We Energies
231 W. Michigan Street
Milwaukee, WI 53203

www.we-energies.com

January 26, 2022

Ms. Jennifer Dorman
Environmental Program Associate
Remediation and Redevelopment Program
Wisconsin Department of Natural Resources
1027 West St. Paul Avenue
Milwaukee, WI 53233

Subject: **VAPOR MITIGATION SYSTEM COMMISSIONING PLAN**
Metro North Service Center
3100 West North Avenue, Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

Dear Ms. Dorman,

Please find attached the Vapor Mitigation System Commissioning Plan (Plan) for the subject site.

This Plan is being submitted via WDNR's online Submittal Portal. Pursuant to WDNR's current Covid-19 policy, a hard copy of the Plan is not being submitted.

Please feel free to contact me at your convenience at (414) 587-4467 (cell) or via email at frank.dombrowski@wecenergygroup.com if you have any questions.

Sincerely,

Frank Dombrowski
Principal Environmental Consultant
WEC Energy Group – Business Services

Attachment

Cc: Project File
David Jaeckels, WEC Energy Group – Business Services
Jeremiah Johnson, Geosyntec Consultants
Linda Stanek, WDNR

Geosyntec consultants

10600 N. Port Washington Road, Suite 100
Mequon, WI 53092
PH 262.377.9828
www.geosyntec.com

VAPOR MITIGATION SYSTEM COMMISSIONING PLAN

Prepared for: Wisconsin Electric Power Company (d.b.a., We Energies)

Prepared by: Geosyntec Consultants
Jeremiah Johnson, P.G., Senior Geologist
Greg Johnson, P.H., P.G., P.E., Senior Engineer
Project Number CHE8094OQ

Date: January 26, 2022

Ref: Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin 53208
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

This Vapor Mitigation System (VMS) Commissioning Plan (CP) was prepared by Geosyntec Consultants (Geosyntec) on behalf of Wisconsin Electric Power Company (d.b.a., We Energies) for the Metro North Service Center (MNSC) site located at 3100 West North Avenue, Milwaukee, Wisconsin 53208 (Site).

The NR 712.09 submittal certification is provided in **Attachment 1**.

The Site VMS is an active submembrane depressurization system (SSDS) installed during the reconstruction of the southwest portion of the Site building.

This VMS CP provides the basis and purpose of the VMS CP, salient background information, a description of the VMS, a summary of construction observations and construction quality assurance testing, a performance verification monitoring plan, an operational baseline conditions documentation plan, reporting and a list of attachments.

1. BASIS AND PURPOSE

A. This VMS CP was prepared pursuant to Section 9 and Appendix D of the Wisconsin Department of Natural Resources (WDNR) guidance *Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin* (RR-800).

B. This VMS CP provides the plan for performance verification monitoring and the subsequent documentation of baseline conditions for the Site VMS.

C. Although the Site investigation data indicated indoor air concentrations less than WDNR vapor action levels (VALs), the VMS was integrated into the building reconstruction area for long-term risk management.

D. The VMS CP will be implemented upon completion of building reconstruction and under normal operating conditions of the building (i.e., standard HVAC settings).

2. BACKGROUND INFORMATION

A. The Site is a 6.28-acre parcel developed with an approximately 81,300 square feet (sf) single story service center building generally consisting of office, storage, and garage areas. The Site layout is depicted on **Figure 1 (Attachment 2)**.

B. Recent building reconstruction/renovation activities included demolition and reconstruction of the southwest portion of the building (VMS area) and expansion of the garage area (eastern portion of the building).

C. Site investigation information is documented in the April 30, 2020 *Site Investigation and Remedial Action Options Report*.

D. Tetrachloroethene (PCE) is the primary Site contaminant associated with a former dry cleaner located on the Site (prior to the current We Energies service center). PCE was the only volatile organic compound (VOC) detected in the Site building indoor air.

E. The VMS is one component of the Site remedial action plan documented in the June 29, 2020 *Remedial Action Design Report*. The other remedial action components include the following:

1. Source area unsaturated soil excavation and disposal [completed in March 2021].
2. Source area shallow groundwater remedial action consisting of in-situ treatment (oxidant mixing) and excavation and disposal[1] and installation of horizontal perforated piping at the bottom of the excavation (and connected to a riser pipe) to allow for potential future oxidant placement [completed March 2021].
3. Site building slabs and pavements maintained as an infiltration barrier [building and pavement reconstruction is ongoing].

[1] Saturated soil within source area shallow groundwater treatment zone (approximately 8 to 11 feet below ground surface) was excavated and disposed due to the resultant treatment zone physical characteristics (to allow for adequate bearing capacity for building reconstruction area foundations). As documented in the June 29, 2020 *Remedial Action Design Report*, the original plan was for this mixing zone soil to remain in place.

4. Groundwater monitoring to demonstrate that natural attenuation is capable of remediating residual PCE groundwater impacts (i.e., to sufficiently establish stable or decreasing PCE groundwater concentrations at the Site) [re-installation of groundwater monitoring wells and piezometers will be conducted in 2022].

3. VMS DESCRIPTION

A. The VMS layout is depicted on **Figures 1 and 2 (Attachment 2)**. The VMS includes a submembrane venting system [venting layer with three (3) riser pipes, blowers, and exhaust stacks], an approximate 19,200 sf barrier layer above the venting layer, and five (5) sub-slab vapor probes.

B. Venting System

1. Venting Layer. The venting layer consists of a 6-inch coarse granular layer with incorporated GEOVENT™ conveyance units (1-foot wide by 1-inch thick, three-dimensional vent core wrapped in a non-woven, needle-punched filter fabric) (refer to Photographs 1 and 2 in **Attachment 3**).
2. Riser Pipes. The venting layer is connected to three (3) 4-inch diameter polyvinyl chloride (PVC) riser pipes (refer to Photograph 15).
3. Blowers and Stacks. The three (3) riser pipes extend to individual blowers [Obar GBR76 SOE (16" WC @ Max Flow 155 CFM)] installed on the roof (refer to Photograph 16). The blowers are connected to the building power supply through a dedicated electrical breaker and each blower has a power disconnect switch. Exhaust stacks extend from the top of each blower[2].
4. Instrumentation. Each riser pipe is fitted with instrumentation for balancing flow (ball valve), measuring vacuum (Magnehelic® differential pressure gauge), flow monitoring (measurement port) and discharge sampling (sampling port). An alarm (RadonAway™ Checkpoint IIa 28001-2) is installed at each riser to provide an auditory indication that the blower has stopped generating vacuum. Refer to Photograph 15 for riser pipe instrumentation.

