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Subject:  
Abandonment of Former Gas Main Tunnel, Former Third Ward MGP Site, 501 East  
Erie Street and 348 South Water Street, Milwaukee, Wisconsin.  
ARCADIS Geraghty & Miller Project No. WI0007290001

ENVIRONMENTAL

Dear Mr. Covi:

Milwaukee,  
13 September 1999

This letter serves to summarize the tunnel abandonment activities conducted at the subject site by ARCADIS Geraghty & Miller, Inc., on behalf of Wisconsin Gas Company. The tunnel abandonment activities were completed during the time period of May 18 through 26, 1999. The abandonment activities were conducted in conjunction with site remediation activities at the Peters=Johnson property portion of the Former Third Ward Manufactured Gas Plant (MGP) Site.

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## Background

The former gas main tunnel was utilized to convey materials generated by the MGP under the Menominee River to distribution facilities located on the south side of the river. The tunnel underlying the river is approximately 10 feet in diameter with an invert of approximately 55 feet below land surface (bls), measured along the river bank. Two 24-inch diameter gas pipelines were contained within the tunnel. Access to the tunnel was provided by a 12.5-foot diameter vertical shaft located at 501 East Erie Street (north side of the river) and a similar shaft at 348 South Water Street (south side of the river). The tunnel system has been out of service since approximately 1989. Both of the vertical shafts were fitted with concrete covers, with manhole access. The south shaft also had a concrete vault surrounding the top of the shaft. The location and layout of the tunnel system is illustrated on Figure 1.

Previous investigation activities for the former gas main tunnels consisted of the inspection and sampling of the north shaft conducted in 1996. A thorough inspection of the shaft was completed, and several water and sediment samples were collected for laboratory analysis. Diver observations indicated that a layer of sediment and debris (total estimated volume of approximately 15 to 20 cubic yards [yd<sup>3</sup>]) was present at the base of the shaft. Laboratory analytical results for the

collected sediment samples indicated that the material contained contaminants associated with the former MGP operations, and would likely require removal. Complete details of the inspection and sampling are contained in the document entitled "Sampling and Laboratory Analysis - Third Ward Area Tunnel Closure Project" dated October 15, 1996.

### Pre-Abandonment Inspection/Preparation

Abandonment activities were initiated on May 18, 1999 with a surface inspection of both the north and south vertical shafts. The manhole access covers were removed and the ambient air within the shafts was tested for oxygen, carbon monoxide, hydrogen sulfide, and explosive gas content. Following confirmation of satisfactory air quality within the shaft located at 501 East Erie Street, personnel from ARCADIS Geraghty & Miller and DUSTCOATING, Inc. (DCI) entered the shaft to inspect the two 24-inch gas mains and test for the presence of explosive gases. Only one of the two gas mains was accessible above the static water level, approximately 4 ft bls. Monitoring results indicated that a limited amount of explosive gas was present in the pipeline, but the concentrations were well below the lower explosive limit. An access port in the exposed gas main was removed and a disposable bailer was lowered down the pipe to determine if any free product, tar, or sludge was present. The main was determined to be essentially dry (1 to 2 inches of water in the bottom of the pipe), and no free product, tar, or sludge was observed.

Following the completion of the inspection and monitoring of the north shaft, site personnel then proceeded to the south shaft located at 348 South Water Street. The ambient air within the shaft was again monitored for the presence of toxic and explosive gases. Air monitoring indicated a satisfactory environment to allow entry and inspection of the 24-inch gas mains. Monitoring results indicated that both 24-inch mains contained explosive gases and carbon monoxide at potentially hazardous concentrations, thus necessitating that the mains be purged prior to commencing work activities.

On May 19, 1999 personnel from DCI entered the south shaft and began purging one of the 24-inch gas mains. The line was purged for approximately 2.5 hours by inserting a compressed airline into the gas main and venting it through an adjacent valve on the piping. Following purging, the air within the pipe was tested for the presence of toxic and explosive gases. Results indicated that the air quality was within acceptable limits and no further purging was necessary. Purging of the second gas main was then initiated. The second gas main was allowed to purge for

approximately 1 hour prior to testing for the presence of toxic or explosive gases. Monitoring results indicated satisfactory air quality within the main. The flanges on both mains were removed with an acetylene torch following purging activities.

