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FIVE YEAR REVIEW OF REMEDIAL ACTIONS
AT THE VAN WATERS & ROGERS INC.
3301 EDMUNDS STREET SITE
ALBUQUERQUE, NEW MEXICO

PROJECT NO. AZ0474.011

Prepared for:
Univar Corporation

November 8, 1995

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Geraghty & Miller, Inc. is submitting this report to Univar Corporation for the five year review of the remedial actions at Van Waters & Rogers, Inc. 3301 Edmunds Street Site in Albuquerque, New Mexico. The report was prepared in conformance with Geraghty & Miller's strict quality assurance/quality control procedures to ensure that the report meets the industry standards in terms of the methods used and the information presented. If you have any questions or comments concerning this report, please contact one of the individuals listed below.

Respectfully submitted,
GERAGHTY & MILLER, INC.



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LIST OF ACRONYMS

111TCA	1,1,1 trichloroethane
11DCE	1, 1 dichloroethene
12DCA	1, 2 dichloroethane
AEHD	Albuquerque Environmental Health Department
AGC	American Groundwater Consultants
BTEX	benzene, toluene, ethylbenzene, xylene
DWMS	D'Appolonia Waste Management Services
EDB	ethylene dibromide
ELCR	excess life time cancer risk
G&M	Geraghty & Miller, Inc.
gpm	gallons per minute
HLA	Harding Lawson Associates, Inc.
MCLs	maximum contaminant levels
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
PCE	tetrachloroethene
PLC	programmable logic controller
PRPs	potentially responsible parties
RAP	remedial action plan
ROD	Record of Decision
TCE	trichloroethene
TPHs	total petroleum hydrocarbons
ug/L	micrograms per liter
URM	Underground Resources Management
USEPA	United States Environmental Protection Agency
VOCs	volatile organic compounds
VWR	Van Waters & Rogers



EXECUTIVE SUMMARY

On behalf of the Univar Corporation, Geraghty & Miller, Inc. has prepared this five year review of remedial actions at the Van Waters & Rogers Inc. facility located at 3301 Edmunds Street (the "site") in Albuquerque, New Mexico, as specified in Section VII paragraphs 16 and 24 of the Consent Decree in the matter of the United States vs. Univar Corporation. The purpose of this report is to summarize the remedial actions during the five year period since completion of the remedial system installation (January 1990 through January 1995), evaluate the effectiveness of the remedial action at meeting the remedial objectives, and show that the remedial action remains protective of public health and the environment, as agreed to by the United States Environmental Protection Agency (USEPA). This report summarizes the installation, operation, maintenance, and monitoring of the remedial system, and monitoring of the groundwater and presents all analytical and operation data collected during the five year period from January 1990 through January 1995. This report is divided into sections covering the site history; remedial system design and installation; remedial system operation, maintenance, and monitoring; long term remedial system operation, maintenance, and monitoring and groundwater monitoring; effectiveness of the remedial action; conclusions; and recommendations for future site activities.

The remedial action for the site was designed as specified in the Record of Decision for the Edmunds Street Groundwater Operable Unit and consists of pumping and treating groundwater to remediate impacts of the following site-related volatile organic compounds (VOCs): 1,1 dichloroethene (11DCE); 1,1,1 trichloroethane (111TCA); trichloroethene (TCE); and tetrachloroethene (PCE). The treated water is returned to the aquifer through an infiltration system. The objective of the remedial action is to reduce the concentrations of the site-related VOCs in the groundwater to concentrations which would pose an excess life time cancer risk (ELCR) of less than one in one million (1×10^{-6}) should the groundwater be used as a drinking water supply. These treatment goals address the State of New Mexico Water Quality Control Commission (NMWQCC) regulations which govern discharges to the State's groundwater resources. The groundwater treatment system, which utilizes an aeration technology, was designed to reduce the concentrations of site-related VOCs in the absence of petroleum-related compounds. In addition to meeting the groundwater discharge criteria specified by the



NMWQCC, air emissions associated with the groundwater treatment system must not exceed an ELCR of 1×10^{-6} under a prescribed exposure scenario, as required by the Albuquerque Environmental Health Department.

In addition to operation of the groundwater remedial system, the remedial action for the site includes a groundwater monitoring program, which was designed to monitor the effectiveness of the remedial action. This monitoring program also provides the necessary data to monitor the movement of groundwater impacted by petroleum-related compounds originating north and west of the site.

Construction of the remedial system was completed in January 1990. The pilot program and pilot program extension were conducted from June 4 through September 10, 1990 and the results of these programs showed that the remedial system could achieve the designed removal efficiencies and that the treatment unit effluent met the groundwater discharge limitations. The system startup program was conducted from September 10, 1990 through January 1991. The results of this program showed that the remedial system would meet the remedial objectives stated in the Consent Decree and the remedial action plan (RAP) at flow rates between 80 and 140 gallons per minute (gpm). The analytical results from these programs also confirmed that the concentrations of site-related VOCs detected in the treatment unit influent samples were below the concentrations necessary to meet the air discharge criteria. The long term remedial system operation, maintenance, and monitoring program has been conducted at the site since January 1991. During operation of the remedial system from June 1990 through January 1995, a total of 245,358,477 gallons of groundwater have been recovered, treated, and returned to the subsurface at an average flow rate of 100 gpm. Operational problems and maintenance of the remedial system were temporary and were resolved as they were discovered.

The remedial system has successfully treated site-related VOCs to below the groundwater discharge criteria. An evaluation of the analytical results for samples collected from the treatment unit influent shows that the total concentration of site-related VOCs reached a maximum of 925 micrograms per liter (ug/L) in October 1990 and have steadily declined to 111 ug/L in January 1995, an overall decrease of 88 percent. Based in the annual average air emission rates calculated for the remedial system, approximately 516 pounds of the site related VOCs have been removed from the groundwater through January 1995. The results of the air emission calculations and the



air dispersion modeling show that the air discharges from the remedial system were well below the air discharge criteria from June 1990 through January 1995.

The analysis of groundwater elevations shows that the remedial system has contained the area of groundwater impacted by the site-related VOCs. The analysis also showed that groundwater elevations have been declining at a rate of approximately one foot per year. Linear regression analyses were conducted on the hydrographs for each monitoring well and the predicted groundwater elevations through January 1997 were calculated assuming the off-site recharge and withdrawal rates remain constant. This information will be used to evaluate the pump setting for the recovery wells and groundwater monitoring wells and to evaluate the effects of remedial activities by off-site facilities on the remedial system.

The results for the long term groundwater monitoring showed that the area of highest concentrations of site-related VOCs in samples collected from the groundwater have remained stationary in the vicinity of monitoring wells GM-9S and GM-2 and recovery wells RW-1 and RW-2. A decrease in the overall areal extent of the groundwater impacted by the site-related VOCs also is illustrated by these results. The concentrations of 11DCE, 111TCA, TCE, and PCE detected in the center of mass have decreased by approximately 95, 90, 77, and 65 percent, respectively, based on the long term groundwater quality monitoring results. Petroleum related compounds continue to be detected in samples collected from the groundwater and the treatment unit influent confirming the presence of a petroleum plume that has been captured and is being treated by the remedial system.

Based on the data presented, the remedial action selected for the site achieves all of the remedial objectives and therefore, remains protective of human health and the environment.

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1.0 INTRODUCTION

On behalf of the Univar Corporation, Geraghty & Miller, Inc. has prepared this five year review of remedial actions at the Van Waters & Rogers Inc. (VWR) facility located at 3301 Edmunds Street (the "site") in Albuquerque, New Mexico (Figure 1), as specified in Section VII paragraphs 16 and 24 of the Consent Decree in the matter of the United States vs. Univar Corporation. The purpose of this report is to summarize the remedial actions during the five year period since completion of the remedial system installation (January 1990 through January 1995), evaluate the effectiveness of the remedial action at meeting the remedial objectives, and show that the remedial action remains protective of public health and the environment, as agreed to by the United States Environmental Protection Agency (USEPA). This report summarizes the installation, operation, maintenance, and monitoring of the remedial system, and monitoring of the groundwater and presents all analytical and operation data collected during the five year period from January 1990 through January 1995.

