Appendix F

Asbestos Abatement Project Closeout Report

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LMS/PIQ/S26625

Asbestos Abatement Project Closeout Report for the Piqua, Ohio, Decommissioned Reactor Site

September 2019

Work performed under DOE contract number DE-LM0000421
for the U.S. Department of Energy Office of Legacy Management.

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Abbreviations

ACM	asbestos-containing material
AFD	air filtration device
C&D	construction and demolition
CFIL	Construction Field Inspection Log
CID	Construction Information Document
CSS	construction site supervisor
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
EST	eastern standard time
f/cc	fibers per cubic centimeter
ft^2	square feet
ft^3	cubic feet
IWCP	Integrated Work Control Process
JSA	job safety analysis
LM	Office of Legacy Management
LMS	Legacy Management Support
MCE	mixed cellulose ester
Ohio EPA	Ohio Environmental Protection Agency
OSHA	Occupational Safety and Health Administration
PAE	Project or Activity Evaluation
PCM	phase contrast microscopy
POW	plan of the week
PPE	personal protective equipment
Rii	Resource International Inc.
SME	subject matter expert
TEM	transmission electron microscopy
WWTP	wastewater treatment plant

Executive Summary

This document serves as the closeout report for the asbestos abatement project at the U.S. Department of Energy Office of Legacy Management (LM) Piqua, Ohio, Decommissioned Reactor Site. This report is a Performance Evaluation and Measurement Plan, Period 5, performance-based incentive milestone requirement to be delivered by September 30, 2019.

The goal of this project was to safely and compliantly remove all accessible asbestos-containing material (ACM) from the Piqua decommissioned reactor site, while maintaining the exterior façade of the site in compliance with the National Historic Preservation Act, and while maintaining protectiveness of the entombed radiological material onsite.

Ten homogenous material groups (e.g., floor tile, pipe dope, pipe insulation) were determined to be ACM. These materials account for approximately 5665 square feet of ACM in the Administration Building, 2500 linear feet of ACM in the Administration Building, 155 cubic feet of ACM in the Administration Building, 1450 linear feet of ACM in the decommissioned Reactor Building, and 150 square feet of ACM in the decommissioned Reactor Building. In addition, there was 80 linear feet of ACM (pipe insulation) in the outside utility vault.

The fiscal year 2019 estimated project cost of the removal of this ACM was $976,852, with $583,585 of that cost attributed to the abatement subcontractor and $393,297 for oversight by the Legacy Management Support contractor and by the asbestos abatement subject matter expert subcontractor. The estimated schedule to complete the abatement work, including verification and closeout following notice of award, was September 30, 2019.

This Piqua Project Team was comprised of LM; Navarro Research and Engineering, Inc. (the Legacy Management Support contractor); Resource International Inc. (the abatement subject matter expert and oversight contractor); and Neuber Environmental Services Inc. (the abatement contractor).

The asbestos abatement contract was awarded on March 8, 2019. Mobilization to the field occurred on April 15, followed by successful abatement then demobilization by August 22, 2019. The project was completed 39 days ahead of the baseline project schedule. The project cost for fiscal 2019 was $1,366,830, which was $389,978 over the estimated project cost. The entombment remained in a protective state for the duration of the project, and the site remained in compliance with the National Historic Preservation Act. The project was completed safely and compliantly with no safety infractions or notices of violations.

The Piqua asbestos abatement project yielded 12.73 tons of solid waste debris that was collected from the selective demolition to access abatement areas and then shipped and disposed of in the licensed landfill. The project also yielded 30.26 tons of ACM that was removed from the site and then shipped as hazardous material to the licensed landfill. As envisioned during planning, there were a few areas considered “inaccessible” and considered outside of the work scope. Certain ACM outside the facilities, or in utility vaults below grade, or within the walls of the facility are considered inaccessible as substantial structural accommodations would have been required to address this material. These inaccessible areas are clearly documented on the redlined drawings in project records.

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1.0 Purpose

This document serves as the closeout report for the asbestos abatement project at the U.S. Department of Energy (DOE) Office of Legacy Management (LM) Piqua, Ohio, Decommissioned Reactor Site. This report is a Performance Evaluation and Measurement Plan, Period 5, performance-based incentive milestone requirement to be delivered by September 30, 2019.

This closeout report is composed of eight sections. Section 1.0 states the purpose of the document. Section 2.0 provides project background that conveys the scope of the Piqua asbestos abatement project. Section 3.0 delivers the abatement schedule and cost to perform the Piqua asbestos abatement project. Section 4.0 highlights the project quality, environmental compliance, and safety results, including a description of 2 of the 19 lessons learned. Section 5.0 provides a summary of abatement activity within each of the three key areas: the Administration Building, the Reactor Building, and utility vaults. Section 6.0 discusses the handling and disposition of waste materials. Section 7.0 describes the process and the results of abatement verification and clearance by containment area. Lastly, Section 8.0 provides the closeout report conclusion.

2.0 Project Background

The Piqua site is in southwestern Ohio in the city of Piqua, which is a rural city off of Interstate 75, 30 miles north of Dayton. Piqua has a population of approximately 21,000. The 0.457-acre Piqua site consists of two DOE-owned structures, the Reactor Building and the Administration Building, and both are unoccupied.

The 4380 square foot (ft^2) Reactor Building has an above-ground containment dome that extends 68 feet high and a 44-foot below-ground portion that contains an entombed thermal reactor that was decommissioned and entombed onsite in 1969. The reactor itself is entirely below ground level and is entombed with 8-foot-thick concrete. There are no radiological exposures at the site, and routine surveillance has shown that the concrete and steel entombment structure continues to be protective of human health and the environment. The Administration Building consists of three stories above ground level and a full basement. The floor space ranges from 5332 ft^2 at the basement level to 355 ft^2 at the third level, for a total of 11,718 ft^2 including stairways.

In 2016, a hazard assessment survey was conducted specific to two industrial hazards: lead and asbestos-containing material (ACM). With the Piqua site facilities vacant and the future use of the site under evaluation, LM elected to not pursue the abatement of lead, but to proceed with the abatement of ACM. The ACM abatement work was expected to include the removal of asbestos-containing floor tile/mastic and asbestos-containing pipe insulation. These materials included (1) approximately 5665 ft^2 of ACM (including floor tile/mastic, and 2500 linear feet of ACM-insulated piping) and 155 cubic feet (ft^3) of ACM (vermiculite) in the Administration Building, and (2) approximately 1450 linear feet of ACM (pipe insulation) and 150 ft^2 of ACM (floor tile/mastic) in the Reactor Building. In addition, there was 80 linear feet of ACM (pipe insulation) in the outside below-grade utility vaults. Additional details on the asbestos abatement work scope can be found in *Asbestos Abatement, Piqua, Ohio, Decommissioned Reactor Site Abatement Specifications* (LTS-111-0027-06-004; September 2018), which is referred to as the "Abatement Specifications" in this closeout report.

3.0 Abatement Schedule and Cost

3.1 Piqua Asbestos Abatement Project Schedule

3.1.1 Abatement Planning

At the close of fiscal year 2018, the Legacy Management Support (LMS) contractor Navarro Research and Engineering, Inc., with the assistance of its contractor Resource International Inc. (Rii) serving as an asbestos abatement subject matter expert (SME), developed the Abatement Specifications document, which was the statement of work to conduct asbestos abatement for the Piqua site. On October 2, 2018, the LMS contractor issued the Request for Proposal soliciting qualified bidders to perform the asbestos abatement.

On March 8, 2019, the LMS contractor awarded the competitively bid Piqua asbestos abatement contract No. LMCP6707B to Neuber Environmental Services Inc. Immediately upon the award, Neuber began developing and producing the contract-required submittals in advance of the pre-abatement meeting held on April 1, 2019. A key submittal for the pre-abatement meeting was the project schedule. Figure 1 illustrates the original schedule approved for the project prior to mobilization. This achievable but aggressive schedule had the project starting on April 1, 2019, with demobilization occurring August 14, 2019.

