



MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
Remediation and Redevelopment Division

FINAL ASSESSMENT REPORT TABLE OF CONTENTS FORM

INSTRUCTIONS

Utilize the following Table Of Contents (TOC) to ensure that all information required by Part 213, Leaking Underground Storage Tanks, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Part 213), is provided in the Final Assessment Report (FAR). RBCA is defined in Part 213 as the ASTM standards E 1739-95 (2010), E 2081-00 (2010), and E 2531-06. Information in these standards must be provided, as applicable per site conditions. The Department of Environmental Quality, Remediation and Redevelopment Division may request supporting documentation to the data and conclusions of the FAR, which may include information identified in the ASTM standards referenced above.

Complete the FAR Cover Sheet and pages 1 through 4 of this TOC. The order and format in which the information is provided is at the discretion of the qualified consultant preparing the FAR. Consecutively number each page of the report, including appendices. The TOC column labeled as “Page(s)” should be completed with the range of page numbers for each section. Information previously submitted to the Department may be referenced by specifying where it is located within the referenced document.

FINAL ASSESSMENT REPORT TABLE OF CONTENTS (TOC) PAGE(s)

A. EXECUTIVE SUMMARY (Optional)

References: ASTM E1739-95 (Reapproved 2010), Section 6.11.1

B. SITE ASSESSMENT and RBCA REPORTING

1. Exposure point(s) (i.e., location of human and environmental receptors that could be impacted).
2. Locate potential exposure and transport pathways (i.e., ground water transport, vapor migration through soils and utilities, etc.).
3. Current or potential future use of the site and surrounding land, ground water, surface water, and sensitive habitats (as applicable).
4. Regional geological and hydrogeological characteristics (i.e., depth to ground water, aquifer thickness, flow direction, gradient, description of confining units, and ground water quality).
5. An evaluation of impacts to environmental receptors.
6. Records of past releases, potential sources areas, and historical site activities.

B. SITE ASSESSMENT and RBCA REPORTING (Continued)

7. Identify Chemical(s) of Concern (CoC), location of sources of the CoC, and maximum concentrations of CoC in soil and ground water.
8. Provide a site description and a description of site-specific hydrogeologic conditions.
9. Provide the following maps (not aerial photographs):
 - a. Site location and extended map showing local land use and water supply wells.
 - b. Site plan view showing location of structures (i.e., ASTs, USTs, buried utilities, conduits, suspected and or confirmed sources of contamination, etc.).
 - c. Site photos, if available.
 - d. Ground water elevation.
 - e. Geologic and hydrogeological cross sections.
 - f. Dissolved plume map(s) of the CoC.

Reference: Part 213, Section 21311a(a) and ASTM E1739-95 (2010), Section 6.2, and Section 6.11.12 thru 6.11.19

C. TIER I EVALUATION

1. Compare Site Conditions and data with Risk-Based Screening Levels (RBSL).
 - a. Discuss all potential exposure scenario(s); primary and secondary sources; transportation mechanisms; relevant exposure pathways; receptors based upon current and anticipated future site use; considering the land use, use restrictions (if any), and the surrounding area and use.
 - b. For all relevant exposure pathways determine if the RBSLs are appropriate for comparison.
 - c. If relying on Risk-Based Screening Levels for the volatilization to indoor air pathway, indicate location of completed “*Checklist for Determining if Generic Volatilization to Indoor Air Inhalation Criteria Apply*”
 - d. Discuss exposure scenarios where the CoC is above the RBSL.
 - e. *ASTM Exposure Evaluation Flowchart, Figure 2*, may be used to characterize site sources and exposure pathways, identify receptors, and compare site conditions with RBSLs. Identifying all possible corrective action measures and select corrective actions to reduce the concentrations of, and or eliminate exposure to the CoC.