The remedial action for the site was designed as specified in the Record of Decision (ROD) for the Edmunds Street Groundwater Operable Unit (USEPA, 1988c), and consists of pumping and treating groundwater to remediate impacts of the following site-related volatile organic compounds (VOCs): 1,1 dichloroethene (11DCE); 1,1,1 trichloroethane (111TCA); trichloroethene (TCE); and tetrachloroethene (PCE). The treated water is returned to the aquifer through an infiltration system. The objective of the remedial action is to reduce the concentrations of the site-related VOCs in the groundwater to concentrations which would pose an excess life time cancer risk (ELCR) of less than one in one million (1×10^{-6}) should the groundwater be used as a drinking water supply. These treatment goals address the State of New Mexico Water Quality Control Commission (NMWQCC) regulations which govern discharges to the State's groundwater resources. The groundwater treatment system, which utilizes an aeration technology, was designed to reduce the concentrations of site-related VOCs in the absence of petroleum-related compounds. In addition to meeting the groundwater discharge criteria specified by the NMWQCC, air emissions associated with the groundwater treatment system must not exceed an ELCR of 1×10^{-6} under a prescribed exposure scenario, as required by the Albuquerque Environmental Health Department (AEHD).

In addition to operation of the groundwater remedial system, the remedial action for the site includes a groundwater monitoring program, which was designed to monitor the effectiveness of the



remedial action. This monitoring program also provides the necessary data to monitor the movement of groundwater impacted by petroleum-related compounds originating north and west of the site.

This report is divided into sections covering the site history; remedial system design and installation; remedial system operation, maintenance, and monitoring; long term remedial system operation, maintenance, and monitoring and groundwater monitoring; effectiveness of the remedial action; conclusions; and recommendations for future site activities.

2.0 SITE HISTORY

The following information describing the site history was taken from the Remedial Action Plan (RAP) (G&M, 1990d).

The site has been used for various industrial and commercial purposes for approximately 30 years. In 1965, Edmunds Chemical Company purchased the land. Edmunds and its successor, SEC Corporation, distributed various industrial chemicals in addition to selling dry ice, chlorine, and ammonia gas. In 1971, SEC sold the industrial chemical portion of its business to VWR and SEC continued in the business of selling dry ice, chlorine, and ammonia gas. VWR began leasing the eastern portion of the property for its activities, while SEC continued to occupy the rest of the site. In 1974, VWR enhanced a naturally occurring shallow depression (now called the SV-10 area) to control storm-water runoff on the eastern portion of the site.

In 1977, AmeriGas acquired SEC Corporation and continued the dry ice, chlorine, and ammonia gas operation, while VWR remained as a tenant. AmeriGas sold the property in 1982 to Dixie Chemical, and re-acquired the property later that same year. Since 1985, only VWR has been active at the site. In June 1988, VWR purchased the property from AmeriGas.

Early in 1978, unpleasant taste and odor were noted in the water from well A-1, an on-site well which supplied the water to the site. This well is completed to a depth of 132 feet below land surface and screened from 112 to 132 feet below land surface. A water sample from well A-1 was subsequently analyzed and several halogenated VOCs were detected. After detection of the VOCs, bottled water was provided for drinking; however, the water from well A-1 was used for non-consumptive purposes until the well was removed from services. This well was replaced by well A-2 in 1980. Well A-2 was completed to a depth of 522 feet below land surface and screened from 510 to 522 feet below land surface.



Also in 1978 the City of Albuquerque analyzed samples from the San Jose and Miles municipal well fields. Wells SJ-3 and SJ-6 (in the San Jose well field) and Miles-1 (in the Miles well field) were temporarily taken out of service following the detection of low levels of contamination in their waters. Well Miles-1 was returned to service as repeated chemical analysis failed to confirm the presence of any contaminants.

In 1981, the USEPA and New Mexico Environment Department (NMED) (formerly the Environmental Improvement Division of the New Mexico Health and Environment Department) designated a 1-square mile area around SJ-6 as a Superfund site (SJ-6 Study Area) which was added to the National Priorities List. In order to locate potential sources of ground-water contamination in the vicinity of SJ-6, the NMED conducted a regional study, entitled "Organic Ground-Water Pollutants in the South Valley of Albuquerque, New Mexico, December 1982."

As a result of the investigation, the USEPA and NMED identified the following six potential source locations in the South Valley: GE/Air Force, Chevron, Texaco, Duke City Distributing, Whitfield Tank Lines, and the Edmunds Street property. The owner of these sites were identified as potentially responsible parties (PRPs). As part of the Superfund process, the USEPA and NMED conducted what is characterized as a focused feasibility study to evaluate remedial measures for Well SJ-6 (USEPA, 1984), and two phases of site characterization conducted in 1984 and 1985. Based on these investigations, the USEPA published a remedial investigation report (USEPA, 1988a) and a feasibility study (USEPA, 1988b) which concluded that the trace concentrations of solvents in the vicinity of SJ-6 "do not pose a threat to public health or the environment" provided that the SJ-6 remedial action as described in the ROD for the South Valley is implemented.

In the early 1980's, three site-specific investigations of groundwater contamination were conducted at the Edmunds Street site for Dixie Chemical, AmeriGas, and VWR by Underground Resource Management (URM, 1982), American Ground-Water Consultants (AGW, 1983), and D'Appolonia Waste Management Services (DWMS, 1983 and 1984), respectively.

In 1985, Geraghty & Miller conducted a Source Control Investigation to locate on-site sources of VOCs and to preliminarily define the nature and extent of the contaminated soil and groundwater. The source control investigation involved installing eight monitoring wells, taking water-level measurements, collecting two rounds of groundwater samples, performing geophysical logging of selected wells, and conducting an aquifer test on well A-1.



Based on the initial results of the source control investigation, a work plan was prepared to investigate the off-site chemical migration which appeared to be occurring. Submitted to the USEPA and NMED on March 26, 1987, the work plan received final approval on July 5, 1987. The purpose of the off-site investigation was to determine the extent of the VOC contamination in groundwater to the east of the site and involved a soil-gas survey and the installation of additional monitoring wells.

Based on additional studies, including the site remedial investigation (G&M, 1989a), feasibility study (G&M, 1989b), and a public health evaluation prepared by Harding Lawson Associates (1989), the USEPA issued a ROD (USEPA, 1988c) which stated that the source of site-related VOCs no longer exists at the Edmunds Street site. Only the groundwater plume of site-related VOCs required remediation, as agreed in the Consent Decree between Univar Corporation and the USEPA and NMED (USEPA, 1988c). A special report prepared by Geraghty & Miller and Harding Lawson, which was accepted by the USEPA and NMED, demonstrated that site-related VOCs did not travel northwestward from the site and were not implicated in the contamination of Well SJ-6 (G&M/HLA, 1989). Ultimately, the VWR site was removed as a PRP from the SJ-6 Operable Unit.

In accordance with the terms established in the ROD (USEPA, 1988c) and Consent Decree (USEPA, 1989), the RAP was prepared to installed a groundwater treatment system (G&M, 1990d). Recovery wells were installed in 1989 and the treatment unit was constructed during the first quarter of 1990. A pilot program was conducted during the third quarter of 1990 and the treatment system stabilized and was fully operational by the end of 1990. Additional information regarding the operation of the treatment unit is provided later in this report.

3.0 REMEDIAL SYSTEM DESIGN AND INSTALLATION

In accordance with the Consent Decree (USEPA, 1989) and ROD (USEPA, 1988c), the remedial action was designed to mitigate the further migration of site-related VOCs in the intermediate aquifer (USEPA's designated deep-shallow aquifer) and to remediate the groundwater impacted with site-related VOCs. A description of the proposed design and operational information is included in the RAP (G&M, 1990d) and the Remedial Design Report (G&M, 1990a). The design plan included containment and collection of groundwater impacted with site-related VOCs by an extraction well system, treatment of the recovered groundwater through packed tower aeration, and return of the treated water to the aquifer through an infiltration system. A groundwater monitoring plan to determine the effectiveness of the remedial actions also was included in the RAP (G&M, 1990d).