Key to the success of every project is proper planning and effective communication across an integrated team. The Piqua Project Team was composed of four organizations:

- **LM:** 1 member (i.e., the LM site manager for the Piqua site)
- **LMS contractor:** 6 members, including the LMS project lead and LMS SMEs in various fields of expertise, such as Environment, Safety, Health, and Quality Assurance; Environmental Compliance; Engineering Support; and Contracts Services
- **Resource International Inc. (Rii):** 4 members, including an Rii oversight contractor project manager who served as the asbestos abatement SME and as the Rii construction site supervisors (CSS). At the onset of the project planning, Navarro recognized it was in the best interest to the government, and it would reduce project risk, to add an asbestos abatement firm to perform daily oversight.
- **Neuber Environmental Services Inc. (Neuber):** 15 members, including the Neuber firm as the abatement contractor, along with several small subcontractors who supported the project

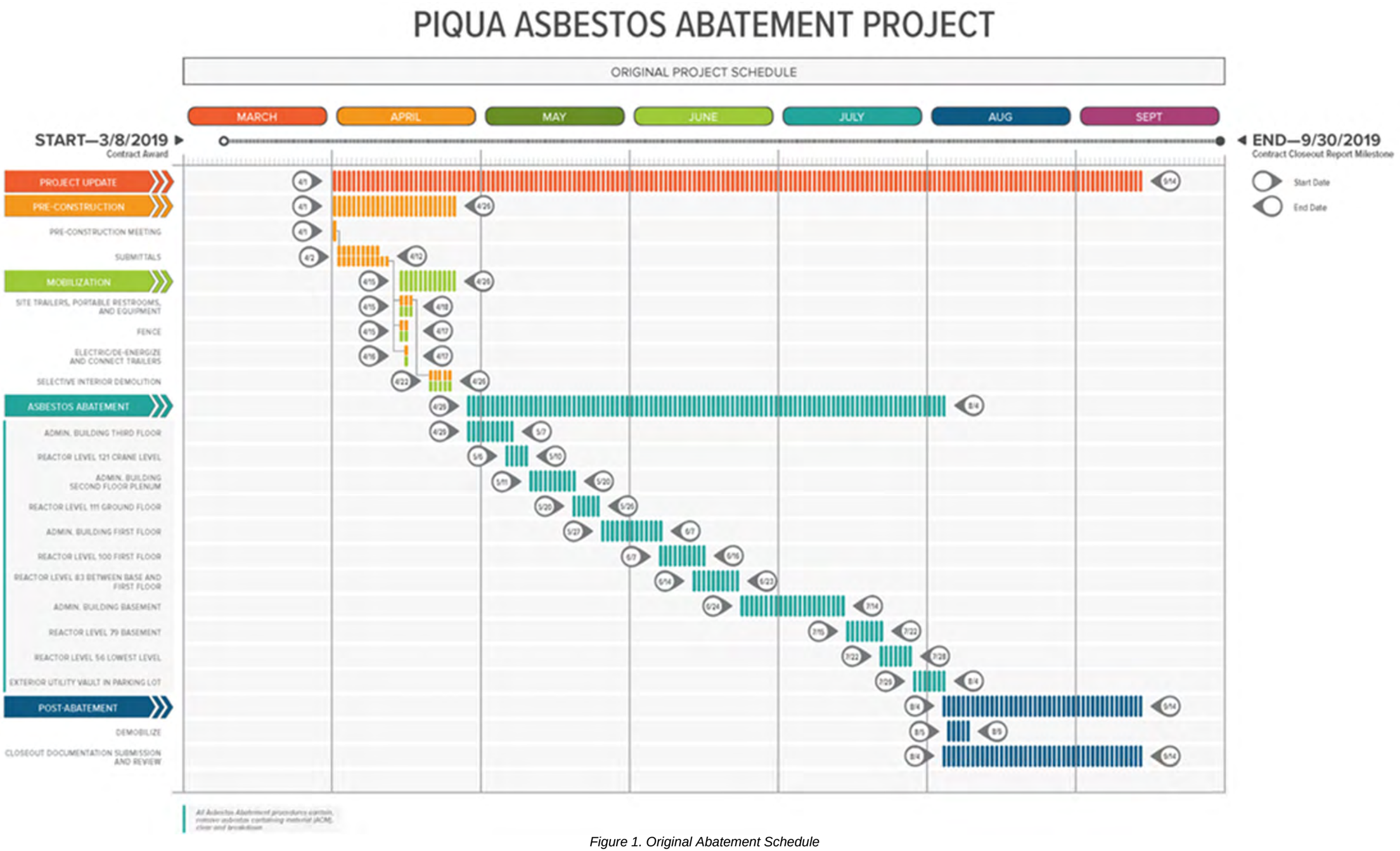

Figure 1. Original Abatement Schedule

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In accordance with the LMS Integrated Work Control Process (IWCP), the Piqua asbestos abatement project is a Type 4 activity that required a *Project or Activity (PAE)* form (LMS 1005) be filled out and approved. The approved Piqua Asbestos Abatement PAE is shown in Attachment 1. In addition, the IWCP required that a readiness review be conducted and approved by LMS management prior to any work in the field.

The field work was scheduled to start on April 15, 2019, and the readiness review was conducted, approved, and signed prior to that date (Attachment 2). Even though no permits were required to perform the asbestos abatement activities, the Ohio Environmental Protection Agency (Ohio EPA) required a notification 10 days prior to the start of the Piqua asbestos abatement project. This 10-day advance deadline was met when Neuber provided a notification to Ohio EPA on April 4, and the notification was acknowledged by Ohio EPA on April 5 (Attachment 3).

In step with the overarching project planning documents, the Piqua Project Team also successfully developed and approved two of eleven job safety analyses (JSAs) (Table 1) and issued 30 of the 48 contract submittals (Table 2) prior to mobilization. The balance of the JSA's and contract submittals were developed and issued post mobilization as scheduled throughout the project and are discussed later in the document.

Table 1. JSAs Developed Prior to Mobilization

JSA Identification Number	JSA Title
OH-040419-001	Mobilization
OH-040419-004	Interior Demolition

With the planning documents complete and the Piqua Project Team poised to start in the field, the LMS project lead worked closely with Rii (the oversight contractor) to develop a shared computer-network drive accessible to all four organizations of the Piqua Project Team. This shared drive, known as "Rii share," had proved invaluable. The Rii share had the viewable working files for the project, including the approved copies of contract submittals and their revisions, JSAs, plan of the week (POW) files, Construction Field Inspection Logs (CFILs), waste manifests, and many other project documents. This one-stop repository was essential for keeping real-time completed documents readily available for staff in various locations. An interested client was able to review photos on the CFILs capturing the abatement effort. The Rii share repository of documents aided in the timely compilation of material for the project closeout report.

Table 2. Contract Submittals Issued Prior to Mobilization

Submittal No.	Specification Reference	Submittal Requirement	Submittal Due
1.	01010 1.3A	Abatement subcontractor qualifications for asbestos, including licenses and certifications	With proposal
2.	01010 3.3	Work schedule	With proposal
3.	01010 3.6	Superintendent resume	With proposal
4.	01020 1.4D	Copies of subcontractor's plans and programs	Upon notice to proceed
5.	01020 1.4E	Site-specific Health and Safety Plan	Pre-abatement meeting
6.	01020 1.4F	Medical surveillance exam letter	1 week prior to individual commencing work
8.	01020 1.4H	Owner/operating manuals	Prior to performing field operations
9.	01020 1.4I	Equipment operator qualifications	Pre-abatement meeting
10.	01020 1.4J	Certification of employee proficiency	Prior to work beginning
11.	01020 1.4K	*OSHA Competent Person Designation* form (LMS 2615CON)	Pre-abatement meeting
12.	01020 1.4L	First aid training evidence	Pre-abatement meeting
13.	01020 1.4M	Safety Data Sheets	Upon bringing material onto the site
18.	01020 1.4R	Submit equipment list, including type of equipment used to transport, and the method for unloading	Pre-abatement meeting
19.	01020 1.4S	List of lower-tier abatement subcontractors and suppliers delivering to or transporting from the site	Pre-abatement meeting
20.	01020 1.4T	Statement that electrical workers are qualified and trained and will have any required arc-flash PPE	5 working days prior to working
23.	01060 1.3D	Copies of licenses	5 days prior to commencing applicable work
24.	01060 1.3E	Completed permits and approval applications	5 days prior to commencing applicable work
25.	01100 1.3D	Initial project schedule	With proposal
33.	01200 1.3H	Waste Management Plan	2 weeks prior to the pre-abatement meeting
34.	01500 1.3D	Type of trailer, tool storage, locations where each will be installed, methods for anchoring, and methods for connecting any utilities	At least 2 weeks prior to mobilization of trailers
35.	01500 1.3E	Trailer anchoring requirements	At least 2 weeks prior to mobilization of trailers
36.	01500 1.3F	List of vehicles and heavy equipment, model, type, and year	Pre-abatement meeting
37.	01500 1.3G	Fueling Plan (LMS 2623CON)	Pre-abatement meeting
40.	02050 1.6E	Schedule of selective demolition activities	With the project schedule
41.	02082 1.5D	Ohio EPA notification and any local notifications	At least 2 weeks prior to start of work
42.	02082 1.5E	Name, certifications, medical clearance, and health records of supervisor	At least 2 weeks prior to start of work
43.	02082 1.5F	Name, certification, medical clearance, and health records of workers	Pre-abatement meeting
44.	02082 1.5G	Detailed work plan	At least 2 weeks prior to the pre-abatement meeting
45.	02082 1.5H	Emergency contact list	Pre-abatement meeting
46.	02082 1.5I	List of all products, tools, and equipment	Pre-abatement meeting

Abbreviation: PPE = personal protective equipment

The planning effort was not limited to the development and management of documents; the LMS project lead also held several discussions with City of Piqua personnel. One example of communication and coordination was the discussion with the City of Piqua Electric department manager on the advance planning to deenergize the Piqua site. Another example was the ongoing dialogue with Piqua wastewater treatment plant (WWTP) management and staff to plan for (1) the use of WWTP facilities to conduct onsite meetings in preparation of abatement; (2) coordinating traffic patterns with the adjacent expansion project, knowing a common point of entry would be shared to ensure the safety of the workforce on the site; and (3) the use of the WWTP tornado shelter in case of a severe weather event.