C. Barrier (Membrane) Layer

1. A barrier (membrane) layer was installed over the venting layer (refer to Photographs 5 through 10).
2. The barrier layer consists of a 20-mil VI-20™ polyethylene geomembrane overlain by a minimum 60-mil LIQUID BOOT® spray-applied barrier.

[2] The above ground height of the blower stacks will be established based on VOC discharge sampling data and associated air permitting conditions [refer to Section 6(D)]

3. The geomembrane seams were overlapped a minimum of six (6) inches. The geomembrane was cut tight around penetrations and along the perimeter edges. A thin tack coat of LIQUID BOOT® was sprayed over the seams, around the penetrations and along the perimeter edges prior to full LIQUID BOOT® application.
4. Penetrations were sealed (around and up the penetrations).
5. Following quality control testing, a barrier protection layer (UltraShield™ G-1000 polypropylene, non-woven geotextile) was placed over the barrier layer (to protect the barrier layer from damage during subsequent slab construction).

D. Vapor Probes

1. Sub-slab vapor probes were installed at five (5) locations for the purpose of pressure field extension (PFE) (i.e., zone of influence/communication) testing to demonstrate PFE (differential negative pressure) over the VMS area (refer to Photographs 3, 4 and 14).

4. CONSTRUCTION OBSERVATION AND QUALITY ASSURANCE TESTING

A. The VMS was installed by Midwest Barrier Solutions, which is a CETCO[3]-approved LIQUID BOOT® Applicator.[4] VMS construction was observed and photo-documented by Geosyntec. Construction photos are provided in **Attachment 3**.

B. The as-built locations of the GEOVENT™ conveyance units, riser pipes and vapor probes were surveyed. The as-built locations are depicted on **Figure 2 (Attachment 2)**.

C. Destructive testing of the cured barrier layer was conducted to confirm a minimum thickness of 80 mils (20-mil geomembrane overlain by a minimum 60-mil LIQUID BOOT®). Twenty-three (23) samples were collected, and the thickness was measured with a mil-reading caliper (refer to Photographs 11 and 12). The number of samples met the specified minimum frequency of one test per 2,000 sf. The measured thickness ranged from 80 to 110 mils, confirming the minimum thickness had been met. Sample holes were patched with 20-mil geomembrane overlapping the void by a minimum of 2 inches (a thin tack coat of LIQUID BOOT® was applied under the 20-mil geomembrane patch) and then applying LIQUID BOOT® to a 60-mil minimum thickness, extending at least 3 inches beyond the 20-mil geomembrane patch.

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[3] CETCO is the manufacturer of the GEOVENT™, VI-20™ polyethylene geomembrane, LIQUID BOOT®, and UltraShield™ G-1000 polypropylene, non-woven geotextile products utilized in the VMS.
[4] https://midwestbarrier.com/about-us/; https://www.mineralstech.com/business-segments/performance-materials/cetco/environmental-products/products/vapor-intrusion-mitigation-products/vapor-intrusion-barrier-systems/liquid-boot-preferred-applicators

D. Smoke leak testing of the barrier layer was conducted following LIQUID BOOT® installation and curing to confirm sealing around penetrations and edges (refer to Photograph 13). Twelve (12) smoke tests were conducted which met the specified frequency of one test per 2,000 sf. Penetration and edge seal leaks observed during the smoke testing were addressed by supplemental LIQUID BOOT® application.

5. PERFORMANCE VERIFICATION MONITORING PLAN

A. Pressure Field Extension (PFE) Testing

1. PFE testing will be conducted using the five (5) installed vapor probes to demonstrate that the target differential negative pressure of at least 0.004 inch-H_2O or 1 pascal (Pa) is achieved at each of the vapor probes.
2. Three (3) PFE testing events will be conducted over a minimum performance monitoring period of six (6) months of operation, including the heating season.
3. PFE testing will be conducted using a TEC DG-8 Digital Pressure Gauge with an accuracy of 0.001 inch-H_2O or 0.1 Pa.

B. Indoor Air Sampling

1. Indoor air sampling will be conducted at two (2) consecutive PFE measurement events to confirm indoor air concentrations are less than WDNR vapor action levels (VALs).
2. Seven (7) indoor air samples and one (1) outdoor air sample will be collected.
3. The air samples will be collected over an 8-hour period using 6-liter, individually certified Summa® canisters with laboratory-supplied flow controllers (to provide an 8-hour time-weighted average concentration). The Summa® canisters will be deployed approximately 3 to 5 feet above the floor/ground surface. One (1) duplicate indoor air sample will be collected.
4. The air samples will be submitted to a NR 149 accredited laboratory under standard chain-of-custody protocols for laboratory analysis of select chlorinated VOCs[5] by EPA-Method TO-15.

[5] Consistent with the Site investigation, indoor air samples will be analyzed for PCE, trichloroethene (TCE), cis-1,2-dichloroethene, trans-1,2-dichloroethene and vinyl chloride. As documented in the April 30, 2020 *Site Investigation and Remedial Action Options Report*, PCE was the only VOC detected in the Site building indoor air.

C. Alarm Testing

1. Each blower alarm will be tested in accordance with the manufacturer's procedure to verify operations.

6. OPERATIONAL BASELINE CONDITIONS DOCUMENTATION PLAN

Operational baseline conditions will be documented once performance verification monitoring is complete. The following baseline conditions will be recorded:

A. Blower Vacuum - blower vacuum will be measured by a Dwyer Magnehelic® Differential Pressure Gauge mounted on each riser pipe.

B. Air Flow - air flow will be measured using a Dwyer Model 471B Digital Thermo Anemometer at the measurement port installed on each riser pipe.