Extraction wells RW-1, RW-2, RW-3, and RW-4 were installed in October and November 1989 at the locations shown on Figure 2. These recovery wells were completed at depths of 155, 166, 180 and 200 feet below land surface, respectively, in the intermediate aquifer. The original design of the recovery well system was based on groundwater modeling scenarios.

The installation of the water conveyance lines, electrical lines, treatment unit, and infiltration gallery was completed by January 1990. The groundwater treatment unit utilizes the aeration treatment method to remove the site-related VOCs from the groundwater influent. Once the groundwater is processed through the treatment unit, the treated effluent is discharged to an on-site infiltration gallery located immediately west of the treatment unit building. The infiltration gallery was originally designed using a single horizontal perforated pipe in a gravel envelope and has since been modified to include a second horizontal perforated pipe in a gravel envelope. Both systems work concurrently.

The operating requirements for the remedial system were identified during the development of the applicable, relevant, and appropriate requirements as part of the remedial investigation and feasibility study. The cleanup objective for the groundwater impacted by site-related VOCs are defined as the USEPA's and NMWQCC's maximum contaminant levels (MCLs) for drinking water supplies. In addition, the groundwater and air discharges from the treatment unit must meet the groundwater discharge criteria specified by the NMWQCC, and the air discharge criteria specified by the AEHD.

As the treatment system was not designed to treat petroleum related compounds, the appearance of these compounds in the recovered groundwater from off-site sources was expected to interfere with and reduce the efficiency of the treatment system's ability to remove site-related VOCs, or cause the system to violate air or water discharge limits established under the Consent Decree (USEPA, 1989). Such interference or violation of discharge limits were identified in Section XXXVIII the Consent Decree (USEPA, 1989) as causes for termination of the groundwater remediation program.

To determine the effectiveness of the remedial system at achieving the remedial objectives, routine treatment unit monitoring, water-level measurements, and groundwater monitoring is conducted at the site. The data collected pursuant to operation and maintenance of the remedial system are appended to this report. The data have been evaluated and are discussed in detail in this report.



4.0 REMEDIAL SYSTEM OPERATION, MAINTENANCE, AND MONITORING

The groundwater treatment system for the site has been operating since June 4, 1990. The remedial system was started using a phased approach to insure compliance with discharge criteria. A six-week pilot program was conducted and was followed by a four week pilot program extension due to incorrect analysis by the laboratory of the samples collected during the pilot program. The pilot program was followed by an 18-week startup program that was conducted to determine the optimum range of flow rates for the remedial system. Long term operation, maintenance and monitoring of the system has continued since completion of the startup program. An overview of each of these programs is discussed below.

4.1 PILOT PROGRAM

The air stripper pilot program was conducted, as proposed in the work plan (G&M, 1990b), from June 4, 1990 to July 18, 1990. The analytical results for the samples collected during this period of time were determined to be invalid after the analytical data were formally validated by Geraghty & Miller. The invalid data resulted from analytical calibration procedures performed by the laboratory which were inconsistent with those established by the USEPA contract laboratory program procedures. Therefore, a pilot program extension was approved by the USEPA and NMED and conducted at the site from August 20 to September 10, 1990, as documented in the air stripper pilot program report (G&M, 1990e).

The objective of the pilot program, and subsequent pilot program extension, was to collect water quality data to determine whether the treatment unit would achieve the removal efficiencies specified in the Remedial Design Report (G&M, 1990a). In addition, equipment operational data were collected to complete the operation and maintenance manual for the remedial system (G&M, 1991).

The analytical results for samples collected during the pilot program extension confirmed that the site-related VOCs were present in the extracted groundwater as measured in the treatment unit influent stream. In addition, 1,2-dichloroethane (12DCA), methylene chloride, and acetone also were detected in samples collected from the influent stream. The analytical results for the samples collected from the treatment unit effluent during the pilot program indicated that the treatment unit achieved the design removal efficiencies specified in the Remedial Design Report (G&M, 1990a) and that the effluent from the treatment unit met the groundwater quality discharge limitations specified in the RAP



(G&M, 1990d). The analytical results also confirmed that concentrations of site-related VOCs detected in samples collected from the treatment unit influent were below the concentrations necessary to meet the air discharge criteria. Additionally, no significant operational or maintenance problems were encountered. Based on the results of pilot program extension, the treatment unit operation was continued under the system startup program as described in the following section.

4.2 SYSTEM STARTUP PROGRAM

The system startup program began on September 10, 1990 and continued through January 14, 1991 as proposed in the RAP (G&M, 1990d). The objective of the startup program was to operate the treatment unit at varying flow rates to determine the optimum flow rate of the system, to ensure that the effluent water quality from the treatment unit was in compliance with the discharge criteria and to ensure that the capture zone of the recovery system would contain the area of groundwater impact.

The treatment unit was operated for an 18-week period at flow rates of 120 gallons per minute (gpm), 130 gpm, and 140 gpm with each flow rate being sustained for 6 weeks. Samples of the treatment unit influent and effluent were collected and groundwater levels were measured prior to starting the remedial system, after one full week of operating at a consistent flow rate, and just prior to increasing each incremental flow rate.

Samples were collected from the treatment unit influent and effluent to determine the efficiency of the treatment system and to verify that the effluent process stream was in compliance with the groundwater discharge criteria. The samples were analyzed for VOCs, total petroleum hydrocarbons (TPHs), and major cations and anions.

The VOCs consistently detected in samples collected from the influent of the treatment unit during the system startup included the four site-related VOCs, 12DCA, and methylene chloride. The results of the VOC analyses verified that, for each flow rate, all VOCs concentrations in the treatment unit effluent were below laboratory reporting limits and met the discharge criteria. Additionally, the analytical results also confirmed that concentrations of site-related VOCs detected in samples collected from the treatment unit influent were below the concentrations necessary to meet the air discharge criteria.

Samples collected from the treatment unit influent and effluent also were analyzed for TPHs to determine whether the petroleum impacted groundwater plume adjacent to the site was affecting the operation of the remedial system. TPHs compounds were detected in samples collected from the



treatment unit influent suggesting that the petroleum impacted groundwater had reached the recovery system. However, no TPH compounds were detected in samples collected from the treatment unit effluent, indicating that the treatment unit was effective in removing the TPH compounds at these concentrations.

The analytical results for cations and anions indicated that low concentrations of these ions are dissolved in the groundwater, that the concentrations of these ions in the influent and effluent process streams were essentially identical, and that little mass was being precipitated in the system. This was supported by visual observations in the field that revealed that precipitates were not rapidly forming on the packing in the air stripper nor causing any operational difficulties.

The capture zone of the remedial system was evaluated using a groundwater elevation map prepared from the water-level measurements collected on January 14, 1991 (at the end of the system startup program). This evaluation indicated that the capture zone generated from the final 140 gpm flow rate test was larger and more extensive than the capture zone predicted by groundwater modeling at 80 gpm, and extended downgradient to a location between monitoring well clusters GM-14 and GM-15 (G&M, 1991b).

The results of the startup program indicated that each flow rate was capable of achieving the containment objectives of the remedial design, so the selected operational flow rate for the system was determined by optimizing the efficiency of each the recovery well pumps. Manufacturer's data indicated the pumps operated most efficiently at approximately 35 gpm. Therefore, the final proposed optimal combined flow rate for the recovery system was 140 gpm, with any flow between 80 gpm and 140 gpm meeting the containment objectives. The proposed optimal flow rate of 140 gpm was discussed and accepted by the regulatory agencies in a conference call among USEPA, NMED, Univar Corporation, and Geraghty & Miller on January 18, 1991.

In summary, the analytical results of the system startup program consistently demonstrated that the treatment unit effluent complied with the effluent discharge criteria specified in the RAP (G&M, 1990d). In addition, the capture zone generated from the recovery wells operating between 80 and 140 gpm encompassed the area of groundwater impacted by site-related compounds identified in the Remedial Investigation (G&M, 1989a). Therefore, the results of the system startup program indicated that the treatment unit would meet the objectives of the Consent Decree (USEPA, 1989) and the RAP (G&M, 1990d) at any flow rate between 80 and 140 gpm. Based on the results of the system startup program, operation of the remedial system was continued at the proposed optimal flow rate of 140



gpm and the long term operation, maintenance, and monitoring program was conducted as specified in RAP (G&M, 1990d) and as described in the following section.