On April 1, 2019, a Piqua Project Team meeting was held in the Piqua WWTP conference room to review the proposed schedule and other submittals, followed by a site tour and project walkdown (see Addendum 1 for meeting notes). Constructive dialogue, transparent discussion, and team formation was evident as the meeting progressed. The Piqua Project Team collaborated on defining work schedules around the holidays and discussed in advance the possibility of working extra Fridays to optimize the schedule. More importantly, the walkthrough identified several safety issues in the work area that were to be tended to at the onset of mobilization. Specifically, there were three broken fire-suppression pipes that were found dangling from the top of the dome and that posed a safety hazard. These pipes were immediately removed and placed to the side for potential repair when and if the fire-suppression system is reinstated. Another issue was the recognition that the front loading dock was to be used as emergency egress only, due to the unsafe condition of the platform. Lastly, the back entrance of the Administration Building had a cut handrail, thus making the railing unsafe. The Piqua Project Team agreed this area would be marked as emergency egress only and that the stairs would be roped off. These examples demonstrate that safety was a top priority for the Piqua Project Team.

Following the meeting held on April 1 and prior to mobilization, a POW was developed in concert with both the Rii oversight contractor and the Neuber abatement contractor. Every Thursday prior to the upcoming work week, the Piqua Project Team developed the POW and adjustments were made to “push or accelerate” work during the planned week as field effort progressed. Each work day started with a team meeting to review the planned activities and applicable JSAs and ended with a daily debrief sharing the progress of work and lessons learned (see Addendum 2 for an example of an authorized POW).

Each day worked, the CSS produced a CFIL that documented (including photographs) the daily activities occurring in the field. During the mobilization phase and selective demolition, LMS had a designated LMS CSS perform this activity. The LMS CSS was also responsible for providing hands-on training to the Rii CSS in accordance with the requirements set forth in the IWCP and the *Construction Procedures Manual* (LMS/POL/S04324), especially regarding the use of LMS forms. From the onset of this project, by design, the LMS CSS’s involvement was limited to mobilization, selective demolition, and demobilization (if necessary), while the Rii CSS, a certified expert in asbestos abatement, served as the full-time onsite CSS during the abatement phase. The training went as planned, and the handoff of responsibilities between the LMS CSS and the Rii CSS was seamless. (See Addendum 3 for an example of an issued CFIL.)

3.1.2 Mobilization and Selective Demolition

Mobilization started as scheduled on Monday, April 15, 2019, with focus on equipment and supply receipt, placement of three 8 × 20 trailers, and setting up the perimeter fence defining the project area. At the request of LM, the LMS project lead made provision for a U.S. Army Corps of Engineers sitewide tour on the that day to participate in a walkdown of the facilities prior to abatement and scheduled the de-energizing of the site electric power for April 16. The abatement contractor Neuber followed suit by rescheduling the temporary electric hookup for the trailers for the afternoon of April 16. Similar LM requests to accommodate site tours and other activities occurred throughout the project, and the LMS contractor accommodated these access requests with no adverse impact to the abatement project.

Photo 1. Arrival of Project Trailers

Selective demolition was initiated as scheduled on April 22, 2019, and waste accumulation began in the open 30-cubic-yard roll-off for waste debris identified as Container P01. The areas for demolition were all within the Administration Building, including an office area on the third floor, several offices and internal walls on the first floor, and dropped ceilings. Removal of walls, ceiling tiles, and other infrastructure was required to access the ACM floor tiles, ACM mastic, and ACM piping. Before the demolition, as the team walked down the area, marking the structure where demolition was to occur, there were several discussions about why a particular wall was identified to be removed (Photo 2). Redline changes were made on the drawings documenting which walls to keep and which walls to remove. The activity to identify areas for selective demolition was completed and demolition began (Photo 3 and Photo 4).

Photo 2. Administration Building, First Floor Office Area, Wall Marked for Selective Demolition

Photo 3. Administration Building, First Floor Office Area, Selective Demolition

Photo 4. Administration Building, First Floor Office Area, Demolition

During the planning of waste loadout from the third-floor demolition, the approach for waste loadout was altered from the original plan. The original plan was to walk and carry the debris down two levels of winding stairs to the first floor, and then discard the waste in the dumpster for construction and demolition (C&D) debris. The revised approach (as documented in the revised work plan submittal number 44**)** was to utilize the Administration Building roof as the loadout area. The rationale for the change was driven by the safety benefit to the workers, allowing for the loadout to be placed onto the third-floor exterior exit door platform, where a second worker would carry the bagged debris across a level walking area directly to a large waste box—an activity involving no stairway tripping hazards and less worker fatigue. The protection of the roof with a plywood walkway to ensure compliance with the National Historic Preservation Act, the establishment of the leading edge line for safety, and the use of a waste box to load and unload the demolition debris were procedures put in place. The waste box was lifted to and from the roof using the telehandler, with a spotter on the roof as well as in the parking lot. The same waste loadout approach was used during the third-floor ACM abatement (see Photos 5, 6, and 7).

Photo 5. Waste Box for Debris from the Administration Building

Photo 6. Using a Telehandler to Move the Waste Box

Photo 7. Waste Loadout Area on the Administration Building Roof

3.1.3 Asbestos Abatement

Abatement efforts began the week of April 29, 2019, with the third-floor abatement preparations by establishing containment. Once the ACM floor tiles and ACM mastic were removed, a visual inspection was performed by the Rii CSS. After the visual inspection had satisfactory results, the air clearance samples were collected and sent to the approved ACM-certified laboratory. The third-floor containment remained in place until the air clearance samples passed. On May 16, the containment was removed, and the third floor was released from asbestos abatement activities.

This cycle of events—containment establishment, abatement, visual/air clearance sampling, and then tear down/release—proceeded until the three Piqua site abatement areas (Administration Building, Reactor Building, and utility vaults) were abated. Refer to Section 5.0 and Section 7.0 for more details.

Table 3 and Table 4 show the remaining 7 of 9 JSAs and the remaining 18 of 48 contract submittals that were issued in accordance with the scheduled timeframe, from post mobilization through the end of project.

Table 3. JSAs Issued Postmobilization

JSA Identification Number	JSA Title
OH-040419-002	Piping Abatement
OH-040419-003	Floor Tile Abatement
OH-040419-006	Waste Loadout/Management
OH-040419-007	Inspection/Clearance Testing
OH-040419-008	Containment Area Setup/Removal
PIQ-040419-005	Utility Vault Abatement
PIQ-040419-009	Demobilization

Table 4. Contract Submittals Issued Post Mobilization

Submittal No.	Specification Reference	Submittal Requirement	Submittal Due
7.	01020 1.4G	List of employees who are absent more than 5 consecutive days	Prior to returning to work
14.	01020 1.4N	Crane and derrick operator, rigger, and signal person information	1 week prior to lift
15.	01020 1.4O	Hoisting and rigging equipment information	1 week prior to lift
16.	01020 1.4P	Hoisting and rigging lift plan	1 week prior to lift
17.	01020 1.4Q	Lifting equipment inspection documentation	1 week prior to lift
21.	01025 1.4D	Payment request and supplemental information	Monthly
22.	01050 1.3D	As-built redlines	Within 2 weeks of project completion
26.	01100 1.3E	Schedule monthly updates	Within the first week of the month
27.	01100 1.3F	Recovery plan	Within 1 week of identifying need
28.	01100 1.3G	Schedule revisions	Prior to implementation
29.	01200 1.3D	Waste Tracking Log	End of each calendar month and at project completion

Table 4. Contract Submittals Issued Post Mobilization (continued)

Submittal No.	Specification Reference	Submittal Requirement	Submittal Due
30.	01200 1.3E	Waste shipping papers	Within 2 weeks of receipt
31.	01200 1.3F	Waste disposal documents	Within 2 weeks of receipt
32.	01200 1.3G	Water volumes and cost	Within 2 weeks of project completion
38.	01500 1.3H	Certification of training for forklift operation	Prior to forklift operation commencing
39.	02050 1.6D	Proposed protection measures	1 week prior to demolition activities
47.	02082 1.5J	Daily project logs	Within 24 hours of day being documented
48.	02082 1.5KL	Close out documents	No later than 45 days after the final clearance and all waste removal

Once the final abatement area was cleared and released, in accordance with the work plan, the Project Team completed their final shipments of waste. Shipments of waste containers P04 (for C&D debris) and P09 and P10 (for ACM) were made on the final day of demobilization, August 22, 2019. Once demobilized, the LMS site lead notified the LM client that the field work of the Piqua asbestos abatement project was completed and that the contractors (LMS, Neuber, and Rii) had left the site.

