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# REPORT ON THE PIPELINE STUDY AND THE GRAVEL FILL STUDY ASSOCIATED WITH THE FMPC OUTFALL LINE OCTOBER 1, 1987

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# REPORT ON THE PIPELINE STUDY AND THE GRAVEL FILL STUDY ASSOCIATED WITH THE FMPC OUTFALL LINE

OCTOBER 1, 1987

## EXECUTIVE SUMMARY

Order 14A of the OEPA's Director's Findings and Orders (DFO) provides that an investigation of the FMPC outfall line to the Great Miami River be performed to assess the integrity of the pipeline in order to locate any holes or leaks in the pipe. Any leaks or holes identified in the pipeline must be sealed as soon as possible under the provisions of this Order.

Order 14C of the DFO provides that an investigation of the gravel fill surrounding the FMPC outfall line be performed to determine if the fill is or has served as a conduit for waste to the Great Miami River buried valley aquifer. A revised Workplan defining the scope of the investigation to satisfy Order 14 was submitted to OEPA on June 16, 1987.

DOE entered into a contract to video inspect, clean, pressure test and chemically grout the pipeline from Manhole 175 to the Great Miami River. During the video inspection of the pipeline, it was observed that the overall condition of the buried line was satisfactory. No leakage, cracked sections or faulty sewer joints were observed. During this inspection it was observed, however, that extensive scaling had occurred along the invert of the entire length of the pipeline. All available cleaning techniques were exhausted to adequately remove the scale. As a result of the inability to remove the scale, the pressure testing and chemical grouting of the sewer line could not be performed as specified in the Workplan. Also, activities associated with the evaluation of the gravel fill could not be completed due to the inability to pressure test the pipeline.

A letter informing OEPA of the inability to meet the compliance schedules defined in the DFO for Orders 14A and 14C was issued on September 22, 1987.

## INTRODUCTION

On June 26, 1987 the Ohio Environmental Protection Agency issued the Director's Final Findings and Orders defining certain compliance actions be completed at the FMPC on a defined schedule. Item 14 of the Director's Findings and Orders (DFO) required that a study be conducted on the FMPC discharge pipeline to the Great Miami River.

Order 14A of the DFO provides that an investigation of the FMPC outfall line be performed to assess the integrity of the pipeline in order to locate any leaks or holes in the pipe. Any leaks or holes identified in the pipeline must be sealed as soon as possible under the provisions of this Order.

Order 14C of the DFO provides that an evaluation of the gravel fill surrounding the buried pipeline be performed to determine if the fill is or has served as a conduit for sewage, industrial waste, or other wastes to the Great Miami River buried valley aquifer.

A revised Workplan defining the scope of the investigations to satisfy the requirements of Order 14 was submitted to OEPA on June 16, 1987. Comments on the Workplan specific to the scope of work to fulfill the requirements of Order 14A were issued by OEPA on July 7, 1987. A DOE response to these comments was issued to OEPA on August 21, 1987.

In accordance with the provisions of the Workplan, DOE entered into subcontract with Video Industrial Services (VIS) to video inspect, clean, pressure test and chemically grout the pipeline from Manhole 175 to the submerged discharge in the Great Miami River. Field activities associated with this subcontract were initiated on August 6, 1987.

During the video inspection of the pipeline, it was observed that the overall condition of the buried pipeline and connecting joints appeared satisfactory. No leakage, cracked sections, or faulty sewer joints were observed. However, during this inspection, it was discovered that extensive scaling had occurred along the invert of the entire length of the pipeline. As a result of the inability to adequately remove this scale, the pressure testing and chemical grouting of the sewer line could not be performed as specified in the Workplan. Also, as defined in the Workplan, activities associated with the evaluation of the gravel fill (Order 14C) were contingent upon the successful completion of the leak testing of the pipeline. Thus, the scope of work for Order 14C could not be completed as defined in the Workplan.