Reference: ASTM E1739-95 (2010), Section 6.5 thru 6.7

D. TIER II EVALUATION

1. Provide all information and an explanation of the calculation of the Site-Specific Target Levels (SSTLs) generated for the site.
 - a. IMPORTANT--If proposing use of the 2020 VIAP Screening Levels as SSTLs, indicate location of completed checklist provided in the [2013 Guidance Document for the Vapor Intrusion Pathway](#).
2. If relying upon alternative points of compliance, provide the reasoning and information supporting their selection.
3. Gather additional site assessment information to develop or identify corrective action goals, if warranted.
4. Complete a Tier II evaluation on potentially relevant exposure pathways.
5. Obtain site-specific hydrogeologic and geologic characteristics to aid in generation of the SSTLs.
6. Define the extent of CoC relative to the residential RBSL and/or SSTL, as appropriate.
7. Evaluate the changes in concentrations of CoC over time to determine if they are stable, increasing, and/or decreasing.
8. Determine the CoC measured at the point(s) of exposure.
9. Complete mathematical models to generate SSTLs based on the measured and predicted attenuation of the CoC away from the source area(s).
10. Compare the concentrations of the CoC at the point(s) of compliance to the RBSLs or SSTLs to determine if corrective action, interim remedial action or further tier evaluation should be implemented.

Reference: Part 213, Section 21311a(b) and ASTM E1739-95 (2010), Section. 5.6, Section 6.2, Section 6.7 thru 6.7.3, and Section 6.8 thru 6.83

E. TIER III EVALUATION

1. Provide all information and an explanation of the calculation of the Site-Specific Target Levels (SSTLs) generated for the site.
 - a. IMPORTANT--If the evaluation relies on the use of the 2020 VIAP Screening Levels as SSTLs for the VIAP, indicate location of completed checklist provided in the Volatilization to Indoor Air Pathway Screening Levels Assessment form ([hyperlink](#)).
2. Site-specific and surrounding area geological and hydrogeologic characteristics.
3. The extent of CoC relative to the residential RBSL and/or SSTL.
4. Changes in concentrations of CoC over time (stable, increasing, and decreasing).
5. CoC measured at point(s) of exposure.
6. Models: SSTLs developed using more sophisticated statistical and contaminant fate and transport analyses, using site-specific input

E. TIER III EVALUATION (Continued)

parameters for direct and indirect exposure scenarios.

7. Identify the exposure scenarios where the measured concentrations of the CoC are above the SSTL at the point(s) of compliance.
8. Compare the target levels (residential RBSLs and/or SSTLs) to the concentrations of the CoC at the point(s) of compliance.

Reference: Part 213, Section 21311a(b), and ASTM E1739-95 (2010), Section 6.7 thru 6.7.3, and Section 6.9 thru 6.9.2

F. CONCEPTUAL SITE MODEL(s) (CSM) – 2.a. LNAPL DISCOVERY

1. **CSMs** - Provide a written and/or pictorial understanding of the site; conduct exposure pathway evaluations; detail the exposure pathways evaluated; determine if the exposure pathways are relevant or not relevant; and identify possible corrective actions.
FOR MOST SITES, A Light Nonaqueous Phase Liquid (LNAPL) CSM (LCSM) WILL BE REQUIRED IN PLACE OF A CSM SINCE A PETROLEUM RELEASE IS A LNAPL RELEASE.
2. **LCSMs** - Describe the occurrence, composition, and physical properties of the LNAPL; as well as the geologic setting(s) where the LNAPL body is located and is used to determine the risks and potential corrective action; as well as the changes to the LNAPL body and/or footprint.
 - a. **LNAPL DISCOVERY:**
 - i. Describe how and where the LNAPL was discovered/observed, in which well(s)/boring(s) and provide a site map of the LNAPL.
 - ii. Describe the soil type and product type. If product type is unknown, describe the characteristics and what might be the product type. Describe the known/suspected source of LNAPL and identify on a map
 - iii. Provide the LNAPL thickness and/or volume and the measured or estimated LNAPL saturation profile, including measurement methods and procedures.
 - iv. List obvious nearby receptors, including basements, utilities, water wells, etc.
 - v. Describe mobile and/or migrating (defined in Part 213) delineation activities completed to date and provide a site map showing known extent of LNAPL.
 - vi. Delineate and depict, plan view and cross section, of the LNAPL body including the site boundaries, as well as the residual, mobile, and migrating LNAPL, as applicable.
 - b. **LNAPL EVALUATION AND RECOVERY:**
 - i. Describe all LNAPL recovery events (i.e., where and what was done, and duration).
 - ii. Describe in detail the LNAPL recovery methods and procedures