As the final schedule shows in Figure 2, the work was configured around preconstruction activities to include the development of submittals and preparing for mobilization. Those activities were followed by abatement of each area, ending with post abatement activities such as demobilization and project closeout support. This schedule also reflected a resequencing of work by structure to optimize the field activities. By resequencing the work, there were several work process improvements. Three examples include (1) waste loadout was more efficient when focused in a single building, (2) equipment relocation was streamlined and less exhaustive to workers when establishing containment areas, and (3) the ability to effectively management abatement when vertical pipes run through multiple floors was gained. Additional schedule changes included (1) a new activity added to reflect the field discovery of significant vermiculite to abate and (2) an extended duration to abate the underestimated linear footage of piping in the Administration Building basement and utility vault. These changes also altered the working week from a 4-day ×10-hour schedule to a 5-day × 10-hour schedule effective mid-June to maintain the target completion date in August.

PIQUA ASBESTOS ABATEMENT PROJECT

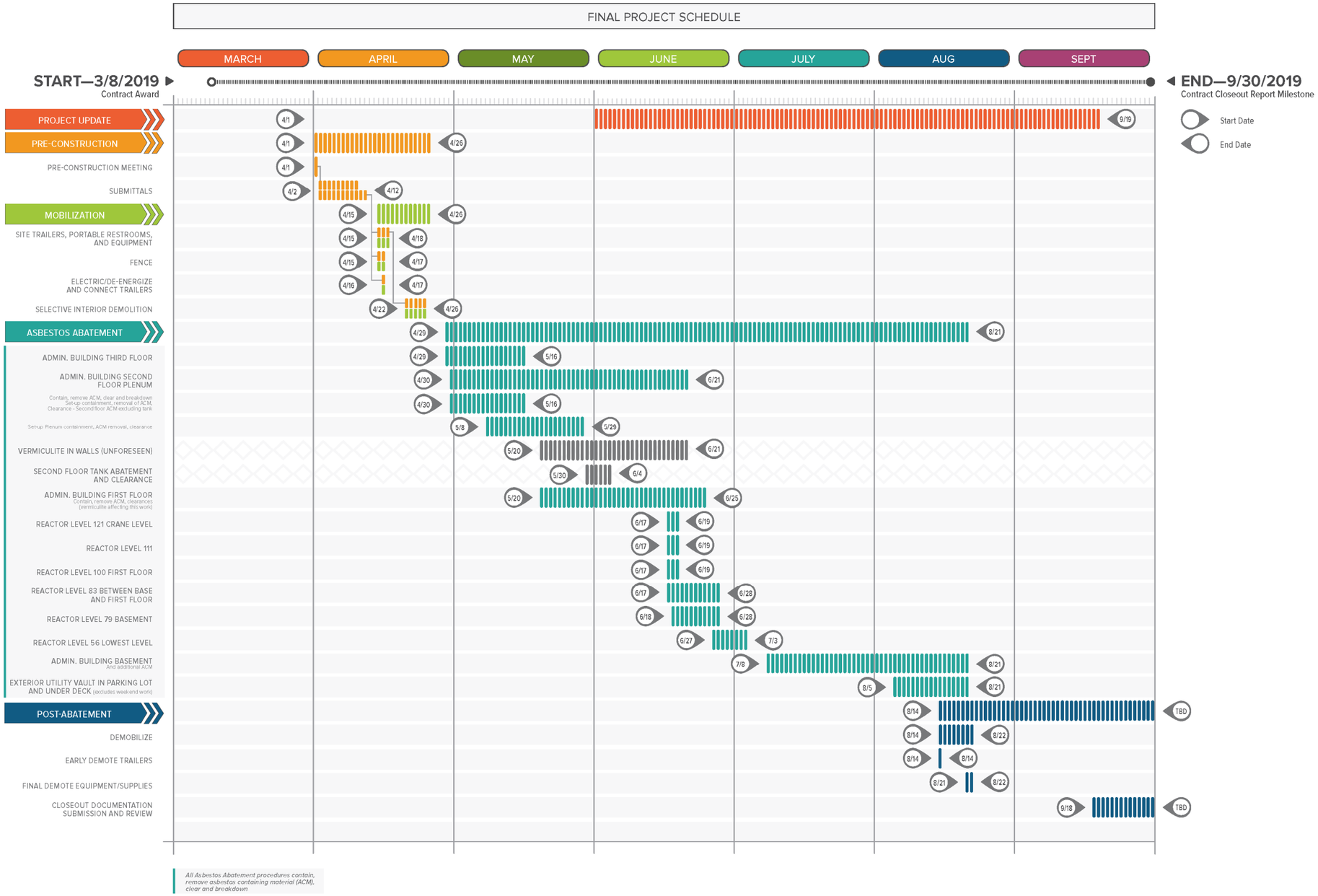

Figure 2. Final Abatement Schedule

3.1.4 Abatement Cost

The fiscal year 2019 cost for the Piqua asbestos abatement project was approximately $1.367 million. Table 5 shows the cost for each contractor in the Piqua Project Team and each contractor's scope in the Project.

Table 5. Piqua Asbestos Abatement Costs for Each Contractor

Name of Contractor	Scope	Amount[a]
Navarro Research and Engineering, Inc	LMS Prime Contractor Support	$ 228,235
Resource International Inc	Abatement Oversight/SME	$ 278,096
Neuber Environmental Services	Abatement Services	$ 860,499
		$1,366,830

[a] Amounts reflect the August 2019 Estimate at Completion for Abatement Project.

During the life of the Piqua asbestos abatement project, there were four change notices issued on the abatement work scope. Two of the change notices, known as Construction Information Document (CID)-001 and CID-002, were administrative changes that did not affect the schedule or cost to the abatement contractor.

CID-001 revised the following four areas within the statement of work to reflect current site conditions:

- **Section 01010, 1.6.A** was deleted. "Contractor will obtain right of entry to the site". The 1.6.A statement was deleted since it is no longer valid because of the LM and City of Piqua lease amendment of January 2019.
- **Section 01200 3.1.C.** Deleted: "In the event of a facility water shutdown, the Abatement Subcontractor shall obtain water from an offsite location. Water volumes obtained from offsite sources shall be tracked, along with associated costs, by the Abatement Subcontractor and provided to the Contractor at the end of the abatement project." Added: "The facility water will remain shut off throughout the abatement project. The Contractor will provide domestic water via a metered fire hydrant near the primary Piqua site entrance gate."
- **Section 01500, 1.9.A.1** was replaced with "The buildings no longer have water, sewer, and electricity utilities providing service to them. The water has been turned off and the electric service will be removed to the meter by the City of Piqua prior to abatement. The Abatement Subcontractor will be required to coordinate with the Contractor for the use of metered water from local fire hydrant and use of thee metered electric service."
- **Section 01500, 1.9.A.4** was replaced with "It will be the Contractor's responsibility to contact the City of Piqua to isolate building utilities prior abatement. Electric and water utility usage costs incurred during abatement at the site shall be borne by the Contractor."

CID-002 modified Section 02082 3.5D. Items 16, 17 and 18 were deleted from the design specification. Item 16 states "Bags, drums and components shall be inspected by the Abatement Subcontractor and landfill operator as they are offloaded at the disposal site". Having the abatement subcontractor follow the shipment to inspect landfill operations is not a requirement.

Items 17 and 18 similarly pertained to the disposal facility personnel (i.e., not the project subcontractor) being responsible for offloading waste.