A letter, informing OEPA of the inability to meet the compliance schedules defined within the DFO for Orders 14A and 14C as a result of the pipeline scaling, was issued on September 22, 1987. A proposed course of action to fulfill the requirements of Orders 14A and 14C was provided in this correspondence.

This report provides a technical summary of actions taken to date in support of Orders 14A and 14C. A final report fulfilling the requirements of Order 14 will be issued following the completion of the hydrogeologic studies associated with Order 14B.

**BACKGROUND**

On June 16, 1987 a revised Workplan for performing an investigation of the FMPC pipeline to the Great Miami River was submitted to the OEPA. The Workplan provided a detailed scope of work for activities associated with Order 14 of the DFO. The objective defined in the Workplan to fulfill the requirements of Order 14A provided that the FMPC locate and seal any leaks in the effluent pipeline. The scope of work for Order 14A as defined in the Workplan was comprised of the following seven tasks.

Task 1: Cleaning of the FMPC outfall line utilizing techniques which include high pressure water jetting, rodding, bucketing and brushing.

Task 2: Closed circuit television inspection of the outfall

Task 3: Pressure testing of connecting joints in the outfall sewer by application of a positive air pressure.

Task 4: Chemical grouting of the joints failing the pressure test defined in Task 3 above.

Task 5: Water testing of manholes to ensure their integrity.

Task 6: Chemical grouting and recoating of manholes failing the test defined in Task 5 above.

Task 7: Preparation of a report documenting the results of Tasks 1 through 6 above.

Order 14C of the DFO provides that an evaluation of the gravel fill surrounding the FMPC pipeline be conducted to assess if the fill is or has served as a conduit for waste or industrial sewage to the Great Miami River buried valley aquifer. The scope of work as defined in the Workplan to fulfill the requirements of Order 14C was comprised of the following four tasks.

Task 1: Following completion of the television inspection and pressure testing of the pipeline, excavation of a series of test pits along the length of the outfall.

Task 2: Collection and analysis of representative samples of the soils and sediments at the base of the gravel pack.

Task 3: Collection and analysis of disturbed samples from the soils immediately adjacent to the pipeline gravel fill.

Task 4: Preparation of a report defining the results of Tasks 1 through 3 above.

The video inspection and chemical grouting process has received widespread use throughout the country since 1971 for the internal inspection and sealing of pipelines to effectively reduce or eliminate excessive infiltration or exfiltration problems. In the video inspection and chemical grouting process, a TV camera with built in lights and a grouting machine are pulled through the lines from manhole to manhole by a flexible steel rod. Closed circuit TV pictures are continuously displayed on a control panel located within a mobile laboratory unit as the camera and grouting head are pulled through the pipeline. As a sewer connecting joint or a leak are visually identified, the grouting machine is positioned at the location within the pipeline. Rubber bladders located at the ends of the grouting head are inflated so as to isolate the joint or leak. A positive air pressure is applied to the joint or leak to test the relative integrity of that section of sewer line. In the event the joint or leak fails to hold the applied pressure over a predetermined period of time, a two component chemical grout is pressure injected into the joint or leak and into the soils surrounding the pipeline. Within a period of from 7 to 60 seconds the grout expands and hardens to fill the available void space and seal the joint or leak. After a sufficient period of time has elapsed to allow for the grout to cure, air pressure is reapplied to the joint or leak to certify its integrity. After completion of the confirmatory air test, the rubber bladders are deflated, and the section of sewer reinspected on the video display. A complete color recording is made of all closed circuit monitor displays.

