line graph with Time on the X-Axis and Concentration on the Y-Axis.

## 12.11 **Water Wells Map**

Include a map depicting all known water wells within two (2) miles from any portion of the MCL isocontour of the groundwater plume. The radius of influence for each water well should be depicted, if available. Estimate if no data is available.

## 12.11 **Site Conceptual Exposure Models (SCEM)**

A final **BASELINE SCEM** must be developed for the site for conditions as they currently exist and a **REMEDIAL SCEM** must be developed for Site conditions after planned remediation.

## 13.0 **Appendices**

Appendices containing the following material, **as applicable**, must be included in the Report. Appendices that contain other pertinent material should be developed and included as necessary.

- 13.1 Include soil boring and monitoring well construction logs. Logs must include notes concerning what is encountered and soil classifications (i.e., "moist sandy clay with visible staining and petroleum odor at 6-8' interval").
- 13.2 Include soil gas or ground water survey analytical reports and QA/QC results.
- 13.3 Include laboratory analytical reports for soil sample analysis.
- 13.4 Include laboratory analytical reports for ground water analysis.
- 13.5 Include data validation and usability summary.
- 13.6 Include vadose zone or aquifer testing data and parameter estimation calculations.
- 13.7 Include vadose zone or ground water flow modeling data and results.

- 13.8 Include pertinent correspondence such as communications with regulatory agencies relative to permitting, waste characterization and disposal, etc.
- 13.9 Photographs may be included such as photographs of property features, investigative activities, etc. Photographs are useful in providing additional documentation of the investigations conducted.
- 13.10 Original prints of historical aerial photographs should be included, if available.
- 13.11 Include Field Equipment Calibration Verification. Provide certification for each piece of field equipment that was utilized which demonstrates that each piece was calibrated prior to being used.