A disposable bailer was lowered down into each gas main to determine the presence of sludge, tar, or free product (if any) within the pipeline. No discernable free product, tar, or sludge deposits were identified in either gas main. One of the gas mains was filled with water to within approximately 8 feet of the top flange, and the other main was completely dry.

Based upon the fact that no free product, tar, or sludge was found within the gas mains, it was determined that backfilling of the pipes with gravel would be sufficient rather than sealing with a cement-based grout.

### South Shaft Abandonment

Abandonment activities were conducted on May 20 and 21, 1999 at the shaft located at 348 South Water Street. An excavator fitted with a hydraulic breaker was utilized for demolition of the vault walls and lid, generating approximately 40 yd<sup>3</sup> of sized concrete rubble, which was subsequently placed as backfill material within the shaft.

Following completion of the vault demolition, stockpiled sized concrete rubble generated during demolition of the Peters-Johnson portion of the MGP project was transported to the site and placed as backfill into the shaft. Approximately 145 yd<sup>3</sup> of concrete rubble was utilized to backfill the shaft to approximately 8 to 10 ft bls.

Vibration and mechanical compacting was conducted on the backfill material by using the excavator bucket and hydraulic breaker. Following the placement of each lift of concrete rubble, from approximately 15 ft bls to the surface, the excavator would compact the backfill material prior to the placement of each subsequent lift.

Imported ¾-inch granular fill material was utilized to backfill the 24-inch gas mains to approximately 8 ft bls (approximately 100 yd<sup>3</sup>). The cast iron mains and valve assemblies were then cut off and removed from the shaft for off-site disposal. The remaining portion of excavation was backfilled to approximately 4 ft bls with additional ¾-inch granular material.

A 12 ounce non-woven geotextile fabric was placed approximately 4 ft bls to provide a barrier to prevent fine material from migrating downward into the rubble

backfill. Following placement of the geotextile fabric, the remainder of the excavation was backfilled, compacted, and graded using ¾-inch granular material.

Based upon the tunnel dimensions, the volume required to backfill the shaft was calculated to be approximately 260 yd<sup>3</sup>. Utilizing an assumed void space of 10 percent for the concrete rubble placed within the shaft, the total volume of backfill material utilized to fill the south shaft is calculated to be approximately 260 yd<sup>3</sup>. This calculated volume indicates that the shaft has been adequately backfilled. Details of the shaft and tunnel abandonment are illustrated on Figure 2.

During backfilling of the South Shaft, water was displaced up the shaft and into the vault area. Backfilling activities were conducted to minimize or eliminate the amount of water displaced over the top of the shaft and vault. During abandonment activities at the South shaft, no changes in the water level in the North Shaft were observed. Based upon this observation it appears that the tunnel under the river may be blocked or may have collapsed around the 24-inch gas mains.

### North Shaft Abandonment

Closure activities for the North Shaft were initiated on May 25, 1999. As stated previously, results of previous investigation activities indicated that approximately 15 to 20 yd<sup>3</sup> of sediment was present at the base of the shaft. Laboratory analytical results indicated that concentrations of polycyclic aromatic hydrocarbons (PAHs) present in the sediments warranted removal prior to abandoning the shaft.

Superior Special Services, Inc. (Superior) of Fond du Lac, Wisconsin was retained to conduct the sediment removal via diver-assisted hydraulic suction dredging. Hydraulic suction dredging removes material from beneath the water surface in a slurry-like mixture consisting of approximately 6 to 10 percent solids. Set-up, initial reconnaissance, and dredging activities were completed on May 24 and 25, 1999.

The initial reconnaissance survey confirmed the estimated volume of sediments present within the shaft. Diver and dredge support crews/equipment were established at the surface of the shaft prior to initiating dredging activities. A submersible hydraulic suction pump, with associated suction, air supply, vent, and discharge lines, was lowered to the base of the shaft. A diver then descended into the shaft to begin dredging activities. The dredge suction hose was physically guided by the diver to remove the sediments from the base of the shaft.

Material generated by the hydraulic suction dredge was pumped into a 6,000-gallon tanker truck, to facilitate transport to the adjacent Peters=Johnson property for dewatering and processing prior to treatment through the thermal desorption unit (TDU) operating on the site. An existing masonry gas holding structure was utilized as a dewatering sump for the dredged materials. The dredge slurry was pumped into the holder sump, and the solids were allowed to settle out via gravity prior to processing the water through the operating pretreatment system at the site, with subsequent discharge to the Milwaukee Metropolitan Sewerage System. Following dewatering, the solid sediment material was blended with on-site soils and processed through the TDU.