The two remaining change notices, CID-003 and CID-004, did affect schedule, did increase costs, and resulted in modifications to the Neuber original purchase order value of $793,000.

CID-003 reflects the discovery of significant volumes of vermiculite in the Administration Building plenum, well beyond the estimates originally conveyed in the work scope. The abatement of additional vermiculite resulted in a cost increase of $42,682.70 and a schedule impact deferring the demobilization start from August 5 to August 9, 2019.

CID-004 addresses the significant volume of ACM discovered in the below-grade utility vaults that was beyond the anticipated volume. In addition, the linear feet of ACM in the Administration Building basement was twice the estimated volume. The additional below-grade vault volume of ACM piping (~775 linear feet) and ACM debris (~685 ft^3), along with the additional linear feet in the Administration Building basement (~1250 feet), increased cost by $24,816.50 and had a schedule impact deferring demobilization completion by 8 working days to August 22, 2019.

As the project evolved to include the new ACM discoveries and extended work week hours to meet the completion target date in August, Rii (as the oversight contractor providing abatement expertise) was issued two contracts amendments that added $96,000.00 to their original purchase order value of $182,096.00.

4.0 Project Quality, Environmental Compliance, and Safety Results

The Piqua Project Team performed in a safe and compliant manner from project start on April 15, 2019, through the August 22 demobilization. The project had zero incidents and zero injuries while maintaining full compliance with abatement regulations. In addition to the onsite project oversight, there were three planned LMS assessments covering quality, environmental compliance/waste management, and safety and health.

The quality assessment was conducted in April during the project mobilization (Attachment 4). This surveillance was conducted to ensure that the work activities met the intent of the work plan. The result of the surveillance indicated that start-up documentation was addressed and performed in accordance with the IWCP. There were no findings, and two observations were identified. The first observation noted that JSA numbers appeared only on the front page and did not carry through the document. To address this form flaw, each of the Piqua JSA footers were modified to display the JSA identification number on each page. The second observation noted the condition of the facility. Water leaks had resulted in mold and a mildew odor along with evidence of black mold on cement walls and floors in the Reactor Building. This site condition was called out in the statement of work to inform abatement contractors, and it was restated during the required prebid tour.

The second planned assessment, *Environmental Compliance of Waste Management at Piqua, Ohio, Decommissioned Reactor Site* (MA-19-012), was conducted in July 2019 during the peak

of abatement. The assessment focused on evaluating waste management activities and applicable environmental requirements associated with the asbestos abatement at the Piqua site. The assessment results were two commendations, three findings, and two observations (Attachment 5). The assessment commendations noted the (1) excellent waste segregation and housekeeping and (2) excellent team collaboration and integration. The findings described in the report concerned minor conditions of noncompliance with requirements of the Abatement Specifications. Specifically, the findings were: the contractor failed to submit copies of the Waste Tracking Log at the end of each calendar month, as described in Article 3.1A of the work specifications; a waste container was missing a unique P-series identification number; and there was a sharp-edged item that was not properly wrapped prior to placement into waste container. All three findings were immediately corrected. The two observations were presented (1) a generator permit exemption that was not documented at the time of the assessment, and (2) requirements in the Abatement Specifications that were not applicable. These two observations were also addressed and closed.

The third and final planned assessment, also conducted in July 2019, was to assess the safety and health aspects of the project. The *Piqua Asbestos Abatement Project Safety Assessment* (SU-19-031) focused on and verified compliance with applicable construction safety and health requirements and the proper donning of personal protective equipment (PPE) by project personnel (Attachment 6). The results of the safety assessment identified that work activities were being conducted in a safe manner and in accordance with the applicable federal and state safety and health requirements evaluated. However, two conditions were found noncompliant, considered serious, and brought to the attention of the subcontractor. The two findings of this assessment concerned two locations where holes were left in the floor from where piping had been removed from the pipe chases during abatement activities earlier in the project. These two areas were immediately corrected and were verified by the assessor as completed by the end of the day.

There were also two observations noted in the report that were immediately addressed. The first observation, found in only two locations, involved the securing of temporary power cable with tie-wire. To address the observation, the tie-wire was removed from around the cable and replaced with zip-ties, and the tie-wire was then secured to the zip-tie, eliminating all direct contact with the cable. The second observation involved the LMS form *Equipment and Vehicle Maintenance Inspection* (LMS 1072). Upon review it was noticed that the initials were not being recorded by the individual inspecting the equipment, which made it unknown as to who had conducted the inspection for that day. It was later determined that the individual who had signed the document was the individual who had performed the daily inspections.

Even as the project progressed in accordance to the work plan, the Piqua Project Team discovered 19 lessons while in the field (Attachment 7). As part of the daily project debrief and during the weekly project meeting, lessons learned throughout the week were discussed. An example of one lesson learned with a win-win solution lies with radio interference. Using portable, hand-held radios for communication was defined as an operational requirement for the Piqua asbestos abatement project since cell phone service is spotty on the site and limited inside the buildings. However, it was discovered that the radios were picking up the construction communication on the adjacent WWTP expansion construction site. With two independent projects sharing multiple radio frequencies, the overlap compromised safety for both operations. The LMS site lead proactively worked with the City of Piqua WWTP expansion project

management to assign dedicated radio frequencies. Another lessoned learned identified was the value of site walkovers. Site drawings provide an understanding of the project scope but should not replace the importance of actually seeing the work area and discussing in detail the approach to execute work. Walkthroughs were routinely conducted by Navarro, Rii, and Neuber to check and verify materials to be abatement and reaffirm the abatement approach.

5.0 Summary of Abatement Activity

The Piqua asbestos abatement project yielded 12.73 tons of solid waste debris that was collected from the selective demolition to access abatement areas and then shipped to a licensed landfill. The project also yielded 30.26 tons of ACM that was removed from the site and then shipped as hazardous material to the licensed landfill. As envisioned during planning, there were several areas considered "inaccessible." These areas involved (1) ACM outside the facility and below grade, and (2) ACM within the walls of the facility that was considered inaccessible (only subject to demolition). These inaccessible areas are clearly documented on the redlined drawings in Addendum 4 and examples are as follows:

- Seven ACM pipes that enter the Reactor Building on Level 79 from the south side and are below grade
- Seven ACM pipes that enter Level 83 of the Reactor Building and are below grade
- Three ACM pipes (of about 96 linear feet) that run between the large vault and small vault and that are under the north parking lot
- 35 square feet of encapsulated caulking in the Administration Building basement wall in Room B8
- 300 square feet of black roof mastic in the connector roof of Administration Building
- Serpentine aggregate (assumed to be ACM) surrounding the entombed reactor core

The abatement effort was proceeding as planned in early May 2019 when, during the abatement of the vermiculite in the plenum, an unforeseen discovery was made. The actual volume of 2224 square feet and widespread location of vermiculite within the plenum far exceeded the localized 155 ft^3 identified in the 2016 hazard assessment survey. The survey captured approximately one open bag of vermiculite from atop the spray-in insulation. As the plenum abatement proceeded, it became apparent that the entire plenum was filled with vermiculite hidden by the spray-in insulation.

In response, the LMS project lead, the Neuber project manager, and the Rii project manager discussed at great length the next steps to safely approach abatement in the plenum area given the widespread amount of vermiculite throughout. Specifically, the Piqua Project Team discussed an approach to establish containment for safely performing an exploratory search for vermiculite behind the first floor walls (i.e., in the office area and locker room that are directly below the plenum). On May 20, a new containment area was established for potential vermiculite. Additional vermiculite was discovered behind several walls on the first floor, and abatement proceeded.

Photo 8 shows two asbestos abatement workers in proper PPE and inside a containment area, shoveling vermiculite (that poured out from the Administration Building north wall area onto the floor) into asbestos disposal bags.

Photo 8. Asbestos Workers Removing Vermiculite for Disposal

5.1 Administration Building

The Administration Building consists of three stories above grade and a full basement, and the floor space ranges from 5332 ft^2 at the basement level to 355 ft^2 at the third level, for a total of 11,718 ft^2 including stairways. The first and third floors required selective demolition of interior wall construction, and it took place after the decommissioning of the Reactor Building. In particular, new construction occurred on the first floor to include three new front offices, a redesigned conference room, and redesigned laundry area and locker room accommodations, all with dropped ceiling installed. Similarly, an office area was established on the third floor. Photo 9 shows the first floor front office area with walls marked for selective demolition, ACM floor tiles in hallway, and laminate flooring in an office. Photo 10 shows the same area after removal of vermiculite, selective demolition of walls, removal of ceiling tiles, and abatement of ACM floor tiles. Photo 10 also shows the removal of ACM piping that was tied to the wall-mounted radiator.

