The remainder of this report discusses the second objective of this study. This included an investigation of the site geology/hydrogeology, installation of five monitoring wells, sampling and analysis of ground water from monitoring wells and from seepage, sampling and analysis of surface water and sediments on the site and from Six Mile Creek, and an investigation of the source of effluent from specific pipes and man-made seeps in the vicinity of the reservoir.

These objectives were initially defined in a proposal entitled "Proposal for Providing Environmental Assistance to Morse Industrial Corporation" dated January 23. The first objective of this work involved sampling of the reservoir on February 4 and subsequent cleanup of the reservoir between February 20 and March 12. The second objective of this work effort was revised in March at the request of the State of New York and implemented between April 13 and May 27. This work was conducted after approval by the State of New York.

1.3 Site History and Operations

Morse Industrial Corporation is a subsidiary of Emerson Electric Company and manufactures industrial power transmission products, primarily steel roller chain, which is fabricated in a wide range of sizes. Morse has been operating at the site since 1906, and is the original owner of all facilities on the property. Morse has been a subsidiary of Emerson Electric Company since January 1983. Prior to that time, Morse was a division of

Borg-Warner. Operations at the facility include metal stamping, heat treating, oil quenching, parts washing (using both alkaline cleaning solutions and organic halogenated and nonhalogenated solvents), and final product assembly. Solvents currently used at the facility include mineral spirits (non-halogenated, non-aromatic petroleum derived solvent) purchased from Safety Kleen Company, a Freon degreaser purchased under the trade name TMC, and 1,1,1-trichloroethane purchased under the trade name "chlorothene". Solvents which were used in the past but have not been used for a number of years include TCE and "Safe-Tee solvent" F.O.-128, a commercially available mixture of aliphatic and chlorinated compounds, including methylene chloride and tetrachloroethylene.

Reconstruction of past operations at the site indicate that on-site activities included purification of spent TCE by distillation, copper plating, cadmium plating, and wire drawing. The copper plating operation was active for about 15 years prior to November of 1982. This operation utilized copper cyanide and involved cleaning the metal parts with water and soap and etching with acid. The cadmium plating operation was active from about 1960 to 1975 and involved essentially the same elements as the copper plating. A wire mill operated for approximately 15 years prior to April 1984. Wire pins were made for roller chain in a process that involved acid pickling and cleaning with phosphate soap.

Since 1983, the principal operation on the site has been metal forming (principally stamping) and assembly of steel roller chain. Waste oil is generated in the manufacturing operations at the plant. The plant has a RCRA

facility generator identification number and waste oil is stored on site for less than one month and is removed by a commercial waste oil handling service.

Fluids currently used in the present operations are machine oil and degreasers. Two types of machine oils are used, a water-based synthetic lubricant called "Vantrol 293" and an oil-based substance called "5 Stan". The degreasers that have been used since 1983 are mineral spirits, freon, trichloroethane (TCA), and methyl ethyl ketone (MEK). The TCA has been used on the site for the past 15 years. The MEK has been used in small quantities for electron beam welding from 1983 to the present.

Degreasers used before 1983 include TCE and Safe-Tee solvent F.O.-128. Safe-Tee solvent FOB-128 was used from 1973 to 1983. A document search has revealed that the earliest record documenting the use of TCE is from 1967 and it was known to be used extensively until 1978 when its use was discontinued. The peak usage of TCE is reported to have been 1,200 gallons per week in the years between 1976 to 1978.

A document search indicates that between 1970 and 1978, spent TCE was recovered, in all likelihood, by distillation on-site. A small batch distillation unit was installed in 1970 that was replaced by a larger still in 1973. No records have been located that establish when the larger still was removed. The documents do not indicate any usage of TCE after 1978. No documentation has been found of the disposal of the still or any waste materials or by-products resulting from its operation.

During the early part of 1987, TCE was detected in some batches of waste oil that contained oil skimmed from the surface of the water in the underground fire reservoir at Morse. Subsequent sampling and analysis by the plant of waste oil sources revealed that TCE was present in the reservoir water. At that time it was decided that a more detailed investigation of the reservoir and its contents were warranted.

5.0 CONCLUSIONS

There are several major conclusions that can be reached as a result of this study. They are summarized in this section under three headings: the reservoir, geology/hydrogeology, and site chemistry.