C. VOC Discharge[6] - air samples will be collected by connecting a 1-liter batch-certified Summa® canister with Nylaflow™ tubing connected to the sampling port on each riser pipe. The samples will be submitted to a NR 149 accredited laboratory under standard chain-of-custody protocols for laboratory analysis of VOCs by EPA-Method TO-15.

7. REPORTING

A. The VMS as-built conditions, performance verification monitoring results and operational baseline conditions will be documented in the NR 724 *Vapor Mitigation System Construction Documentation Report*. The NR 724 *Vapor Mitigation System Construction Documentation Report* will include the completed Interstate Technology and Regulatory Council (ITRC) *Vapor Intrusion Mitigation System Post-Installation Verification Checklist*. A copy of the checklist is included as **Attachment 4**.

B. A *Vapor Mitigation System Long-Term Operation, Monitoring and Maintenance Plan* will be prepared in accordance with WDNR guidance *Maintenance Plans for Vapor Mitigation Systems/Vapor Intrusion Response Actions/Vapor Barriers* (RR-981). The plan will be included in the NR 724 *Vapor Mitigation System Construction Documentation Report.*

[6] The VOC discharge sampling and air flow data will also be used to assess the need for an Air Pollution Construction Permit or whether a request for exemption is applicable pursuant to Wisconsin Administrative Code Chapter NR 406, (Section NR 406.04, Direct Sources Exempt from Construction Permits) and subsequently confirm the needed above ground height of the blower stacks.

8. LIST OF ATTACHMENTS

The following is the list of the attachment to this VMS CP:

Attachment 1 - NR 712.09 Submittal Certification
Attachment 2 - Figures
Attachment 3 - Construction Photographs
Attachment 4 - ITRC *Vapor Intrusion Mitigation System Post-Installation Verification Checklist*

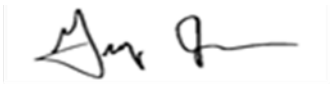
ATTACHMENT 1

NR 712.09 Submittal Certification

Vapor Mitigation System Commissioning Plan
Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

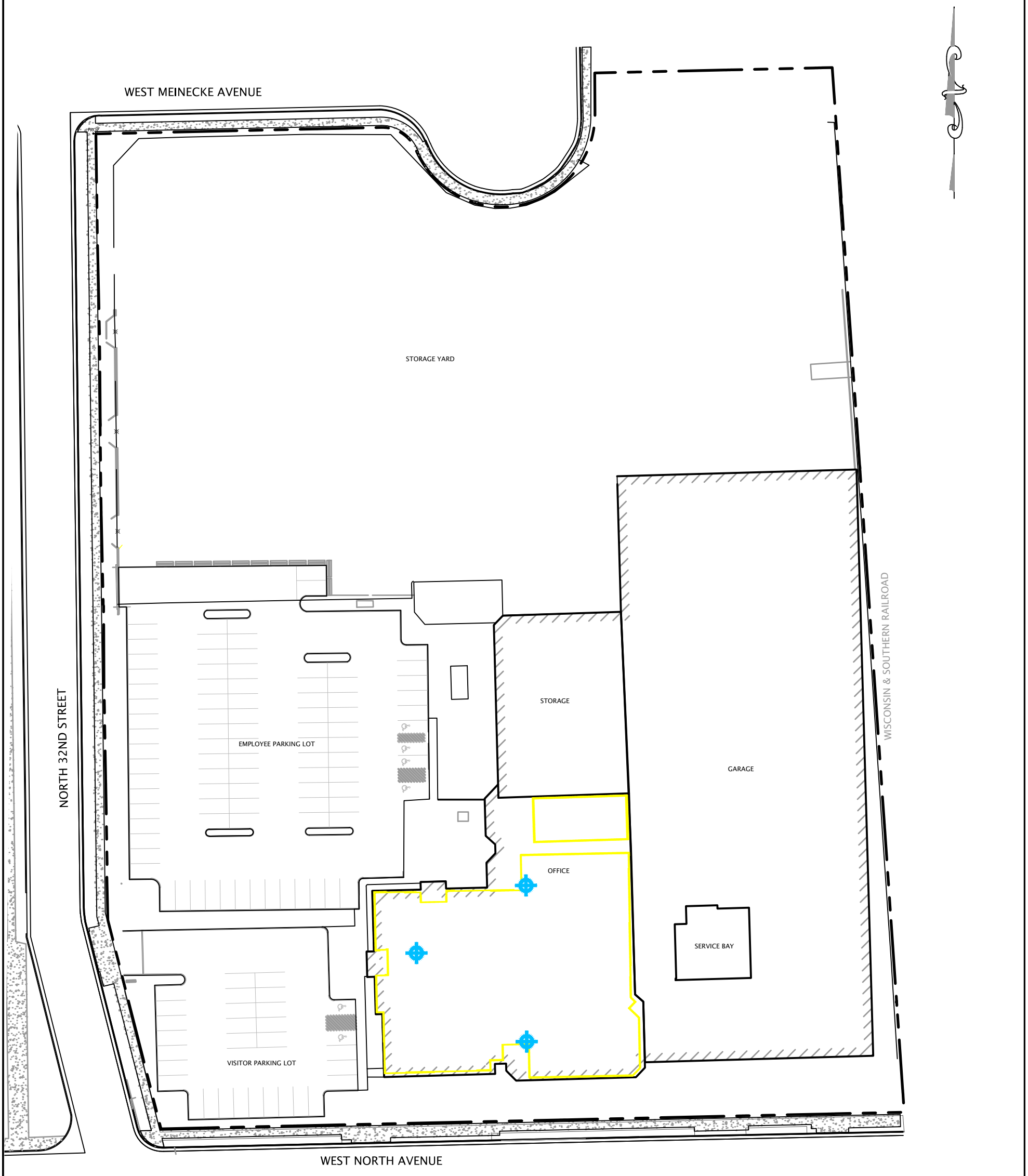
NR 712.09 Submittal certification.