The FMPC outfall carries treated process and sanitary sewage along with stormwater to a submerged discharge in the Great Miami River. The outfall, which consists of a 4650 foot buried 16 inch cast iron sewer, was constructed in 1952. Eight concrete manholes were originally located along the line for access and maintenance purposes. These manholes are consecutively numbered from Manhole 175 at the FMPC sewage treatment plant to Manhole 182 located at the river bank. During this study, it was learned that due to the movement of the Great Miami River in the vicinity of the FMPC outfall, Manhole 182 and a section of sewer was subsequently removed. The depth of the buried pipeline ranges from approximately 4 feet to 16 feet with a maximum and a minimum slope of 12.9 percent and 0.1 percent, respectively. The invert of the concrete encased submerged discharge is located on the bottom of the Great Miami River approximately 15 inches below the lowest recorded water level at the discharge point in the river. Typical flows in the outfall range from 0.4 million gallons per day (MGD) to 0.6 MGD with a peak of 1.1 MGD. The calculated hydraulic capacity of the 16-inch pipeline is approximately 1.4 MGD.

## ACTIONS TO DATE

### GENERAL

In response to Order 14A of the DFO, DOE entered into a contract with Video Industrial Services (VIS). Under the provisions of this subcontract, VIS was to clean , video inspect, pressure test and chemically grout the buried effluent pipeline from Manhole 175 to the submerged discharge in the Great Miami River.

The following sections provide a detailed technical summary of the actions taken to date in support of Order 14A and 14C. For clarity, the technical summary is presented in a format consistent with the Workplan.

ORDER 14A

Task 1: Cleaning of the Outfall Line

In order to prepare the 16 inch cast iron pipeline for pressure testing and chemical grouting, it was first necessary to clean the internal surfaces of the sewer line. Initially, a high pressure water jet angled at 35 degrees from vertical was introduced into Manhole 177 in an attempt to utilize conventional cleaning techniques. The high pressure water jet was propelled to Manhole 178 repeatedly in an attempt to scour residual material from the internal surfaces of the pipeline. Following completion of this initial cleaning attempt between Manhole 177 and 178, the video camera and grouting head were introduced into the section of sewer line. During video inspection of this section of sewer, it became immediately evident that extensive scaling of the internal surfaces of the pipeline had occurred since installation in 1952. Based upon visual inspection of the TV monitor it was estimated that a single layer between 3 and 4 inches in thickness was present along the invert of the pipeline.

During this initial video inspection of section 177 to 178, repeated attempts were made to pressure test and chemically grout the connecting joints of the pipeline. All these attempts failed due to the inability to form a tight seal between the inflatable bladder and the wall of the pipe. At this time it was decided to employ alternate cleaning techniques in an attempt to adequately remove the scale from the sewer line. Additional cleaning techniques utilized included: 1) a hydraulically activated jet cutter turning an affixed 12 inch diameter root cutter blade; 2) A hydraulically activated jet cutter turning an affixed 15 inch diameter root cutter blade; and 3) a series of progressively larger wire brushes. All sections of pipeline from Manhole 175 through Manhole 181 were subjected to at least one pass, both forward and backward, utilizing each of the available cleaning techniques. If any noticeable resistance was felt while cleaning the line, several passes through the section were performed in an attempt to clear the line. Each of the hydraulic cleaning techniques listed above were performed by utilizing 1000 feet of high pressure hose attached to a pumping truck supplying in excess of 1500 psi of water pressure to the cleaning head.

Due to the extensive buildup of scale, conventional electric winches could not be utilized to support the wire brush cleaning of the pipeline. A gasoline powered winch with a high tension steel cable was employed on the pipeline in an attempt to remove the scale.

Repeated attempts utilizing each of the available techniques were made to remove the scale so as to complete the pressure testing and chemical grouting of the pipeline. All attempts proved unsuccessful as demonstrated by the inability to maintain pressure between the inflatable bladder in tests on tight sections of pipe. A significant percentage of the scale was, however, removed from the line. Over the entire length of the sewer line, it is estimated that the average depth of flow dropped in excess of three inches resultant from the cleaning of the pipeline. All sections of sewer line from Manhole 175 through Manhole 181 were cleaned as completely as possible utilizing all commercially available techniques.