Photo 9. Piqua Administration Building, First Floor Office Area, Before Abatement

Photo 10. Piqua Administration Building, First Floor Office Area, After Abatement

Photo 11 shows the first-floor Administration Building conference room before abatement. The area included false rear walls, a dropped ceiling, and carpeting. The room required selective demolition since the room had concealed ACM pipes, ACM floor tiles, and ACM mastic. Photo 12 shows the same room after selective demolition and abatement of those ACM materials.

Photo 11. Piqua Administration Building, Conference Room, Before Abatement

Photo 12. Piqua Administration Building, Conference Room, After Abatement

Photo 13 and Photo 14 are before and after images of the Administration Building basement level hallway. More than 2500 linear feet of ACM pipes were glove bagged, cut, and wrapped for disposal. This area required scaffolding and scissor lifts to access the pipes.

Photo 13. Piqua Administration Building, Basement Level Hallway, Before Abatement

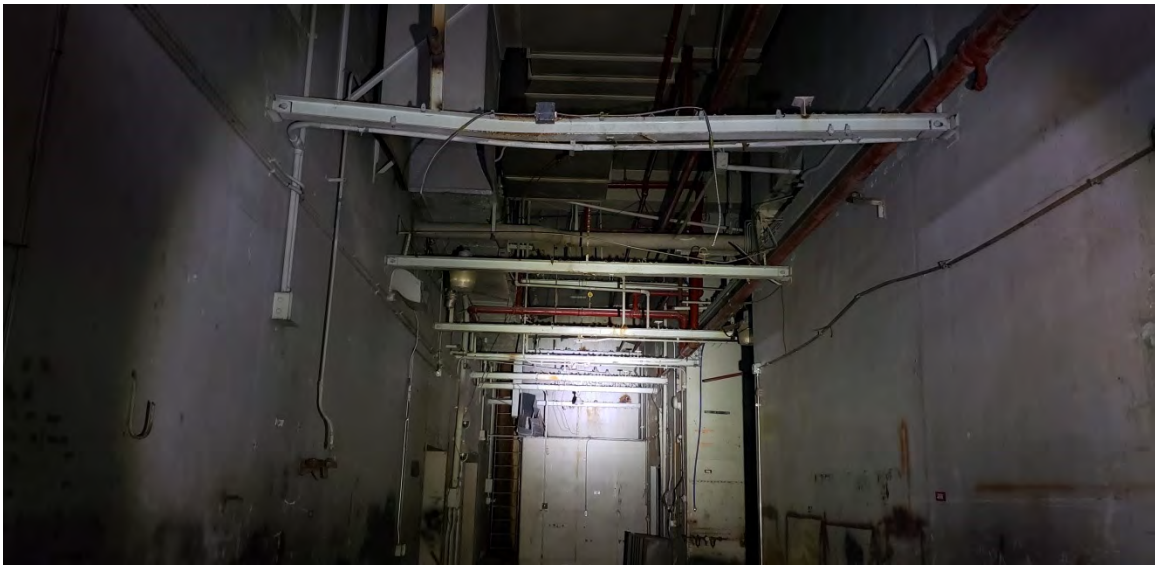

Photo 14. Piqua Administration Building, Basement Level Hallway, After Abatement

Photo 15 and 16 illustrate the large chemical tank inside the Administration Building before and after abatement. In Photo 15, the view is from above the tank that has metal-jacketed ACM. In Photo 16, the metal jacket and the ACM has been removed to reveal the heating coils on the tank.

Photo 15. Administration Building, Basement, Large Chemical Tank Before Abatement

Photo 16. Administration Building, Basement, Large Chemical Tank, After Abatement

5.2 Reactor Building

The 4380 ft^2 Reactor Building has an above-ground containment dome known as Level 100 that extends 68 feet high. The portion of the Reactor Building below grade has several levels and extends 44 feet below ground level. Photo 17 shows a section of ACM pipes requiring abatement located at Level 100 in the Reactor Building. Photo 18 shows the same area after the ACM pipes had been removed.

Photo 17. Reactor Building, Level 100, Before Abatement

Photo 18. Reactor Building, Level 100, After Abatement

Photo 19 shows the placement of glove bags in preparation of removal of ACM pipes in an area on Level 56 in the Reactor Building, and Photo 20 shows the same area after the ACM pipes had been removed. That removal required the use of a scissor lift due to the area limitations and height of the pipes.

Photo 19. Reactor Building, Level 56, Before Abatement

Photo 20. Reactor Building, Level 56, After Abatement

5.3 Below-Grade Utility Vaults

The abatement of the utility vaults below grade was a challenging endeavor. Air monitoring was required prior to entry into the confined space each day. As shown in Photo 21, a wooden containment area was constructed to be use as the entry point. This structure provided asbestos containment and served as a barrier to entry to prevent falls into the confined space opening.

Photo 21. Entry to the Below-Grade Utility Vaults

Each of the utility vaults had standing water that required pumping. Before the pumped water could be released to the environment, it was filtered through a micron filter because the vault contained ACM pipe insulation. The pipe insulation was deteriorated, which meant that asbestos was in the water and found friable in the floor debris. Once the standing water in the north vault was pumped down to floor level, workers discovered a lower tiered vault (i.e., a 20 × 20 room that was not identifiable on the original as-builts) directly below the north vault. The lower tiered vault was filled with 8 feet of water. That water had to be pumped out before anyone could enter the lower tiered vault, where workers determined ACM was present.

Photo 22 shows the north vault with standing water. Photo 23 shows the poor condition of the ACM pipes and ACM in the floor debris in the north vault after the pumping and before the abatement. Photo 24 shows the final condition of the north vault after abatement.

Photo 22. Water in the North Vault, Before Abatement

Photo 23. North Vault After Pumping and Before Abatement

Photo 24. North Vault Final Condition, After Abatement

To summarize the asbestos abatement project, Table 6 provides a detail inventory of abated material during the Piqua asbestos abatement project.

Table 6. Inventory of Abated Material

Week	Material Abated	Building	Location	Quantity	Bags
4/15/2019	N/A	N/A	N/A	N/A	
4/22/2019	N/A	N/A	N/A	N/A	
4/29/2019	Floor tile	Admin Bldg	3rd Floor	1267 sf	417
5/6/2019	Floor tile mastic	Admin Bldg	3rd Floor	1267 sf	
	Tank & Pipe insulation		Rm 203	300 lf	
	Brown putty		3rd Floor - electric wiring putty	1 lf	
5/13/2019	Electrical transite panel	Admin Bldg	Rm 202	30 sf	
	Vermiculite insulation		Plenum	2,224 sf (varied in thickness)	

Table 6. Inventory of Abated Material (continued)

Week	Material Abated	Building	Location	Quantity	Bags
5/20/2019 5/27/2019 6/3/2019	Pipe insulation Floor tile	Admin Building	1st Floor Conference Room, Rooms 112A & 112B, Admin office, portion of first floor hallway	27 lf 800 sf	406
	Plaster walls with vermiculite		Rms 112A & B, Admin	168 sf - walls	
	Mudded pipe fittings		Rms 104, 109, 116, 110	12 lf	
6/10/2019	Pipe insulation	Admin Bldg	Rms 115, 121, bathrooms	436 lf	198
	Floor tile and mastic		Rms 90, 110, 116, 112A & B, Admin Office, Hallways 1 & 2	1,465 sf	
6/17/2019	Pipe insulation	Reactor Bldg	Level 100	215 lf	99
	Firestop - white	Admin Bldg	File Rm floor penetration	2 sf	
	Brown putty	Reactor Bldg	Level 100	150 sf	
	Pipe Insulation	Reactor Bldg	Level 79 & 83	0	
6/24/2019	Pipe Insulation	Reactor Bldg	Levels 79 & 83	464 lf	56
	Fabric gasket - HVAC panel	Reactor Bldg	Level 83	40 lf	
7/1/2019	Pipe Insulation	Reactor Bldg	Level 56	42 lf	84
7/8/2019	Pipe insulation	Admin Bldg	Basement	592 lf	38
7/15/2019	Pipe insulation	Admin Bldg	Basement	348 lf	122
7/22/2019	Pipe insulation	Admin Bldg	Basement	426 lf	52
	Duct insulation	Admin Bldg	OAP Room	400 sf	
7/29/2019	Pipe insulation	Admin Bldg	Basement	748 lf	52
8/5/2009	Tank & Pipe insulation	Admin Bldg	Rm B-2	10 lf	47
	Pipe insulation & Debris	North Vault	North Vault	40 lf	140
	Tank & Pipe Insulation	Admin Bldg	Rm B-5	218 lf	100
8/12/2019	Pipe Insulation & Debris	South Vault & Tunnels	South Vault & Tunnels	456 lf	341
	Tank & Pipe insulation	Admin Bldg	Rm B-5	70 lf	27
	Sink & tabletop	Admin Bldg	Rm B-1	60 sf	0
	Pipe Insulation & Debris	North Sub-vault	North Sub-vault	10 lf	17
8/19/2019	Pipe Insulation	Admin Bldg	Basement	339 lf	133

6.0 Waste Material Disposition

At the onset of abatement planning, Section II, Subsection 4, “Environmental Evaluation Checklist,” and Section II, Subsection 5, “Environmental Compliance Requirements,” of the Piqua Asbestos Abatement PAE (Attachment 1) was used to thoroughly evaluate the asbestos abatement requirements for the Piqua site. The environmental compliance requirements, including waste management protocols, were incorporated into the Abatement Specifications.