Document Name	VAPOR MITIGATION SYSTEM COMMISSIONING PLAN
Document Date	January 26, 2022
Site Name	Metro North Service Center
WDNR BRRTS #	02-41-583015

"I, Greg Johnson, hereby certify that I am a registered professional engineer in the State of Wisconsin, registered in accordance with the requirements of ch. A-E 4, Wis. Adm. Code; that this document has been prepared in accordance with the Rules of Professional Conduct in ch. A-E 8, Wis. Adm. Code; and that, to the best of my knowledge, all information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."	
 Greg Johnson, P.H., P.G., P.E. Senior Engineer P.E. #: 29898-006	 1/26/2022
Signature, title and P.E. number	P.E. stamp
"I,_____, hereby certify that I am a hydrogeologist as that term is defined in s. NR 712.03 (1), Wis. Adm. Code, am registered in accordance with the requirements of ch. GHSS 2, Wis. Adm. Code, or licensed in accordance with the requirements of ch. GHSS 3, Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."	
Signature and title	Date
"I, _____ , hereby certify that I am a scientist as that term is defined in s. NR 712.03 (3), Wis. Adm. Code, and that, to the best of my knowledge, all of the information contained in this document is correct and the document was prepared in compliance with all applicable requirements in chs. NR 700 to 726, Wis. Adm. Code."	
Signature and title	Date

ATTACHMENT 2

Figures



SCALE IN FEET

0 60'

LEGEND:

- APPROXIMATE SITE PROPERTY LINE
- EXISTING SITE PROPERTY BUILDING
- EXTENT OF VMS BARRIER LAYER
- APPROXIMATE VMS VENTING SYSTEM BLOWER/EXHAUST STACK LOCATION

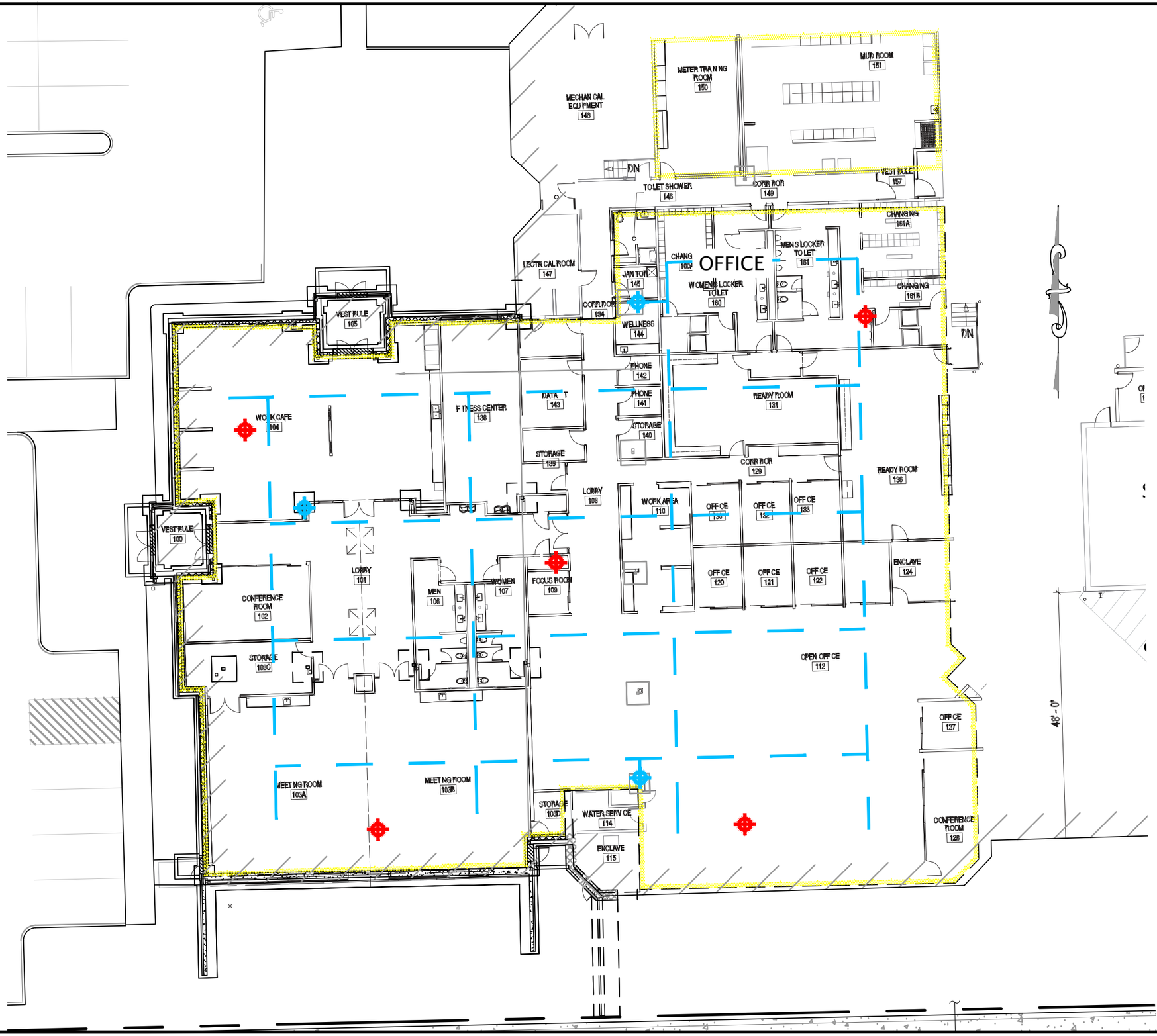
NOTES:

VMS - VAPOR MITIGATION SYSTEM

Geosyntec consultants

CLIENT:	WE ENERGIES
PROJECT:	METRO NORTH SERVICE CENTER (MNSC) 3100 WEST NORTH AVENUE MILWAUKEE, WISCONSIN
TITLE:	SITE LAYOUT MAP

PROJECT: CHE8094OQ	FIGURE NO.: 1	DRAWING NO.: 1 OF 2
DATE: January 20, 2022	FILE NO.:2005 MNSCP 002	



LEGEND:

- EXTENT OF VMS BARRIER LAYER
- VMS VENTING LAYER GEOVENT™ LOCATION
- 4" DIA RISER PIPE LOCATION
- APPROXIMATE VAPOR PROBE LOCATION

NOTES:

VMS - VAPOR MITIGATION SYSTEM

SCALE IN FEET

0 60'

Geosyntec consultants

CLIENT:	WE ENERGIES
PROJECT:	METRO NORTH SERVICE CENTER (MNSC) 3100 WEST NORTH AVENUE MILWAUKEE, WISCONSIN
TITLE:	VAPOR MITIGATION SYSTEM AS-BUILT LAYOUT

PROJECT: CHE8094OQ	FIGURE NO.: 2	DRAWING NO.: 2 OF 2
DATE: January 20, 2022	FILE NO.:20-05 MNSCP 002	

ATTACHMENT 3

Construction Photographs

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: WBS	**Project Number:** CHE8094OQ
Site Name: Metro North Service Center	**Site Location:** Milwaukee, WI

Photograph 1 **Date:** 2/23/2021 **Direction:** NA **Comments:** venting layer (granular layer and GEOVENT™) installation	

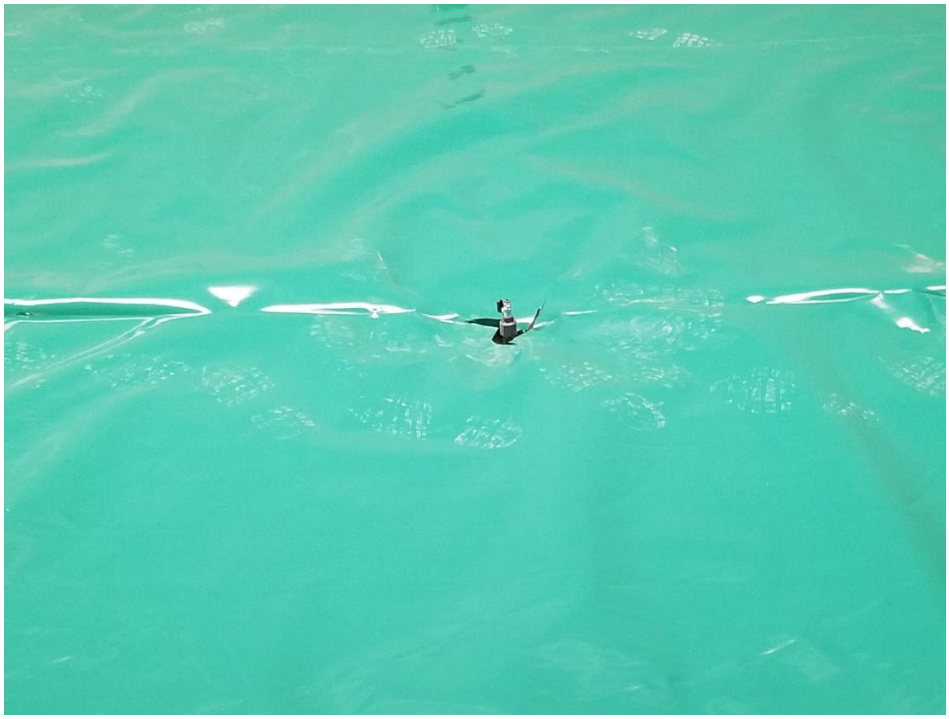
Photograph 2 **Date:** 7/28/2021 **Direction:** NA **Comments:** venting layer (granular layer and GEOVENT™) installation	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: WBS | **Project Number:** CHE8094OQ

Site Name: Metro North Service Center | **Site Location:** Milwaukee, WI

Photograph 3 **Date:** 2/23/2021 **Direction:** NA **Comments:** vapor probe installation	
Photograph 4 **Date:** 2/24/2021 **Direction:** NA **Comments:** vapor probe during barrier installation (geomembrane)	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: WBS | **Project Number:** CHE8094OQ

Site Name: Metro North Service Center | **Site Location:** Milwaukee, WI

Photograph 5 **Date:** 2/24/2021 **Direction:** NA **Comments:** barrier installation (geomembrane)	
Photograph 6 **Date:** 2/24/2021 **Direction:** NA **Comments:** barrier installation (geomembrane and LIQUID BOOT® seams)	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: WBS | **Project Number:** CHE8094OQ

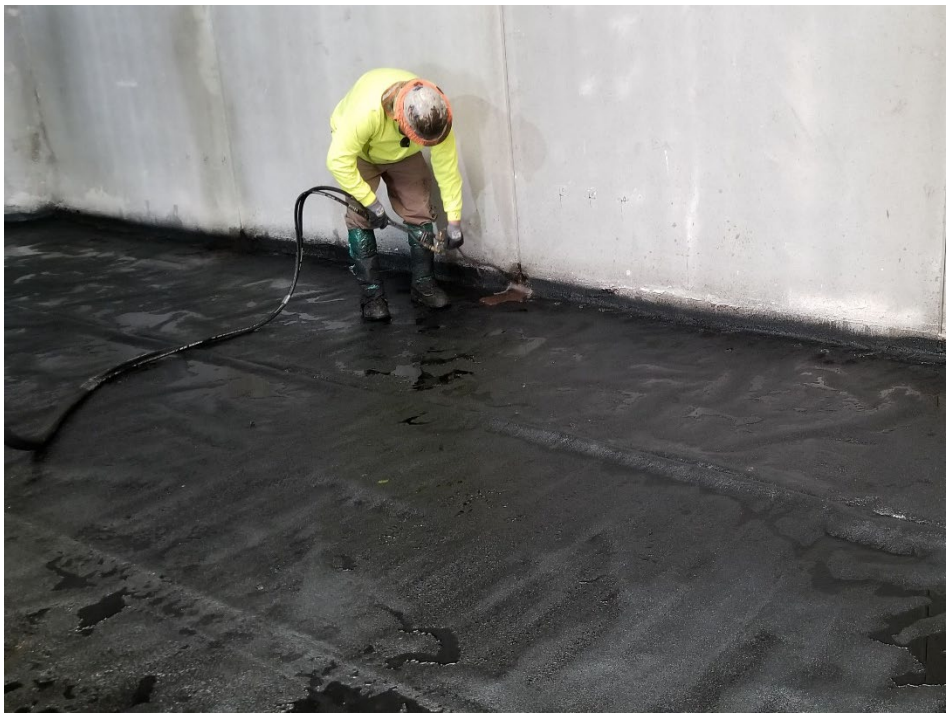
Site Name: Metro North Service Center | **Site Location:** Milwaukee, WI