Task 2: Closed Circuit Television Inspection of the Outfall

Television inspection of the pipeline was completed from the grate near Manhole 175 to Manhole 181. All monitor displays during this inspection of the sewer line were recorded on video tape for historical purposes. Based upon the results of this inspection, it appears that all sections of outfall are in satisfactory condition. No crushed or severely cracked sections of pipe were encountered during this TV inspection. However, despite the repeated attempts to clean the line prior to the inspection, a significant build-up of scale could be seen along the pipeline. Additionally, the camera was periodically submerged in water between Manhole 180 to Manhole 182 resultant from swales in the pipeline.

Task 3: Pressure Testing of Connecting Joints in the Pipeline

Pressure testing of the connecting joints along the outfall could not be successfully performed as proposed within the Workplan. Numerous and repeated attempts were made to successfully conduct these pressure tests on representative joints along the outfall. Test results were rendered inconclusive as a result of the inability to form a tight seal between the inflatable bladder and the internal surfaces of the pipe. A tight seal could not be formed due to the irregular shape of the pipe resultant from the buildup of scale. Video recordings were made of several of these attempts to perform pressure tests on the joints.

Task 4: Chemical Grouting of the Failing Joints on the Pipeline

Chemical grouting of the joints failing the pressure test in Task 3 above could not be successfully performed as a result of the inability to form a tight seal between the bladder and the interior surfaces of the pipeline. Repeated attempts were made to perform chemical grouting of representative sewer joints. Results of the attempts to chemically grout sewer joints were rendered inconclusive due to the inability to maintain the seal during the application of positive air pressure to the subject joints.

Task 5: Water Testing of Manholes to Assess Their Integrity

Water testing of manholes could not be performed as proposed in the Workplan due to the inability to provide an adequate seal between the bladder and the connecting lines. An adequate seal is necessary to hold a column of water within the manhole to demonstrate the integrity of the manhole.

Task 6: Chemical Grouting and Recoating of the Manholes Failing the Test Defined in Task 5 Above

While water testing of the manholes along the outfall could not be successfully performed, an attempt was made to rehabilitate noticeable deterioration and areas exhibiting potential infiltration. Manholes 176 and 177, which are constructed of precast concrete, showed signs

(i.e., staining of concrete at joints) of potential leakage along the joints. Holes were drilled through the concrete at strategic locations and chemical grout pumped into the surrounding soil until it was determined that a suitable apron of grout encircled the suspect joint. Eight 1/2 inch diameter holes were drilled in Manhole 176 and 150 gallons of grout injected into the surrounding soil at a pressure of approximately 70 psi. Twelve 1/2 inch diameter holes were drilled in Manhole 177 and 270 gallons of grout injected into the surrounding soil. Setting time on the grout was set at between 20 and 53 seconds so as to completely infiltrate the surrounding soils. In both cases, grout could be seen seeping into the manhole through the joints or up through the ground surface surrounding the manhole. Manhole 175 showed no visible signs of leakage. Manhole 178 through 181 were formed of one piece construction, and as such, had no joints nor showed any visible signs of leakage.

All interior surfaces of the manholes were coated with a quick setting concrete patching mix as a final preventative maintenance task. All manholes received two coats of Drycon water-proofing paint over all interior surfaces as a final water repellant coating.

The sewer casting on Manhole 176 was severely damaged and no longer capable of protecting the manhole. A new cast iron casting was placed on the manhole and sealed with concrete.

ORDER 14C

Task 1 Through 4

As a result of the inability to successfully complete the pressure testing of the pipeline, the DOE was unable to complete activities in support of Order 14C. As specified in the Workplan, the positioning of test pits along the length of the outfall for the collection of biased soil samples is contingent upon pinpointing areas of current or historical leakage in the pipeline. The selection of randomized sampling locations along the 4650 foot line provides an unacceptably low statistical basis for forming conclusions about potential environmental impacts associated with the gravel fill surrounding the pipeline.