Following the 10-day advance notification by Neuber to Ohio EPA that an asbestos abatement project was planned at the Piqua site (Attachment 3), LMS personnel developed two waste profiles. The first waste profile (Attachment 8) covered solid waste (C&D debris), and the second waste profile (Attachment 9) addressed the disposition of friable asbestos as a hazardous waste. Throughout the project, there were three C&D shipments and seven asbestos containing material (ACM) shipments, as documented on the Waste Tracking Log (Attachment 10).

Photos 25–28 illustrate different aspects of the placement of ACM into the waste container. Photo 25 shows ACM-labeled double bagged-units. Photo 26 shows glove-bagged ACM pipes wrapped and candystriped. Note that the sharp edges of cut pipe are taped to prevent injury in transport and avoid tearing adjacent ACM bags. Photo 27 shows a laydown area of abated ACM pipe lifted from the lower levels of the Reactor Building. Photo 28 illustrates the innovation of using a waste box for safe handling and transport of waste material.

Photo 25. ACM Bags

Photo 26. ACM Pipes

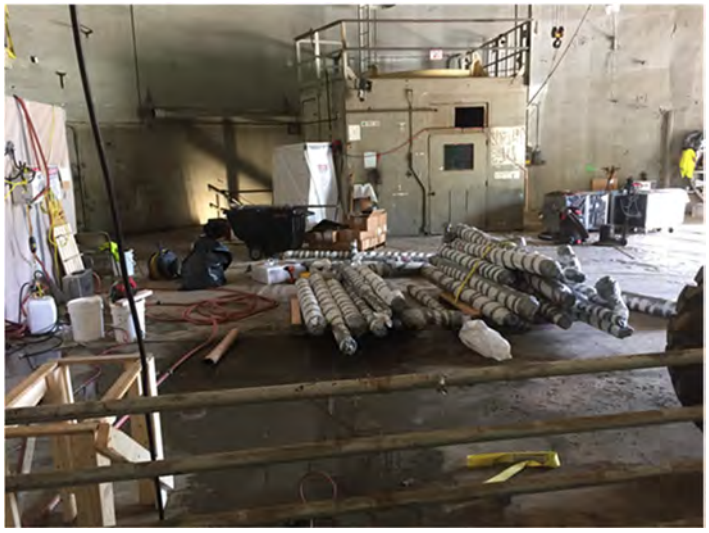

Photo 27. Laydown Area

Photo 28. Using a Waste Box to Transport ACM Bags to the Waste Container

The integral process of properly dispositioning waste was well executed, given the circumstance that the Piqua site is a remote unmanned facility. The advanced and real-time coordination among the project workers at the Piqua site; the certified waste shipper in Westminster, Colorado; and the LM security subcontractor in Grand Junction, Colorado, was exceptional.

Of the 10 waste shipments that were prepared for transport at the Piqua site, the majority of shipments were scheduled to be picked up at 7:00 a.m. eastern standard time (EST). This required the certified shipper to be working by 5:00 a.m. EST (3:00 a.m. MT) to review inspection logs and photographs of the waste load to verify compliance prior to signing the waste manifest (Photo 29). Once the waste load was approved for transport, the certified shipper notified LM 24-hour site security subcontractor that the hazardous waste shipment was in route to the licensed landfill. When the waste container arrived at the landfill, Nueber staff notified the certified shipper, and the certified shipper notified LM security.

Photo 29. ACM Waste Container Approved for Transport to Stony Hollow Disposal Facility

The Piqua Project Team performed a number of proactive measures beyond implementing proper waste management practices for handling and disposing of the project waste. For example, during the selective demolition activities it was important to retain original historical features such as facility doors, lighting, plaques, and signage. Doors and lighting were removed from the working areas and placed aside for preservation, and the signage and plaques were handled with care when containment areas were established and then broken down. A waste management review determined there was not a sufficient amount of recyclable material to segregate from the waste destined for disposition. In a proactive measure to minimize waste and prevent the potential hazard of broken lamps, Navarro staff removed the fluorescent lamps from throughout the Administration Building and Reactor Building to recycle as universal waste. Approximately 160 pounds of universal waste lamps were recycled.

6.1 ACM Waste Material

The Piqua asbestos abatement project resulted in 30.26 tons of ACM being shipped as hazardous waste to the Stony Hollow disposal facility (a licensed landfill), as documented on the Waste Tracking Log. Table 7 provides information on the seven ACM shipments.

Table 7. ACM Shipment Information

Container ID#	Container Type/Volume	Accumulation Start Date	Disposal Date	Waste Net Weight (tons)
P02	Closed 40 Cubic Yard Roll-off	4/29/2019	6/07/2019	3.24
P05	Closed 40 Cubic Yard Roll-off	6/06/2019	06/25/2019	5.38
P06	Closed 40 Cubic Yard Roll-off	6/07/2019	7/24/2019	5.69
P07	Closed 40 Cubic Yard Roll-off	6/25/2019	8/06/2019	3.03
P08	Closed 40 Cubic Yard Roll-off	7/24/2019	8/14/2019	6.18
P09	Closed 40 Cubic Yard Roll-off	8/06/2019	8/22/2019	6.35
P10	Closed 40 Cubic Yard Roll-off	8/19/2019	8/22/2019	0.39

6.2 C&D Waste Material

The Piqua asbestos abatement project resulted in 12.73 tons of solid waste debris dispositioned to Stony Hollow disposal facility, as documented on the Waste Tracking Log. Table 8 provides information on the three solid waste C&D shipments.

Table 8. C&D Shipment Information

Container ID#	Container Type/Volume	Accumulation Start Date	Disposal Date	Waste Net Weight (tons)
P01	Open 30 Cubic Yard Roll-off	4/22/2019	4/25/2019	3.68
P03	Open 30 Cubic Yard Roll-off	4/25/2019	6/5/2019	4.95
P04	Open 30 Cubic Yard Roll-off	6/5/2019	8/22/2019	4.1

7.0 Abatement Verification and Clearance

When performing asbestos abatement, certain ACM requires the construction of a containment space. Full containment is necessary for the abatement of friable ACM and abatement of materials that could become friable during the removal process. The glove-bag removal method for pipe insulation does not require full containment, but it does require a designated abatement zone, the sealing of all critical barriers, and additional protective measures. Ten full containments were constructed within the Administration Building for the removal of floor tile/mastic, tank insulation, vermiculite within the walls and plenum, and duct wrap (Photos 31–33). There were no full containments constructed in the Reactor Building because only the pipe insulation required abatement performed by glove-bag procedures. Two additional full containments were constructed within the north parking lot for the abatement of both the small and large vaults. The large vault containment included the below-ground north parking lot tunnel and sub-porch area.