4.3 LONG TERM REMEDIAL SYSTEM OPERATION, MAINTENANCE, AND MONITORING AND GROUNDWATER MONITORING

4.3.1 Long Term Remedial System Operation and Maintenance

Long term operation and maintenance of the remedial system has been conducted since completion of the system startup program in January 1991. Routine operation and maintenance of the remedial system was conducted from January 1991 through January 1995, as specified in the RAP (G&M, 1990d). The following is a summary of the average flow rates for each year as well as any operational problems that occurred. A more detailed chronology of events is included in Appendix A.

The first year of remedial system operation (June 1990 to June 1991) included conducting the pilot program, pilot program extension, system startup program, and continued operation of the remedial system as described above. During the first year, the remedial system operated at an average flow rate of 109 gpm with minimal down time reported.

The remedial system operated at an average flow rate of 104 gpm during the second year operation (June 1991 to June 1992). Operational problems that occurred throughout the year included electrical outages due to weather conditions, blown recovery well fuses, cracked air monitoring lines, and precipitation of calcium carbonate in the infiltration gallery. The recovery well fuses and cracked air monitoring lines were replaced upon determination of the problem. The calcium carbonate precipitation in the infiltration gallery was dissolved by reducing the pH of the effluent with hydrochloric acid in January 1992. The addition of the acid was a one time event and was approved by the USEPA and NMED. Upon completion of the pH adjustment, the remedial system continued operating at a flow rate of 138 gpm through June 1992.

During the third year of operation (June 1992 to June 1993), the remedial system operated at an average flow rate of 90 gpm. Operational problems occurred throughout the year. In June and July 1992, the remedial system kept shutting down due to low air flow readings caused by gusting winds at the site and power outages caused by weather conditions. The annual maintenance of the remedial system was conducted in August 1992 and included replacing the packing in the stripping tower, repairing flow meters, and reprogramming the electronic monitoring system to compensate for the



gusty wind conditions at the site. A carbon dioxide diffusion pilot study was conducted in September 1992 to determine if this would be an appropriate method for controlling the precipitation in the infiltration gallery. The results from this pilot test were evaluated and it was determined not to be a practical or cost effective method.

The infiltration gallery lost capacity, which was noted on November 10, 1992. On November 23, 1992, approximately 50 feet of specialty piping called "infiltrator pipe" was connected to the existing infiltration gallery piping. Once the infiltrator pipe was installed, the treatment unit was operating at an average rate of 120 gpm and continued at this rate through June 1993. In October 1992, the galvanized steel riser pipes in the shallow monitoring wells near the infiltration gallery were replaced with stainless steel pipe due to corrosion problems associated with the oxygenated water from the infiltration gallery.

The remedial system operated at an average flow rate of 97 gpm from June 1993 to June 1994, the fourth year of remedial system operation. Operational problems continued throughout the year. In June 1993, the packing in the stripping tower was replaced. During the third quarter of 1993, the infiltration gallery was modified to provide non-potable water to the site. The non-potable water needs of the site exceeded the amount diverted from the infiltration gallery and therefore, this diversion was disconnected in February 1994 and monitoring well A-1 was set up as a non-potable water supply well with the approval of the USEPA. Modifications to the remedial system also occurred during the second quarter of 1994. These modifications included reconstruction of the infiltration gallery to remove the portions affected by the precipitation of calcium carbonate and increase the discharge capacity, installation of a programmable logic controller (PLC) and flow meters to remotely monitor the remedial system operations and flow rates, and installation of an AquaMag system to stabilize the water and discourage the precipitation of calcium carbonate.

The flow meter for recovery well RW-1 stopped working in February 1994 due to a build up of a black material on the inside of the meter. Once the meter was returned to operation in March 1994, it was noted that the flow rate had dropped to 19 gpm. The pump and associated piping were removed from recovery well RW-1 and it was observed that the same black material also had precipitated on the intake to the pump and on the inside of the riser pipe. A sample of the black substance was analyzed and found to be primarily manganese oxide. In August 1994, the recovery well was inspected with a video camera, cleaned using sonar jetting and scrubbing, and the pump was set 10 feet deeper. Once this was accomplished, the average flow rate for this well was 33 gpm.



The remedial system operated at an average flow rate of 100 gpm from June 1994 through January 1995. Operation problems that occurred during this time period included recovery well RW-4 being shut off by the new PLC from approximately June 20, 1994 to August 18, 1994 and as explained above, recovery well RW-1 was only operating at 19 gpm. Upon discovering the problem with recovery well RW-4, the well was restarted and has been operating since this time.

A summary of the remedial system operations and maintenance for the entire fifth year of operation (June 1994 to June 1995) will be included in the 1995 Annual Progress Report to be distributed in July 1995.

4.3.2 Long Term Remedial System Monitoring

Long term monitoring of the remedial system has continued since completion of the system startup program in January 1991, as proposed in the RAP (G&M, 1990d). Monitoring of the remedial system included collecting samples from the treatment unit influent and effluent, collecting samples from the individual recovery wells, recording the influent flow rate and total amount of water treated, and measuring the depth to groundwater in the recovery wells and monitoring wells. Monthly monitoring of the remedial system was conducted from February through July 1991 and continued on a quarterly basis from July 1991 through January 1995. Table 1 summarizes the sampling events and the constituents analyzed during each sampling event. This monitoring information has been summarized in the Annual Progress Reports prepared for the site (G&M 1991b, 1992, 1993, and 1994) and is discussed below.

Samples were collected from the treatment unit influent and effluent and individual recovery wells to monitor the overall efficiency of the treatment unit at achieving the discharge criteria. The analytical results for samples collected from the treatment unit influent and effluent and individual recovery wells have been summarized and the VOC analytical results are included in Tables 2 and 3 and Appendix B; the TPHs, benzene, toluene, ethylbenzene, xylene (BTEX), 12DCA, and ethylene dibromide (EDB) analytical results are included in Appendix C; the major cations and anions analytical results are included in Appendix D; and the semivolatle organic compound analytical results are included in Appendix E. All of the data were validated according to the procedures outlined in the RAP (G&M, 1990d). Graphs also were prepared to show time trends in concentrations of the four site-related VOCs (Appendix F), and TPH gasoline and diesel compounds (Appendix G).



The analytical results show that the concentrations of site-related VOCs detected in samples collected from the treatment unit influent have gradually decreased since the treatment unit has been in operation (Figure F-41 and Table 2). The concentrations of 111TCA in the treatment unit influent decreased to levels below the analytical method detection limit in October 1992 and have remained below the detection limit through April 1994. The maximum concentration of total site-related VOCs (calculated by adding the individual concentrations of the four site-related VOCs in one sample) detected in samples collected from the treatment unit influent reached a maximum during the first year of operation and have continued to decrease over time. The maximum concentration of total site-related VOCs reported in the treatment unit influent has decreased from 925 micrograms per liter (ug/L) in October 1990 to 111 ug/L in January 1995, an overall decrease of 88 percent.

Concentrations of site-related VOCs remained below reporting limits in the treatment unit effluent from June 1990 through January 1995 (Figure F-40 and Table 2). Based on these results, the treatment unit effluent has been in compliance with the groundwater discharge criteria.

The recovery wells were sampled individually four times from June 1990 through January 1995. The analytical results show that the highest concentrations of site-related VOCs have consistently been detected in samples collected from recovery wells RW-1 and RW-2 and the lowest in samples collected from recovery well RW-4 (Figures F-36 through F-39 and Table 3). The concentrations of VOCs are decreasing in all samples collected from the recovery wells.

The analytical results for petroleum related compounds (TPHs, BTEX, 12DCA, and EDB) in samples collected from the treatment unit influent and effluent and recovery wells are summarized in Appendices C and G. These results show that BTEX and EDB were never detected above reporting limits in samples collected from the treatment unit influent and effluent or the recovery wells.