**F. CONCEPTUAL SITE MODEL(s) (CSM) – 2.a. LNAPL DISCOVERY
(Continued)**

- utilized, including if groundwater was also recovered and how the recovered LNAPL was differentiated from the recovered groundwater.
- iii. Complete a table (i.e., Example Table 1 in Appendix A) and discuss event based and cumulative LNAPL, and groundwater volumes recovered.
 - iv. Provide observations of LNAPL recharge rate(s) for each impacted well.
 - v. If an LNAPL recovery test was performed, complete a table (i.e., Example Tables 2a and 2b in Appendix A) and include applicable figures. Describe the methods, procedures, calculations, results, and conclusions.
 - vi. Describe how recovered LNAPL and groundwater were handled, including the disposal method and location.
 - vii. Describe any and all risks posed by the LNAPL (i.e., expanding plumes, explosion hazards, vapor hazards, contact hazards, etc.).
 - viii. Provide recommendations for future recovery of LNAPL and discuss the rationale for those activities.
- c. **FIGURES (not aerial photographs):**
- i. Attach the following figures in order of discussion in the text. All figures must include a north arrow, scale, and legend. Approximate scales are not acceptable.
 1. Site Location Map.
 2. One or more Site Maps showing (as applicable).
 - A. Structures.
 - B. Boring and well locations (including drinking water wells on site).
 - C. Suspected source(s) of LNAPL.
 - D. Locations and depths of on-site buried utilities.
 - E. All past and present petroleum storage tanks, piping, dispensers, and transfer areas.
 - F. Extent of soil excavation.
 - G. Horizontal and vertical extent of LNAPL and state/occurrence of LNAPL
 - ii. Distinguish sequential elements of investigations by dates, symbols, etc. in the legend.
 - iii. LNAPL recovery test graphs showing LNAPL thickness and volume versus time during the recharge phase (i.e., Example Table 2b data).
 - iv. Trend analysis of mobile and/or migrating (as defined in Part 213) LNAPL vs Water Table elevation and select downgradient MWs dissolved contaminants vs. Water Table elevation to determine if the LNAPL is acting as a continuing source of groundwater contamination. Graphical representation is preferred.

**F. CONCEPTUAL SITE MODEL(s) (CSM) – 2.a. LNAPL DISCOVERY
(Continued)**

Reference: CSMs: ASTM E2081-00(2010), Section 3.2.52; and LCSMs: ASTM 2531-06, Section 3.1.19; and Sections 6 and 7; and Part 213, Section 21307(2), Section 21307(3)(b), Section 21308a.(1)(E)xv through xviii(A – H), Section 21308a(2), Section 21309a(2)(a) and Section 21311a(1)(c)(ii). See Example Tables in Appendix A

G. SITE CLASSIFICATION

1. Classify site according to Michigan's site classification system which is based upon the Risk-based Corrective Action (RBCA) process.