Six tanker truck loads (36,000 gallons) of sediment/water were removed from the shaft with the suction dredge. Assuming a 10 percent solids loading, the volume of sediment dredged from the shaft (approximately 18 yd<sup>3</sup>) compares favorably to the initial estimated quantity of 15 to 20 yd<sup>3</sup>. Based upon visual observations by the diver, and the calculated volume of dredged material, complete removal of the sediments has been achieved within the North shaft.

Due to the volume of water removed by the suction dredge, the water level within the shaft decreased approximately 20 to 25 feet during the dredging activities. This further supports the assumption that the horizontal tunnel beneath the Menominee River has collapsed or been sealed off.

On May 26, 1999, DCI and ARCADIS Geraghty & Miller personnel inspected the shaft and monitored air quality within the 24-inch gas main. Air quality monitoring results indicated satisfactory conditions, and the cast iron valves and piping assembly were removed to facilitate backfilling activities. The concrete lid and the upper portion of the shaft walls were removed and transported off-site for recycling.

Stockpiled demolition concrete was again used for backfill material within the main shaft, and ¾-inch granular material was utilized to abandon the 24-inch gas main. Approximately 225 yd<sup>3</sup> of concrete rubble and granular material was required to fill the shaft and the gas main to approximately 4 ft bls. Geotextile fabric was placed over the surface of the material, and the remainder of the shaft was backfilled to grade with an additional 30 yd<sup>3</sup> of granular material. Placement and compaction of the backfill materials was conducted in accordance with the procedures followed during abandonment of the South shaft.

A total of 255 yd<sup>3</sup> of backfill material was utilized to abandon the vertical tunnel and gas main of the north shaft, which is approximately equal to the estimated volume (250 yd<sup>3</sup>) required to fill the shaft. This indicates that the shaft has been completely backfilled and abandoned. It should be noted that void space was assumed to be negligible for the north shaft, as this material was generally smaller than the fill placed in the south shaft.

### Conclusions

Abandonment of the vertical tunnel shafts and 24-inch gas mains has been completed at the subject site. Approximately 515 yd<sup>3</sup> of concrete rubble and ¾-inch granular material was used to completely backfill and close the shafts. The placement of geotextile fabric and adequate compaction of the backfill materials should be sufficient to prevent any future subsidence at the shaft locations.

Based on the absence of any discernible quantity of product or sludge within the 24-inch gas mains, the pipes were abandoned by backfilling with granular material instead of grouting with a concrete slurry. Any gas main piping or valves above 4 ft bls were removed and transported off-site for disposal.

Approximately 36,000 gallons of sediment/water slurry were removed from the base of the North shaft via hydraulic suction dredging. This corresponds to approximately 18 yd<sup>3</sup> of sediment dredged from the shaft. Following dewatering of the dredge slurry, the water was processed through the on-site treatment unit and discharged to the sanitary sewer. The sediments were thermally treated at the adjacent MGP site undergoing remediation at the time of the tunnel abandonment.

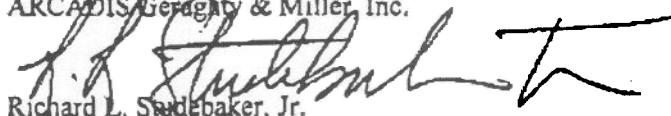
A photo documentation log summarizing the abandonment activities is provided as an attachment to this letter.

**ARCADIS GERAGHTY & MILLER**

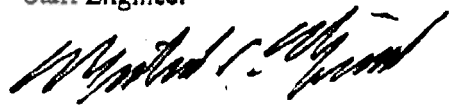
We trust this information will meet your needs. If you have any questions regarding this report, or require any further information, please contact either of the undersigned.

Sincerely,

ARCADIS Geraghty & Miller, Inc.



Richard L. Swadebaker, Jr.  
Staff Engineer



Michael S. Maierle, P.E.  
Principal Engineer

Attachments

# WISCONSIN ELECTRIC GAS OPERATIONS

## Map II

Racine Wisconsin - Root River Crossing

**8" Main Abandonment Date: October 26 & 27, 1954**

8" Main near 2nd Street, Lake Avenue and Dodge

**16" Main Abandonment Date: November 20, 1964**

16" Main near Dodge Street River Crossing