Photograph 7 **Date:** 7/30/2021 **Direction:** NA **Comments:** barrier installation (geomembrane and LIQUID BOOT® seams and boundaries)	
Photograph 8 **Date:** 2/24/2021 **Direction:** NA **Comments:** barrier installation (LIQUID BOOT® over geomembrane)	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: WBS	**Project Number:** CHE8094OQ
Site Name: Metro North Service Center	**Site Location:** Milwaukee, WI

Photograph 9 **Date:** 2/25/2021 **Direction:** NA **Comments:** barrier installation (LIQUID BOOT®)	

Photograph 10 **Date:** 2/25/2021 **Direction:** NA **Comments:** barrier installation (LIQUID BOOT®)	

GEOSYNTEC CONSULTANTS
Photographic Record

Geosyntec consultants

Client: WBS | **Project Number:** CHE8094OQ

Site Name: Metro North Service Center | **Site Location:** Milwaukee, WI

Photograph 11 **Date:** 7/30/2021 **Direction:** NA **Comments:** barrier quality control sample collection for thickness verification	

Photograph 12 **Date:** 7/30/2021 **Direction:** NA **Comments:** barrier quality control sample thickness verification	

GEOSYNTEC CONSULTANTS Photographic Record	Geosyntec consultants
Client: WBS	**Project Number:** CHE8094OQ
Site Name: Metro North Service Center	**Site Location:** Milwaukee, WI

Photograph 13 **Date:** 2/25/2021 **Direction:** NA **Comments:** barrier quality control smoke testing	
Photograph 14 **Date:** 11/3/2021 **Direction:** NA **Comments:** vapor probe following floor slab installation	

GEOSYNTEC CONSULTANTS Photographic Record	Geosyntec consultants
Client: WBS	**Project Number:** CHE8094OQ
Site Name: Metro North Service Center	**Site Location:** Milwaukee, WI

Photograph 15 **Date:** 9/23/2021 **Direction:** NA **Comments:** riser pipe fitted with ball valve, Magnehelic® differential pressure gauge and alarm	
Photograph 16 **Date:** 11/3/2021 **Direction:** NA **Comments:** roof-mounted blower	

ATTACHMENT 4

ITRC Vapor Intrusion Mitigation System Post-Installation Verification Checklist

Vapor Mitigation System Commissioning Plan
Metro North Service Center
3100 West North Avenue
Milwaukee, Wisconsin
WDNR BRRTS # 02-41-583015
WDNR FID # 241311510

VAPOR INTRUSION MITIGATION SYSTEM POST-INSTALLATION VERIFICATION CHECKLIST

The purpose of this checklist is to provide the user with a selection of tools to verify that the appropriate system components for the vapor intrusion mitigation system (VIMS) were installed and the system is operating as designed. This information applies to the four most common active mitigation systems (SSD, SSV, SMD, and CSV) and passive systems that are described in the associated Fact Sheets and Technology Information Sheets. The user of this checklist should review the VIMS design or as-built documentation prior to completing this checklist.

This document was prepared in consideration of multiple types of VIMS. Not all the information presented below is necessary to document system operation for all types of systems on all types of buildings. The user should be able to identify which criteria below best represent effective operation for their specific mitigation system and which criteria will validate the conceptual site model for the VIMS that was implemented. Timing on when to collect post-installation verification data may vary and more than one event may be reasonable. See the ***Post-Installation Verification Fact Sheet*** for additional information on timing a post-installation verification site visit.

Instructions for Use: Major system components are grouped below for this checklist, and one or more of these groups may not apply to a particular VIMS design. Those groups can be marked as Not Applicable by selecting the 'X' box to the right of the group.

Design elements within these groups that **will** apply should be selected by checking the appropriate box included for this checklist as:

Yes—the design element was considered and documented
No—this item was not considered and may be relevant to the overall system performance, applicable guidance, and/or best practices
NA—not applicable to the system design or operation

This checklist is intended to serve as a guide for design considerations and as documentation for VIMS installation. This list can be modified for a specific project or program if needed or can be used as shown. The list should be submitted along with the final project as-builts and/or installation oversight verification documentation and reporting.

1. SITE INFORMATION

Address inspected: _____

_____

Date of inspection: _____

Inspector(s): _____

_____

Inspector's company name:

_____

Building contact:

_____

Building contact phone number:

_____

Note: As-built drawings & performance criteria are needed when conducting inspections of vapor intrusion mitigation systems.

2. BUILDING TYPE

☐ Existing building

☐ New construction

3. TYPE OF SYSTEM

Active

☐ Sub-slab depressurization (SSD)
☐ Sub-slab venting (SSV)
☐ Sub-membrane depressurization (SMD)
☐ Crawlspace ventilation (CSV)

Passive (Check all that apply)

☐ Epoxy floor coating (EFCs)
☐ Passive barrier system
☐ Passive sub-slab venting (PSSV)
☐ Aerated floors

4. SYSTEM DESIGN COMPONENTS AND INSTALLATION DOCUMENTATION

4.1. Site Conditions/Conceptual Site Model

- Contaminant concentrations at the site have been reviewed and compared to generic or building-specific screening levels. The level of applied effort (flow and vacuums) should be proportional to the magnitude of the concentrations. In large buildings, the VIMS target treatment area may not include the entire footprint, but should allow for adequate capture of vapors to mitigate the potential for unacceptable risk to the occupants of the building. ☐ Yes ☐ No ☐ NA
- Slab conditions should be verified/inspected for cracks/voids/utility penetrations/potential preferential pathways (if known/observed) and identified on a diagram, sealed to the extent practical, and visually inspected during post-installation verification event. ☐ Yes ☐ No ☐ NA