The analytical results do show that TPH compounds have been detected in samples collected from the treatment unit influent (Figure G-27). The TPH-diesel analytical results all have been qualified as estimated because the sample chromatograms do not exhibit the standard diesel pattern; however, peaks were identified and quantified as TPH compounds. The TPH-gasoline results are all qualified as estimated because the sample chromatograms do not match the gasoline standard exactly and because the quantified results include the site-related VOCs also detected in the sample. For these reasons, these data are only used qualitatively to indicate the presence of petroleum-related compounds in the treatment unit influent. In addition, 12DCA, a common petroleum additive, also has been detected in samples collected from the treatment unit influent. No TPH-gasoline or 12DCA have been



detected above reporting limits in samples collected from the treatment unit effluent although low levels of TPH-diesel have been detected. This suggests that the petroleum related compounds have been captured by the remedial system and that the treatment unit is removing the volatile fraction.

TPH compounds detected in samples collected from the individual recovery wells indicate the majority of the TPH-diesel compounds and 12DCA are entering the remedial system through recovery well RW-4 where as the TPH-gasoline compounds are entering the remedial system through recovery wells RW-1, RW-2, and RW-3 (Appendix C). These data are consistent with the groundwater contour maps, which show that the off-site source of petroleum-contaminated groundwater on the northern portion of the property flows toward and is captured by the recovery wells.

The cations and anions analytical results show that concentrations of these ions are low and have been consistent throughout the operation of the remedial system. These data are summarized in Appendix D.

The semivolatile compound analytical results are summarized in Appendix E. No semivolatile compounds were detected above reporting limits in samples collected from the treatment unit influent and effluent or recovery wells.

The average annual air emission rates were calculated for each year of treatment unit operations and were reported in the 1991, 1992, 1993 and 1994 annual progress reports. The air emission rates are calculated by multiplying the individual concentrations of site-related VOCs detected in the treatment unit influent each sampling quarter by the amount of groundwater treated during that sampling quarter. The emission rates always have been lower than the rates set by the NMWQCC as presented in the RAP (G&M, 1990d).

Air dispersion modeling also was performed on an annual basis to evaluate both the location and magnitude of maximum exposure to the air stripper emissions from the treatment unit and to verify that the discharges were within the limitations specified in the RAP (G&M, 1990d). These calculations were necessary to ensure that the operation of the treatment unit was not creating an unacceptable health risk to local residents and site employees. As shown on Table 4, the excess lifetime cancer risk associated with the operation of the treatment unit during the fourth year of operation (June 1993 to June 1994) was 3.5×10^{-9} with a cumulative risk of 7.9×10^{-8} for the first four years of operation (June 1990 to June 1994). These risks are well below the USEPA guidance of an excess lifetime cancer risk of 1.0×10^{-6} , the maximum air discharge requirements specified by the RAP (G&M, 1990d).



From June 4, 1990 through January 31, 1995, a total of 245,358,477 gallons of groundwater have been recovered, treated, and returned to the subsurface at an average flow rate of 100 gpm. This flow rate is within the range of flow rates for achieving capture established for the treatment unit (80 to 140 gpm) but less than the optimal instantaneous flow rate of 140 gpm because of down time due to operational problems and maintenance as discussed in the previous section of this report. Based on air emission rates calculated for the time period from June 1990 through January 1995, the remedial system removed approximately 516 pounds of the site-related VOCs from the aquifer.

Depth to groundwater measurements were collected monthly from January 1991 to July 1991 and quarterly from July 1991 through January 1995 in all of the recovery wells and monitoring wells. These measurements were converted to groundwater elevations and used to evaluate the hydraulic effects of operating the remedial system. The depth to groundwater measurements and calculated groundwater elevations were summarized for each well and are included in Appendix H. The calculated groundwater elevations through October 1994 also were plotted against time to illustrate groundwater elevation trends and the graphs are contained in Appendix I. These graphs show that groundwater elevations at the site have declined at a rate of approximately one foot per year with the exception of monitoring wells GM-19 and GM-20, which show increases in groundwater elevations upon startup of the remedial system (Figure I-25 and I-26). These two monitoring wells are located near the southern end of the infiltration gallery (Figure 1) and show the effect of the infiltrated water mounding on the water table.

Linear regression analyses were performed for groundwater elevations measured from December 1990, which is when the remedial system was fully operational. These analyses are shown on the hydrographs contained in Appendix I and the statistics and predicted values are summarized on the individual hydrographs and in Table 5. These analyses were performed to project future groundwater elevations through January 1997, given that all regional and local recharge and withdrawal rates remain constant. Additionally, the 95 percent upper and lower confidence limits were calculated and typically ranged plus or minus five feet from the predicted groundwater elevation; however, the confidence limits were highly dependent on the number of data points. These analyses will be used to evaluate the depths at which the permanent pumps are currently set in the recovery wells and monitoring wells and to evaluate the potential effects of remedial activities by off-site facilities on the remedial system.



The groundwater elevations in shallow monitoring wells and the recovery wells were mapped annually to illustrate the configuration of the water-table surface at those times and are included in the annual progress reports. The maps for March 1991, April 1992, April 1993, and April 1994 are included in Appendix J. The key features of the water-level elevation maps include cones of depression surrounding the recovery wells and a mound on the water table in the area near the infiltration gallery. The resulting groundwater flow lines generally diverge away from the infiltration gallery and converge on the recovery wells showing that there is a hydraulic capture zone that includes the area of documented groundwater contamination from the site. The capture zone appears to extend downgradient of monitoring wells GM-14S and GM-14D but not as far downgradient as GM-15S and GM-15D (Figures J-1 through J-4). Also, the capture zone appears to extend to the monitoring wells located on the northern portion of the site (i.e., monitoring wells GM-24S, GM-24D, GM-10, GM-23, and GM-22) where petroleum related compounds have been identified. Concentrations of TPH compounds and 12DCA were detected in samples collected from the recovery wells and treatment unit influent which also indicates that the capture zone includes the wells on the northern portion of the site.

4.3.3 Long Term Groundwater Quality Monitoring

As specified in the RAP (G&M, 1990d), long term groundwater quality monitoring for the site began in April 1991, continued on a quarterly basis through April 1993, and was conducted on a semi-annual basis (every April and October) through 1994. This monitoring information has been summarized in the Annual Progress Reports prepared for the site (G&M, 1991, 1992, 1993, and 1994) and is discussed below.

Samples were collected from the monitoring wells to monitor the overall effectiveness of the remedial system in achieving the cleanup objectives. The analytical results for samples collected from the monitoring wells have been summarized and the VOC analytical results are included in Appendix B; the TPH, BTEX, 12DCA, and EDB analytical results are included in Appendix C; the major cations and anions analytical results are included in Appendix D; and the semivolatile organic compound analytical results are included in Appendix E. All of the data were validated according to the procedures outlined in the RAP (G&M, 1990d). EDB and semivolatile organic compounds were never detected in any samples collected from the monitoring wells.

To evaluate the VOC and petroleum compound analytical results for the samples collected from the monitoring wells, graphs were prepared to show time trends in concentrations of the four site-



related VOCs (Appendix F) and TPH compounds (Appendix G). Additionally, distribution maps were prepared for the four site-related compounds in the intermediate aquifer for August 1989 (prior to construction of the remedial system), April 1992, and April 1994. The distribution maps for 11DCE, 111TCA, TCE, and PCE are contained in Appendices K, L, M, and N, respectively.

The following observations have been made based on the time trends in concentrations of site-related VOCs detected in samples collected from the groundwater monitoring wells (Appendices B and F):

- Since the startup of the remedial system (June 1990), the concentrations of site-related VOCs have been less than the reporting limits in samples collected from monitoring wells GM-3, GM-7, GM-9D, GM-11D, GM-14S, GM-15S, GM-17D, GM-17S, GM-19, GM-23, GM-24D, GM-24S, A-1, and I-4. Concentrations of site-related VOCs in samples collected from monitoring well GM-20 have been below laboratory reporting limits except for once when PCE was detected just above the reporting limits in the sample collected in October 1993.
- The concentrations of site-related VOCs have been less than the reporting limits in samples collected from monitoring well GM-14D since April 1992.
- Since startup of the remedial action (June 1990), the concentrations of site-related VOCs appear to have peaked and are still decreasing in samples collected from monitoring wells GM-1, GM-2, GM-4, GM-5, GM-6, GM-9S, GM-10, GM-11S, GM-12R, GM-13, GM-16, and I-01.
- TCE was first detected in a sample collected from monitoring well GM-15D in October 1993 at concentrations just above reporting limits and consistently has been detected at this level through January 1995. The source of TCE detected in samples collected from this monitoring well is not known at this time. Because the primary site-related compound is PCE (which occurs in concentrations at least three times the concentrations of TCE) and based on results of capture zone analyses, it does not appear that the site-related plume is the source of TCE detected in samples collected from monitoring well GM-15D.
- Concentrations of site-related VOCs are increasing slightly in samples collected from monitoring wells GM-8, GM-21, and GM-22. Based on results of capture zone analyses, it appears that the contaminants from areas of higher concentration and are moving towards the recovery wells past these monitoring wells.