Photo 30. Administration Building, First Floor: Inside Full Containment

Photo 31. Administration Building, First Floor: Glove-Bag Abatement in Conference Area

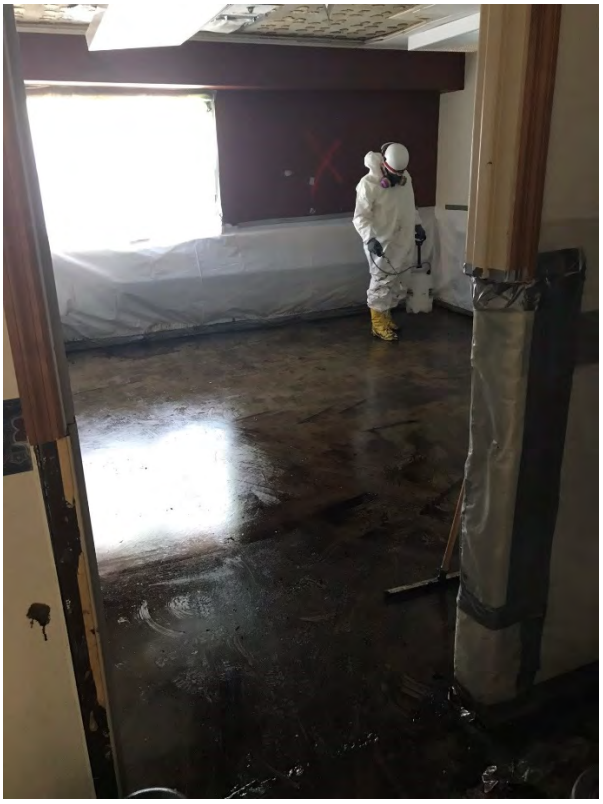

Photo 32. Administration Building, Third Floor: Floor Tile/Mastic Removal in Full Containment

Each full containment constructed required a decontamination enclosure system. Neuber was required to submit an abatement work plan detailing the containment area for review and approval by Navarro and Rii prior to starting the abatement. The containment entrances required building-suitable framing or portable prefab units. The containment entrances (Photo 33) were constructed as three totally enclosed chambers (Equipment/Dirty Room, Shower Room, and Clean Room). The Equipment Room had an airlock to the work area and a curtained doorway to the Shower Room. The Shower Room had two curtained doorways (one to the Equipment Room and one to the Clean Room) and contained at least one shower with hot and cold water. All wastewater from the Shower Room was collected and pumped through a 5-micron filter system, and the filter was disposed of as contaminated ACM waste. The Clean Room had one curtained doorway into the Shower room and one entrance or exit to non-contaminated areas of the Administration Building. The Clean Room had sufficient space for storage of the workers' street clothes, towels, and other noncontaminated items. Joint use of this space for other functions, such as offices or storage of equipment, materials, or tools, was prohibited.

Photo 33. Containment Entrance to Clean Room

Throughout each working day, Neuber and Rii personnel frequently monitored the negative pressure differential in the full containment with a manometer (Photo 34). A pressure differential of 0.02 inch of water or above was required. When the pressure differential dropped less than 0.02 inch of water, the work practices and containment setup were evaluated to determine the root cause. Corrective measures included adding additional air filtration devices to lower the inside containment negative pressure, reducing the number of times workers went in and out of containment, and reinforcing to the workers the proper closure of the containment poly door flaps.

Photo 34. Manometer

Asbestos abatement oversight included conducting daily inspections to evaluate work area isolation structures, decontamination facilities, and protective coverings to ensure the worker protection program was being implemented. Furthermore, oversight ensured proper performance of asbestos hazard abatement work including work area preparation and isolation, stripping, removal, encapsulation, and disposal; conformance with regulations from the State of Ohio, the U.S. Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the U.S. Department of Transportation, and other local agencies.

Rii, as the abatement oversight contractor and the asbestos abatement SME for this project, performed air monitoring during abatement, and for final air clearance testing (Photo 35). Rii also was responsible for approving the continuation of Neuber work practices (daily practices, enclosure construction, modification and removal, and permits for unrestricted entry). In addition, after Neuber provided notification that the abatement was complete (Attachment 11), Rii was responsible for visually inspecting the abatement area and performing final air clearance testing within each containment. Prior to the performance of final air clearance monitoring, Rii completed a visual inspection of each containment for the potential presence of asbestos dust or residue (Attachment 12). If residue is found, the entire abatement work area was given another vacuuming or wipe down.

Photo 35. Air Clearance Testing

Final air clearance sampling was conducted once the containment passed the visual inspection. A minimum of three air volume samples of 1000–1800 liters were collected and sent to EMSL Analytical Inc. for third-party laboratory analyses. The analyses were performed using phase contrast microscopy (PCM) per NIOSH Method 7400 and transmission electron microscopy (TEM) using the AHERA Method. The area was considered cleared and the ACM fully abated if

the PCM or TEM analysis was below the clearance criteria of 0.01 fibers per cubic centimeter (f/cc) of air. If the air sampling indicated that the work area had not been decontaminated, the abatement contractor (Neuber) repeated the cleaning and/or encapsulation application, and the oversight contractor (Rii) repeated the clearance air sampling, until the work area was in compliance. Samples were collected using 25-millimeter cassettes with a 0.8 micrometer (µm) mixed cellulose ester (MCE) membrane filter material for PCM analysis, or a 0.45 µm MCE membrane filter material for TEM analysis.

During the project there were only three containments areas that failed to pass initial air clearance tests, as described below:

- Administration Building, Third Floor: While abating floor tile and black mastic, the initial air clearance sampling failed due to the exterior east-facing door being left open. The neighboring property to the east is the City of Piqua WWTP, which had been undergoing major construction improvements. The construction had led to bare ground with dusty conditions possible during windy days. The abatement activity on the third floor did not require full containment with negative pressure. The work space had two air filtration devices (AFDs) venting work space atmosphere out the building, whereby the make-up air was unknowingly provided from the open exterior door, which had critical barrier triple flaps only during abatement and after abatement while air clearance sampling. Based on an evaluation of the containment setup, it was determined that dust from the construction site next door contributed to the total dust reading analyzed by PCM for the floor tile and mastic removal.
- Administration Building, First Floor, Room 103 (Former Locker Room): While abating the vermiculite in the plaster and drywall walls, the air clearance sampling failed twice due to the exterior walls having rust holes to the northern parking lot area. The abatement activity did require full containment with negative pressure. The work space had two AFDs venting the work space air out of the building, and the make-up air was unknowingly provided from the holes in the exterior walls, while air clearance sampling during abatement and after abatement. It is believed the dust created by the outside contributed to the total dust reading analyzed by PCM for the abatement.
- Administration Building, Operating Air Pressure Room: While abating the duct wrap, the air clearance sampling failed due to a used AFD filter being unknowingly left behind in the dirty room of the decontamination unit. The filter was placed in a black asbestos bag that was left behind while the rest of the asbestos waste was loaded out after abatement activities. The bagged filter was mistakenly thought to be a stack of unused waste bags staged for potential use. The abatement activity did require full containment with negative pressure. The area had an AFD venting the work space air out of the building, and the make-up air was unknowingly coming through the decontamination unit past the used unsealed bag with the filter during abatement and after abatement while air clearance sampling. It is believed the bag was stepped on while entering and exiting the decontamination unit, which allowed fibers to contribute to the air clearance sample analyzed for the abatement.

In accordance with OSHA asbestos standards, abatement contractors are required to conduct personal air monitoring of the work force during the abatement activities. Neuber posted all personal air monitoring results on the break-room trailer information board. Several personal air monitoring results failed the permissible exposure limit (PEL) of 0.1 fibers per cubic centimeter (f/cc). A majority of the failed personal samples were during the vermiculite abatement. When

personal air sample results showed exceedances of 0.10 fibers/cc, a root cause evaluation of the abatement methods was conducted after review of each failed personal air sample report between the CSS and Neuber site supervisor to determine corrective measures. As a corrective measure the abatement contractor may select a different respirator for use which has a higher protection factor (i.e., half face respirator changed to powered air purifying respirator [PAPR]) or alter the means and methods to effectively reduce the amount of fibers released into the containment air space. Corrective measures implemented that rectified the issues included:

- using a higher efficiency respirator (PAPR);
- reducing the sample accumulation time;
- lowering the sample flow rate;
- affirming and increasing the use of sufficient water during the active abatement procedures; or
- altering the method of how the work activity was being performed.

The final closeout documents provided by Neuber included all compiled personal air monitoring laboratory results. Refer to Attachment 13 and Attachment 14 for examples of the air monitoring laboratory results issued for the project. As specified, Neuber provided closeout documents following completion of the field abatement activities. Closeout documents included final submittals for the waste documentation, rectified Ohio EPA notification quantities and fee payments, and a closeout certification letter stating the work was performed in accordance with Ohio EPA and OSHA requirements.

8.0 Conclusion

The Piqua asbestos abatement project met the high expectations of Navarro and its strategic partner LM. The Piqua asbestos abatement project was conducted safely without incident or injury and fulfilled all compliance requirements to properly abate, manage, and dispose of the waste. Performance by the Piqua Project Team was of high quality, including their attention to detail in maintaining historic attributes of the site, and their leaving the site in better condition than what was originally found. Lastly and equally important, the asbestos abatement project was accomplished slightly over budget by addressing the unforeseen discovery of ACM during the project to achieve the project goal of abating all accessible areas. Furthermore, the project was completed 39 days ahead of schedule while successfully submitting this closeout report by September 30, 2019.

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