References: Part 213, Section 21314a; and ASTM E1739-95 (Reapproved 2010), Section 5.4 and Section 6.3

H. FEASIBILITY ANALYSIS

1. On-site and off-site corrective action alternatives to remediate contaminated soil and groundwater for each cleanup type above the applicable RBSL or applicable SSTL, including alternatives that permanently and significantly reduce the volume, toxicity, and mobility of the regulated substances, if above the applicable RBSL or applicable SSTL. The identified corrective action alternatives should only be those that are feasible based on the specific site conditions.
2. An analysis of the recoverability and whether the NAPL is mobile or migrating.
3. The costs associated with each corrective action alternative, including alternatives that permanently and significantly reduce the volume, toxicity, and mobility of the regulated substances that are above the applicable RBSL or applicable SSTL.
4. The effectiveness and feasibility of each corrective action alternative, in meeting cleanup criteria for contaminants that are above the applicable RBSL or applicable SSTL.
5. The time necessary to implement and complete each corrective action alternative.
6. The preferred corrective action alternative based upon all of the above.
7. An implementation schedule for completion of the corrective action.

Reference: Part 213, Section 21311a(c)

I. CORRECTIVE ACTION PLAN (CAP)

1. Description of the corrective action to be implemented.
2. Analysis of indicator parameters to be used in evaluating the implementation.
3. Analysis of the recoverability of NAPL and whether NAPL is mobile or migrating.
4. Description of ambient air quality monitoring activities.
5. Operation and maintenance plan.
6. A monitoring plan including:
 - a. Location of monitoring points.
 - b. Environmental media to monitor, including, but not limited to, soil, air, water, soil gas, biota.
 - c. Monitoring schedule.
 - d. Monitoring methodology, including sample collection and other procedures.
 - e. Substances to be monitored, with explanation of how they will be used.
 - f. Lab methodology, lab name, method detection limits, practical quantitation levels.
 - g. Quality control/quality assurance plan.
 - h. Data presentation and evaluation plan.
 - i. How monitoring data will be used to demonstrate effectiveness of corrective actions.
 - j. Other elements required by the Department to determine the adequacy of the monitoring plan.
7. A schedule for implementation of the corrective action.
8. Financial assurance mechanism.

Reference: Part 213, Section 21309a

J. NOTICE OF CORRECTIVE ACTIONS, INSTITUTIONAL CONTROLS, RESTRICTIVE COVENANTS, ALTERNATIVE MECHANISMS, NOTICE OF LAND & USE RESTRICTIONS

1. An explanation of land and use restrictions, or resource use restrictions, and how they will prevent or control unacceptable exposures.
2. Provide notice to the public directly impacted by the release above a residential RBSL and/or SSTL and the proposed corrective action.
 - a. The notice shall include the name, address, and telephone number of a contact person.
 - b. A copy of the notice and proof of providing the notice shall be submitted to the Department.

Reference: Part 213, Section 21310a

APPENDIX A – EXAMPLE TABLES

**Table 1
LNAPL¹ Recovery**

Recovery location ID	Recovery date	Pre-recovery measurements				Recovery method	Event recovery ³		Cumulative recovery ⁴		Comments
		Depth to LNAPL (ft)	Depth to GW ² (ft)	LNAPL thickness (ft)	LNAPL volume (gal)		LNAPL (gal)	GW (gal)	LNAPL (gal)	GW (gal)	

¹ LNAPL = Light Non-Aqueous Phase Liquid

² GW = Groundwater

³ Volume recovered during individual recovery event for that location.

⁴ Cumulative volumes recovered at each recovery location (i.e., total volume removed for all recovery events to date).

Add additional rows as needed.

Notes:

**Table 2a
LNAPL¹ Recovery Test – Removal Phase**

Recovery location ID	Date	Time (HH:m m)	Elapsed time (min)	Depth to LNAPL (ft)	Depth to GW ² (ft)	LNAPL thickness (ft)	LNAPL volume in well (gal)	Total LNAPL removed (gal)	Total GW removed (gal)	LNAPL Removal rate (gal/day)	Removal method	Comments

¹ LNAPL = Light Non-Aqueous Phase Liquid

² GW = Groundwater

Add additional rows as needed.

Notes:

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