- The highest concentrations of the site-related VOCs are consistently detected in samples collected from monitoring wells GM-2, GM-9S, GM-11S, GM-13, and I-01.

The following observations were made regarding the distribution of site-related VOCs detected in samples collected from the intermediate aquifer based on the distribution maps for the site-related VOCs in 1989, 1992, and 1994 (Appendices K through N):

- The highest concentration of 11DCE in 1989 was detected in the sample collected from monitoring well GM-9S at 760 ug/L (Figure K-1). In 1992, the highest concentration of 11DCE, 420 ug/L, was detected in the sample collected from monitoring well GM-11S (Figure K-2). In 1994, the highest concentrations of 11DCE were detected in samples collected from monitoring wells GM-9S and GM-11S, at 60 ug/L and 62 ug/L, respectively (Figure K-3). In addition, the highest concentrations of 11DCE detected within the groundwater impact area have decreased by approximately 95 percent and the overall areal extent of groundwater impacted by 11DCE also has decreased.
- In 1989, 1992 and 1994, the highest concentrations of 111TCA were 510, 140, and 60 ug/L, respectively, and were detected in samples collected from monitoring well GM-9S (Figures L-1, L-2, and L-3). These data indicate that the groundwater containing the highest concentrations of 111TCA has remained stationary in the vicinity of monitoring well GM-9S, the highest concentrations detected within the groundwater impact area have decreased by approximately 90 percent, and the overall areal extent of the groundwater impacted by 111TCA also has decreased.
- The highest concentrations of TCE were detected in samples collected from monitoring well GM-9S in 1989 and 1994 at 1100 ug/L and 280 ug/L, respectively (Figures M-1 and M-3). In 1992, the highest concentration of TCE, 720 ug/L, was detected in the sample collected from monitoring well GM-2, which is located approximately 200 ft north of monitoring well GM-9S (Figure M-2). These data indicate that the highest concentrations of TCE in groundwater located within the vicinity of monitoring wells GM-9S and GM-2, the highest concentrations detected within the groundwater impact area have decreased by approximately 75 to 79 percent, and the overall areal extent of TCE contaminated groundwater also has decreased.
- In 1989, 1992, and 1994, the highest concentrations of PCE were detected in samples collected from monitoring well GM-9S at 2,500, 2,000, and 1,600 ug/L, respectively, and



monitoring well GM-2 at 2,000, 3,200, and 1,000 ug/L, respectively (Figures N-1 through N-3). These data indicate that the groundwater containing the highest concentrations PCE has remained stationary in the vicinity of monitoring wells GM-9S and GM-2 and that the highest concentrations detected within the groundwater impact area have decreased by approximately 60 to 70 percent.

Only samples from selected monitoring wells have been analyzed for petroleum compounds. The TPH compound analytical results over time (Appendix G) were evaluated and the following observations have been made regarding TPH-gasoline and TPH-diesel compounds in the intermediate aquifer:

- The concentrations of TPH-gasoline and diesel compounds have been less than the reporting limits since startup of the remedial system (June 1990), in samples collected from monitoring wells GM-11D, GM-14D, GM-17S, and A-1.
- Since startup of the remedial system (June 1990), the concentrations of TPH-gasoline and TPH-diesel compounds have decreased to levels below the reporting limits in samples collected from monitoring wells GM-1, GM-10, GM-14S, GM-15D, GM-17D, GM-19, GM-20, GM-23, and GM-24S.
- The concentrations of TPH-gasoline and TPH-diesel compounds have continued to decrease since startup of the remedial system (June 1990) in samples collected from monitoring wells GM-11S, GM-22, I-1, and I-4.
- Since startup of the remedial system (June 1990), the concentrations of TPH-gasoline and TPH-diesel compounds have remained consistent in samples collected from monitoring wells GM-13 and GM-24D.
- TPH-diesel compounds are increasing in samples collected from monitoring well GM-15D.

The TPH compound analytical results along with the groundwater flow fields illustrated on the groundwater elevation maps (Appendix J) indicate that at least a portion of the plume of petroleum-related compounds located north and west of the site is within the capture zone of the remedial system.

5.0 EFFECTIVENESS OF THE REMEDIAL SYSTEM

The following section summarizes the effectiveness of the remedial system for the site at achieving the remedial objectives. The objectives of the remedial action are to keep the impacted



groundwater from further migration and reduce the concentration of the site-related VOCs in the groundwater and groundwater discharge from the remedial system to concentrations below an ELCR of 1×10^{-6} . In addition to meeting the groundwater and discharge criteria, air emissions associated with the remedial system also must not exceed an ELCR of 1×10^{-6} .

The analysis of groundwater elevations in monitoring wells at the site show that the remedial system has been effective at preventing further migration of impacted groundwater from June 1990 through January 1995. The analytical results for samples collected from the monitoring wells show that the highest concentrations of 1,1-DCE, 1,1,1-TCA, TCE, and PCE detected within the groundwater impact area have decreased by approximately 95, 90, 75 to 79, and 60 to 70 percent, respectively. The total site-related VOC concentrations in samples collected from the treatment unit influent have decreased by 89 percent. The analytical results for samples collected from the treatment unit effluent show that treated groundwater met the groundwater discharge criteria from June 1990 through January 1995. The results of the air emission rates calculations and air dispersion modeling show that the air discharged from the remedial system has been well below the air emission criteria.

Based on the data presented above, the remedial action selected for the site achieves all of the remedial objectives and remains protective of human health and the environment.

6.0 SUMMARY AND CONCLUSIONS

Construction of the remedial system was completed in January 1990 and the remedial system started operating on June 4, 1990. The pilot program and pilot program extension were conducted from June 4 through September 10, 1990 and the results of these programs showed that the remedial system could achieve the designed removal efficiencies and that the treatment unit effluent met the groundwater discharge limitations. The analytical results from these programs also confirmed that the concentrations of site-related VOCs detected in the treatment unit influent samples were below the concentrations necessary to meet the air discharge criteria.

The system startup program was conducted from September 10, 1990 through January 1991. The results of this program showed that the remedial system would meet the remedial objectives stated in the Consent Decree and the RAP at flow rates between 80 and 140 gpm. The analytical results from these programs also confirmed that the concentrations of site-related VOCs detected in the treatment unit influent samples were below the concentrations necessary to meet the air discharge criteria. The



long term remedial system operation, maintenance, and monitoring program has been conducted at the site since January 1991.

During operation of the remedial system from June 1990 through January 1995, a total of 245,358,477 gallons of groundwater have been recovered, treated, and returned to the subsurface at an average flow rate of 100 gpm. Operational problems and maintenance of the remedial system were temporary and were resolved as they were discovered.

The remedial system has successfully treated site-related VOCs to below the groundwater discharge criteria. An evaluation of the analytical results for samples collected from the treatment unit influent shows that the total concentration of site-related VOCs reached a maximum of 925 ug/L in October 1990 and have steadily declined to 111 ug/L in January 1995, an overall decrease of 89 percent. Based in the annual average air emission rates calculated for the remedial system, approximately 516 pounds of the site related VOCs have been removed from the groundwater through January 1995. The results of the air emission calculations and the air dispersion modeling show that the air discharges from the remedial system were well below the air discharge criteria from June 1990 through January 1995.