4.2. Extraction Point(s) ☐ Not applicable

- Suction point location, diameter, and sealing are documented. ☐ Yes ☐ No ☐ NA
- Pipe and manifold location, materials, diameter, slope, and sealing are documented. ☐ Yes ☐ No ☐ NA
- Sample port, shutoff valve, and access have been identified.
- U-tube manometer (or similar vacuum gauge) is installed and target vacuum level is clearly marked ☐ Yes ☐ No ☐ NA

4.3. Collection Piping ☐ Not applicable

- As-built collection piping diagrams have been provided. ☐ Yes ☐ No ☐ NA
- Riser pipe is located in an interior wall where possible and does not penetrate firewalls or shear walls. ☐ Yes ☐ No ☐ NA
- Fire collars are installed on pipes where firewalls are penetrated. ☐ Yes ☐ No ☐ NA
- Vent piping system was designed by a qualified individual with VIMS design experience. ☐ Yes ☐ No ☐ NA
- All vent stack piping is identified as solid, rigid pipe. ☐ Yes ☐ No ☐ NA
- All pipe joints and connections are permanently sealed. ☐ Yes ☐ No ☐ NA
- Foundation penetration sleeves are installed as approved by the structural engineer. ☐ Yes ☐ No ☐ NA
- All exhaust pipes are supported and secured in a permanent manner consistent with building codes. ☐ Yes ☐ No ☐ NA

- Horizontal piping runs are sloped to ensure that condensation drains into the ground beneath the slab. ☐ Yes ☐ No ☐ NA
- Vertical piping runs drain naturally or can be verified to be free of water or moisture. ☐ Yes ☐ No ☐ NA

4.4. Piping Completion Specifications ☐ **Not applicable**

(Review the primary wind flow direction from nearby weather stations.)

- As-built collection piping diagrams have been provided. ☐ Yes ☐ No ☐ NA
- Pipes are completed with an exhaust stack and are an appropriate height above the roof. ☐ Yes ☐ No ☐ NA
- Point(s) of discharge are an appropriate distance away from any air intake location, opening (door, chimney flue, window, vent, etc.), or occupied spaces, including adjacent structures. ☐ Yes ☐ No ☐ NA
- To reduce the risk of vent stack blockage, confirm that the point of discharge from vent stack pipes is vertical and upward, outside the structure. Consider wire mesh to deter birds and small animals ☐ Yes ☐ No ☐ NA

4.5. Blower/Fan ☐ **Not applicable**

- Blower/fan number, location, size, model number, and performance specifications are documented. ☐ Yes ☐ No ☐ NA
- Blower/fan is securely mounted with discharge locations far from building intake locations. ☐ Yes ☐ No ☐ NA
- Electrical components and wiring were installed by a licensed electrician in accordance with applicable building codes. ☐ Yes ☐ No ☐ NA
- Intrinsically safe or explosion-proof components installed where specified in the project plans. ☐ Yes ☐ No ☐ NA
- Diagnostic testing and results are documented and summarized to meet design criteria. ☐ Yes ☐ No ☐ NA
- Audible and/or visual low vacuum alarm is installed, tested, and separately powered (e.g., battery). ☐ Yes ☐ No ☐ NA
- Controller system (where present): model number, location, OM&M manual are documented. ☐ Yes ☐ No ☐ NA
- Telemetry system (where present): model number, location, OM&M manual are documented. ☐ Yes ☐ No ☐ NA

4.6. Monitoring Probes ☐ **Not applicable**

- Sub-slab vapor probes, if needed, are installed in accordance with design (appropriate number and location(s)). ☐ Yes ☐ No ☐ NA
- Surface completion provides a seal to the subsurface and a leak check test was passed. ☐ Yes ☐ No ☐ NA
- Probes and surface completions are level to grade to minimize trip hazard. ☐ Yes ☐ No ☐ NA

4.7. Post-Installation Diagnostic Testing ☐ **Not applicable**

- System flow and vacuum are documented in vent pipe(s) and data meet design criteria. ☐ Yes ☐ No ☐ NA

- Pressure field extension (PFE) testing is documented to meet design criteria across targeted areas. ☐ Yes ☐ No ☐ NA
- Additional diagnostics were performed as appropriate where data do not meet expectations. ☐ Yes ☐ No ☐ NA
- Effluent concentrations were measured and calculated discharge meets design criteria/permit limits, if needed. ☐ Yes ☐ No ☐ NA
- Nonsealed combustion appliances were checked for back drafting/CO_2 levels. ☐ Yes ☐ No ☐ NA

4.8. System Monitors and Labeling ☐ **Not applicable**

- System labels are placed on the mitigation system, riser piping, electrical panel breaker and junction box, and other prominent locations, including the exterior venting locations. ☐ Yes ☐ No ☐ NA
- Description of signage and locations is provided. ☐ Yes ☐ No ☐ NA
    - signage contains language indicating that the mitigation vent may contain volatile organic compounds ☐ Yes ☐ No ☐ NA
    - figure provided, if needed, identifying locations of signs ☐ Yes ☐ No ☐ NA
    - name and contact information for operator clearly visible with instructions to notify operator in the event of alarm conditions, damage to any system component, power failure, etc. ☐ Yes ☐ No ☐ NA
- Documentation states that a notice has or will be provided to tenants that will be occupying the structure. ☐ Yes ☐ No ☐ NA

4.9. System Design and Specification ☐ **Not applicable**

- Mitigation system design has been reviewed by a vapor intrusion mitigation specialist, professional engineer, or professional with demonstrated mitigation design experience. ☐ Yes ☐ No ☐ NA
- As-built project plans and specifications have been prepared and reviewed by the designer. ☐ Yes ☐ No ☐ NA
- Electrical one-line diagrams have been prepared and reviewed by a licensed electrician. ☐ Yes ☐ No ☐ NA
- Dewatering has been considered and, if necessary, incorporated into the design. ☐ Yes ☐ No ☐ NA
- Engineer or design firm is identified. ☐ Yes ☐ No ☐ NA
- Building/fire codes: Document states that mitigation systems is designed and installed to conform to applicable building and fire codes and to maintain the function and operation of existing equipment and building features, including doors, windows, access panels, etc. ☐ Yes ☐ No ☐ NA
- Permits: Documentation is provided that the system passed required permit inspections. ☐ Yes ☐ No ☐ NA