5.1 Reservoir

The conclusions that can be reached about the reservoir and its cleanup are the following:

1. Significant volatile organic contamination was found in the water and sludges of the reservoir.

2. All water and sludges were removed from the reservoir and the concrete walls, floor, and ceiling were cleaned to remove visible contamination. It is still possible, however, that contamination may be present in the concrete.

3. The reservoir walls and floor contain numerous cracks and joints that allow for the continued seepage of ground water into it. This permitted partial refilling of the reservoir with water after the cleanup was completed.

4. The water that accumulated in the reservoir subsequent to the cleanup activities was sampled and was found to contain reduced concentrations of volatile organics. These organics could be coming from contaminated ground water seeping into the reservoir, or could be the result of clean ground water seeping into the reservoir and becoming contaminated by coming into contact with contamination embedded within the concrete walls or floor.

5. The reservoir was one obvious secondary source of volatile organics at the site but this does not eliminate the possibility of other secondary sources. The primary source(s) has not yet been identified.

5.2 Geology/Hydrogeology

The geology and hydrogeologic flow patterns at the site are major factors in the control of the distribution of contaminants at the site. The conclusions that can be reached concerning the geology and hydrogeologic setting include the following:

1. The plant is located in a fractured rock setting with a relatively thin soil cover. Ground water is found both in the overburden soils and in the fractures in the bedrock.

2. Ground water is flowing to the northwest and shallow ground water is discharging out of the hillside. The major component of flow appears to be strongly influenced by the fractures in the bedrock.

3. Over the years it seems likely that there has been hydraulic communication between the reservoir and ground water regime. This is demonstrated by the continuing seepage into the reservoir and the dynamic nature of the ground-water system.

4. Six Mile Creek is a local drainageway, accumulating surface water runoff and shallow discharging ground water.

5.3 Site Chemistry

The distribution of chemicals at the site is controlled by both the physical and chemical characteristics of the materials present there. The major conclusions that can be drawn from the study are:

1. Eight points along a man-made structure related to Outfall 001 were sampled to see if they contained chlorinated volatile organics. Those associated with non-process wastewater discharges (i.e. boiler blowdown) do not appear to be contributing to the trichloroethylene found at the site.

2. The two soil samples collected immediately downgradient from the reservoir contained the highest concentrations of chlorinated volatile organic compounds, due to the fact that contaminated ground water has deposited these compounds in the soils.

3. The railroad ditch collects ground water discharging from the hillside and was found to be contaminated with chlorinated volatile organics at a location downhill from the reservoir. There is no indication that channelized surface water moving into this area in the ditch is contaminated. The water quality in the ditch improves along the path of travel.

4. Two sediment samples from Six Mile Creek, one upstream and one downstream from the Morse site, were found to contain elevated levels of methylene chloride. Although definitive conclusions cannot be drawn concerning the water quality in the creek, the sampling effort indicates that some solvents at some point in time were discharged into the creek upstream from the Morse site.

5. Only one out of four natural seeps sampled exhibited detectable levels of trichloroethylene and associated compounds. The water coming out of the seeps may contain higher concentrations of volatiles that were lost due to the slow rate of seepage and the methods of collection.

6. The upgradient well contained detection limit quantities (sub-part per billion) of volatile organic compounds. This represents upgradient concentrations and can be considered to be background.

7. Well MW-1 exhibited trace quantities of chlorinated volatile organics. This well is only 40 feet northeast of well MW-2, which contained extremely high levels of trichloroethylene. Well MW-3 had water quality comparable to that of MW-2. The shallow well, MW-3s, contained two orders of magnitude less trichloroethylene than the deeper well MW-3, only five feet away. The shallow well is in overburden soils and the deeper well is in bedrock.

8. Based upon the distribution of the trichloroethylene in the four downgradient wells, the shape of the plume in the bedrock may be controlled by the fracture patterns found there and might have a different configuration from the plume within the overlying soils.

9. Petroleum hydrocarbons were detected in the two contaminated bedrock wells (MW-2 and MW-3) and the two contaminated soil samples taken from the railroad ditch. No conclusions can be drawn about the oils and solvents originating from the same source or whether they represent two distinct sources.