The analysis of groundwater elevations shows that the remedial system has contained the area of groundwater impacted by the site-related VOCs. The analysis also showed that groundwater elevations have been declining at a rate of approximately one foot per year. Linear regression analyses were conducted on the hydrographs for each monitoring well and the predicted groundwater elevations through January 1997 were calculated assuming the off-site recharge and withdrawal rates remain constant. This information will be used to evaluate the pump setting for the recovery wells and groundwater monitoring wells and to evaluate the effects of remedial activities by off-site facilities on the remedial system.

The results for the long term groundwater monitoring showed that the area of highest concentrations of site-related VOCs in samples collected from the groundwater have remained stationary in the vicinity of monitoring wells GM-9S and GM-2 and recovery wells RW-1 and RW-2. A decrease in the overall areal extent of the groundwater impacted by the site-related VOCs also is illustrated by these results. The concentrations of 11DCE, 111TCA, TCE, and PCE detected in the center of mass have decreased by approximately 95, 90, 75 to 79, and 60 to 70 percent, respectively, based on the long term groundwater quality monitoring results.



Petroleum related compounds continue to be detected in samples collected from the groundwater and the treatment unit influent confirming the presence of a petroleum plume that has been captured and is being treated by the remedial system.

Based on the data presented, the remedial action selected for the site achieves all of the remedial objectives and therefore, remains protective of human health and the environment.



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APPENDICES

- A. Laboratory Analytical Data Sheets for March and April 1996
- B. Time Trends in Concentrations of 1,1-Dichloroethene, 1,1,1-Trichloroethane, Trichloroethene, Tetrachloroethene, and Total Site-Related Volatile Organic Compounds Detected above the Reporting Limit through April 1996 in the Treatment Unit Influent
- C. Time Trends in Concentrations of 1,1-Dichloroethene, 1,1,1-Trichloroethane, Trichloroethene, and Tetrachloroethene Detected above the Reporting Limit through April 1996 in the Treatment Unit Effluent
- D. Time Trends in Concentrations of 1,1-Dichloroethene, 1,1,1-Trichloroethane, Trichloroethene, and Tetrachloroethene Detected above the Reporting Limit through April 1996 in Recovery Well RW-01
- E. Time Trends in Concentrations of 1,1-Dichloroethene, 1,1,1-Trichloroethane, Trichloroethene, and Tetrachloroethene Detected above the Reporting Limit through April 1996 in Recovery Well RW-02
- F. Time Trends in Concentrations of 1,1-Dichloroethene, 1,1,1-Trichloroethane, Trichloroethene, and Tetrachloroethene Detected above the Reporting Limit through April 1996 in Recovery Well RW-03
- G. Time Trends in Concentrations of 1,1-Dichloroethene, 1,1,1-Trichloroethane, Trichloroethene, and Tetrachloroethene Detected above the Reporting Limit through April 1996 in Recovery Well RW-04

TABLE 1
 Summary of Remedial System and Groundwater Quality Monitoring
 Van Waters & Rogers Inc.
 3301 Edmunds Street, Albuquerque, New Mexico

Well Number	Date Sampled																																
	08/01/1988-09/02/1988	01/23/1989-02/03/1989	08/21-30/1989	09/11/1990	09/25/1990	10/23/1990	10/29/1990	12/03/1990	12/10/1990	01/14/1991	02/25/1991	03/13/1991	03/27/1991-04/05/1991	05/16/1991	06/17/1991	07/17-19/1991	10/16-17/1991	12/17/1991	01/13-15/1992	04/06-14/1992	07/20-23/1992	10/19-21/1992	01/18-20/1993	04/19-29/1993	07/20/1993	10/18-22/1993	02/23/1994	04/11-20/1994	07/26-27/1994	10/10-14/1994	01/16-17/1995		
GM-1	V	V	V										V			V				V	V	V	V	V	VTS		VT		VTBS		VTB		
GM-2	V	V	V										V			V				V	V	V	V	V	VTS				V				
GM-3	V	V	V										V			V				V	V	V	V	V	VTS				V				
GM-4	V	V	V										V			V				V	V	V	V	V	VTS				V				
GM-5	V	V	V										V			V				V	V	V	V	V	VTS				V				
GM-6	V	V	V										V			V				V	V	V	V	V	VTS				V				
GM-7	V	V	V										V			V				V	V	V	V	V	VTS		VI		V				
GM-8	V	V	V										V			V				V	V	V	V	V	VTS				V				
GM-9S	V	V	V										V			V				V	V	V	V	V	VTS				V				
GM-9D	V	V	V										V			V				V	V	V	V	V	VTS		V		V				
GM-10	V	V	V										VTB			TB	TB			TB	VTB	TB	VTB	TB	VTS		VT	VTB	VTBS		TB		
GM-11S	V	V	V										V							V	V	V	V	VTS				VTBS					
GM-11D	V	V	V										V							V	V	V	V	VTS		V		VTBS	V				
GM-12R	V	V	V										V							V	V	V	V	V	VTS				V				
GM-13	V	V	V										V							V	V	V	V	V	VTS				VTBS				
GM-14S	V	V	V										V			V	V			V	V	V	V	V	VTS		V		VTBS		VTB		
GM-14D	V	V	V										V			V	V			V	V	V	V	V	VTS		V		VTBS	V	V	V	
GM-15S	V	V	V										V			V	V			V	V	V	V	V	VTS		V		VTBS	V	V	V	
GM-15D	VT	VT	V										V			V	V			V	V	V	V	V	VTS		V	VTB	VTBS	VTB	VTB	V	
GM-16	V	V	V										V							V	V	V	V	V	VTS								
GM-17S	VS	VT	V										VTB			TB	TB			TB	VTB	TB	VTB	TB	VTS		VT		VTBS		TB		
GM-17D	VS	VT	V										VTB			TB	TB			TB	VTB	TB	TB	VTS		VT		VTBS		TB			
GM-18*	VTS	VT	V																														
GM-19	V	V	V										VTB			TB	TB			TB	VTB	TB	TB	VTS				VTBS					
GM-20	V	V	V										VTB			TB	TB			TB	VTB	TB	TB	VTS		VT		VTBS		TB			
GM-21	V	V	V										V			V	V			V	V	V	V	V	VTS		V		V		V		
GM-22	V	V	V										V							V	V	V	V	V	VTS		V		VTBS		VTB		
GM-23	V	V	V										VTB			VTB	VTB			TB	VTB	TB	TB	TB	VTS		VT		VTBS		TB		
GM-24S	VTS	V	V										TB			TB	TB			TB	TB	TB	VTB	TB	VTS		VTB		VTBS		TB		
GM-24D	VTS	VT	V										TB			TB	TB			TB	TB	TB	TB	VTS		VT		VTBS		TB			
TUI				V	VTB	VTBI	VTB	VTBI	VTB	VTBI	VTBI	VTBI	VTBI	VTBI	VTBI	VTB			VTBI	VTBI	VTBI	VTBIS	VTBI	VTBI	VTBIS	VTB	VTB	VTB	VTBIS	VTB	VTB	VTB	
TUE				V	VTB	VTBI	VTB	VTBI	VTB	VTBI	VTBI	VTBI	VTBI	VTBI	VTBI	VTB			VTBI	VTBI	VTBI	VTBIS	VTBI	VTBI	VTBIS	VTB	VTB	VTB	VTBIS	VTB	VTB	VTB	
RW-1																									VTS		VT		VTBS		VTB		
RW-2																									VTS		VT		VTBS		VTB		
RW-3																									VTS		VT		VTBS		VTB		
RW-4																									VTS		VTB		VTBS		VTB		
I-01	V	VT	V										V											V	VTS				VTBS				
I-04	VTS	VT	V																								VTB						
A-1	V	V	V																						VTS		VTB	VTBS	V	VTB	V		
A-2	V	V	V																						VTS		VI		V				
HL-01																											VI		V				

* - Monitoring well GM-18 was abandoned on October 23, 1992.
 TUE - treatment unit effluent
 TUI - treatment unit influent
 V - volatile organic compounds
 T - total petroleum hydrocarbon compounds
 B - benzene, toluene, ethylbenzene, xylene, and 1,2 dichloroethane
 I - inorganic compounds
 S - semivolatile organic compounds