4.10. Sumps ☐ **Not applicable**

- Floor drains are designed to allow water to flow into sumps while sealing out soil gases from entering the indoor air space from the sub-floor area (e.g., Drainjer-style drain). ☐ Yes ☐ No ☐ NA

5. NEW CONSTRUCTION ☐ **Not applicable**

5.1. Aggregate Layer ☐ **Not applicable**

- Delivered sub-slab aggregate grain size gradation matches project design specifications. ☐ Yes ☐ No ☐ NA
- Aggregate is uniformly compacted and rolled flat and is free of protrusions or debris that may be a puncture hazard. ☐ Yes ☐ No ☐ NA
- Aggregate thickness was measured and documented to meet project specifications. ☐ Yes ☐ No ☐ NA

5.2. Engineered Plenums (e.g., drainage mats) ☐ **Not applicable**

- Engineered plenums were supplied and documented to meet project specifications. ☐ Yes ☐ No ☐ NA
- Plenum was uniformly laid flat across target treatment area to meet project specifications. ☐ Yes ☐ No ☐ NA

5.3. Collection and Manifold Piping ☐ **Not applicable**

- Delivered vapor collection piping matches project design specifications. ☐ Yes ☐ No ☐ NA
- Vapor collection piping is laid and pipe joints and connections are permanently sealed. ☐ Yes ☐ No ☐ NA
- Solid piping is used in areas adjacent to utilities or trenches or where short circuiting may occur ☐ Yes ☐ No ☐ NA

5.4. Membrane Installation Documentation ☐ **Not applicable**

- Membrane manufacturer installation requirements are provided. ☐ Yes ☐ No ☐ NA
- System was installed by a certified installation vendor, if required by the manufacturer. ☐ Yes ☐ No ☐ NA
- Mitigation system as-built drawings are provided. ☐ Yes ☐ No ☐ NA
- Photographic log is provided for seals/repairs at the following locations: ☐ Yes ☐ No ☐ NA
    - along foundation edge ☐ Yes ☐ No ☐ NA
    - around foundation penetrations ☐ Yes ☐ No ☐ NA
    - along vertical exterior walls ☐ Yes ☐ No ☐ NA
    - around elevator shafts ☐ Yes ☐ No ☐ NA
    - coupon/smoke testing repairs ☐ Yes ☐ No ☐ NA
- **Trench Dams:** Utility trench dams were installed in all utility trenches leading to the building. ☐ Yes ☐ No ☐ NA
- **Conduit Seals**: Conduit seals were installed in all electrical conduits that extend below the membrane. ☐ Yes ☐ No ☐ NA

5.5. Membrane Design and Specification ☐ **Not applicable**

- Membrane selection and/or thickness was considered for potential contaminant concentrations in the subsurface (i.e., chemical compatibility). ☐ Yes ☐ No ☐ NA
- Sub-slab screening levels protective of diffusive transport across the slab have been calculated and monitoring is specified to document sub-slab concentrations after the membrane is placed. Contingencies are in place to modify the system (i.e., ☐ Yes ☐ No ☐ NA

potentially activate a passive system) if diffusive transport may become an issue.

- Documentation provides details for areas that require specialized completion, including all penetrations and terminations. ☐ Yes ☐ No ☐ NA
- Drains that perforate the barrier are designed to allow water to flow into sumps and floor drains while sealing out soil gases from entering the indoor air space from the sub-floor area (e.g., Drainjer-style drain). ☐ Yes ☐ No ☐ NA
- Membrane selection and/or thickness was considered for potential contaminant concentrations in the subsurface (i.e., chemical compatibility). ☐ Yes ☐ No ☐ NA

5.6. Quality Assurance/Quality Control Installation Plan Requirements Identified in the Design Document ☐ **Not applicable**

- Products and materials installed meet the project design specifications. ☐ Yes ☐ No ☐ NA
- Material Safety Data Sheets (MSDS) for potential background contaminants (e.g., adhesives, glues, etc.) were reviewed. ☐ Yes ☐ No ☐ NA
- Installation was conducted in accordance with manufacturer's specifications (e.g., weather, curing time). ☐ Yes ☐ No ☐ NA
- Estimated quantities of the product to be used are provided. ☐ Yes ☐ No ☐ NA
- Engineer of record or barrier manufacturer identifies steps to document the effectiveness of the mitigation system. ☐ Yes ☐ No ☐ NA
    - Coupon sampling ☐ Yes ☐ No ☐ NA
        - Sample frequency is appropriate to assess integrity of entire barrier.
    - Smoke testing ☐ Yes ☐ No ☐ NA
        - Locations are appropriate to assess integrity of entire barrier. ☐ Yes ☐ No ☐ NA
        - Assessment of barrier integrity is based on visual observation of where smoke has migrated and/or where membrane repairs were made. ☐ Yes ☐ No ☐ NA
- On-site installation oversight and documentation by the design firm is noted. ☐ Yes ☐ No ☐ NA
- Documentation is present verifying that the installation and repairs have been completed per project specifications and manufacturer's installation instructions. ☐ Yes ☐ No ☐ NA
- Verification sampling was performed in accordance with the system design plan. ☐ Yes ☐ No ☐ NA
    - Field sampling procedures specified were followed. ☐ Yes ☐ No ☐ NA
    - The correct number and locations of verification samples were collected. ☐ Yes ☐ No ☐ NA
    - Verification samples were collected at the appropriate frequency. ☐ Yes ☐ No ☐ NA
    - Verification samples were analyzed using the appropriate analytical method. ☐ Yes ☐ No ☐ NA

- Results of the verification samples indicate that the VIMS is effectively mitigating the vapor intrusion risk present at the site. ☐ Yes ☐ No ☐ NA
- Deviations in the verification sampling plan, if needed, are documented with rationale for the change. ☐ Yes ☐ No ☐ NA