TABLE 2
 CONCENTRATIONS OF SITE-RELATED VOLATILE ORGANIC COMPOUNDS
 DETECTED ABOVE THE REPORTING LIMIT
 IN SAMPLES COLLECTED FROM THE TREATMENT UNIT INFLUENT AND EFFLUENT
 THROUGH JANUARY 1995

Well No.	Site-Related Volatile Organic Compounds (ug/L)	Date Sampled																									Cleanup Goals		
		09/11/90	09/25/90	10/23/90	10/29/90	12/03/90	12/10/90	01/14/91	02/25/91	03/13/91	04/05/91	05/16/91	06/17/91	07/17/91	12/17/91	01/13/92	04/06/92	07/20/92	10/19/92	01/18/93	04/19/93	07/20/93	10/18/93	02/23/94	04/11/94	07/26/94		10/10/94	01/16/95
TUE	1,1-Dichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	60
	Trichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5
	Tetrachloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	20
TUI	1,1-Dichloroethene	100 J	120	120	96 J	94	92	89	60	65	65	47 J	40 J	51	34	29	20 J	30	27	22	15	9	13	14	13	11	10	8	5
	1,1,1-Trichloroethane	28 J	28	39	25 J	23	24	20	10 J	10 J	20 J	12 J	12 J	12	8	6	< 5	9	6 J	5	5 J	< 5	< 5	5 J	< 5	< 5	< 5	< 5	60
	Trichloroethene	140 J	150	190	120 J	130	140	10 J	91	95	110	84 J	62 J	89	71	55 J	50	72	55	43	41	20	30	35	31	29	26	20	5
	Tetrachloroethene	510 J	470	570	430 J	420	410	340	400	360	380	280 E	230 J	370	220 D	350 D	250	260 D	150	160	170	85	120	160	140	120	110	83	20

Notes:
 TUE - Treatment Unit Effluent
 TUI - Treatment Unit Inffluent
 D - Concentrations determined at a secondary dilution factor.
 E - Concentration exceeded the calibration range of the instrument.
 J - Estimated value.

TABLE 3
 CONCENTRATIONS OF SITE-RELATED VOLATILE ORGANIC COMPOUNDS
 DETECTED ABOVE THE REPORTING LIMIT
 IN SAMPLES COLLECTED FROM THE RECOVERY WELLS AND MONITORING WELLS
 THROUGH JANUARY 1995

Well No.	Site-Related Volatile Organic Compounds (ug/L)	Date Sampled																		Cleanup Goals
		08/10/88 to 09/01/88	01/24/89 to 02/02/89	08/21/89 to 08/30/89	03/27/91 to 04/05/91	07/17/91 to 07/19/91	10/01/91 to 10/17/91	01/13/92 to 01/15/92	04/6/92 to 04/16/92	07/20/92 to 07/23/92	10/17/92 to 10/21/92	01/18/93 to 01/21/93	04/19/93 to 04/29/93	10/18/93 to 10/23/93	2/23/94	04/11/94 to 04/20/94	07/24/94 to 07/31/94	10/10/94 to 10/14/94	01/16/95 to 01/17/95	
A-01	1,1-Dichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	< 5	--	< 5	< 5	< 5	< 5	< 5	5	
	1,1,1-Trichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	< 5	--	< 5	< 5	< 5	< 5	< 5	60	
	Trichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	< 5	--	< 5	< 5	< 5	< 5	< 5	5	
	Tetrachloroethene	7 X	< 5	< 5	--	--	--	--	--	--	--	< 5	--	< 5	< 5	< 5	< 5	< 5	20	
A-02	1,1-Dichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	< 5	< 5	--	< 5	--	--	--	5	
	1,1,1-Trichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	< 5	< 5	--	< 5	--	--	--	60	
	Trichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	< 5	< 5	--	< 5	--	--	--	5	
	Tetrachloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	< 5	< 5	--	< 5	--	--	--	20	
GM-01	1,1-Dichloroethene	13	14	14	16	8	9	23	24	28	31	24	9	11	--	11	--	6	5	
	1,1,1-Trichloroethene	5	< 5	6	8	< 5	7	11	15	19	19	11	5 J	6	--	6	--	< 5	60	
	Trichloroethene	28	30	37	38	18	30	55	70	90	84	60	28	45	--	46	--	24	5	
	Tetrachloroethene	51	67	93	110	52	83	230 E	270 D	370 DJ	240	280 J	100	130	--	140	--	87	20	
GM-02	1,1-Dichloroethene	150	170	300	190 J	--	--	--	170	--	--	--	94	--	--	50 J	--	--	5	
	1,1,1-Trichloroethene	79	77	140	97 J	--	--	--	110	--	--	--	40	--	--	< 50	--	--	60	
	Trichloroethene	480	420 X	800	1300 DJ	--	--	--	720 D	--	--	--	330 D	--	--	240	--	--	5	
	Tetrachloroethene	1500	1200 D	2000	4200 DJ	--	--	--	3200 DJ	--	--	--	1400 D	--	--	1000	--	--	20	
GM-03	1,1-Dichloroethene	6	< 5	< 5	< 5	--	--	--	< 5	--	--	--	< 5	--	--	< 5	--	--	5	
	1,1,1-Trichloroethene	14	8	8	< 5	--	--	--	< 5	--	--	--	< 5	--	--	< 5	--	--	60	
	Trichloroethene	9	6	6	< 5	--	--	--	< 5	--	--	--	< 5	--	--	< 5	--	--	5	
	Tetrachloroethene	38	25	29	< 5	--	--	--	7 J	--	--	--	< 5	--	--	< 5	--	--	20	
GM-04	1,1-Dichloroethene	< 5	18	8	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	--	< 5	--	--	--	5	
	1,1,1-Trichloroethene	7	48	25	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	--	< 5	--	--	--	60	
	Trichloroethene	6 X	56	34	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	--	< 5	--	--	--	5	
	Tetrachloroethene	21 X	180	110	13 J	11	9	< 10	16	11	13	14	12	--	11	--	--	--	20	
GM-05	1,1-Dichloroethene	30 X	23	15	6 J	--	--	--	6	--	--	--	< 5	--	--	< 5	--	--	5	
	1,1,1-Trichloroethene	46	55	48	< 5 J	--	--	--	9	--	--	--	< 5	--	--	< 5	--	--	60	
	Trichloroethene	86 X	86	100	16 J	--	--	--	26	--	--	--	8	--	--	9	--	--	5	
	Tetrachloroethene	270 EY	290 E	320	105 J	--	--	--	180	--	--	--	52	--	--	59	--	--	20	
GM-06	1,1-Dichloroethene	< 5	22	5	< 5	--	--	--	< 5	--	--	--	< 5	--	--	< 5	--	--	5	
	1,1,1-Trichloroethene	5	46	10	< 5	--	--	--	< 5	--	--	--	< 5	--	--	< 5	--	--	60	
	Trichloroethene	14 X	110	27	< 5	--	--	--	< 5	--	--	--	< 5	--	--	< 5	--	--	5	
	Tetrachloroethene	61 X	400 E	100	15	--	--	--	23	--	--	--	26	--	--	13	--	--	20	
GM-07	1,1-Dichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	--	--	< 5	--	< 5	--	--	5	
	1,1,1-Trichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	--	--	< 5	--	< 5	--	--	60	
	Trichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	--	--	< 5	--	< 5	--	--	5	
	Tetrachloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	--	--	< 5	--	< 5	--	--	20	
GM-08	1,1-Dichloroethene	52 X	77	34	40	5 J	5	5 J	< 5	< 5	< 5	< 5	< 5	--	7	--	--	--	5	
	1,1,1-Trichloroethene	110	200	90	50	5 J	8	6	< 5	< 5 J	< 5	< 5	< 5	--	8	--	--	--	60	
	Trichloroethene	170 X	280	150	110	13	16	18	13	19	11	18	11	--	31	--	--	--	5	
	Tetrachloroethene	540 X	1300	630	510	130	170	180	120	160	75	140	100	--	210	--	--	--	20	

TABLE 3
 CONCENTRATIONS OF SITE-RELATED VOLATILE ORGANIC COMPOUNDS
 DETECTED ABOVE THE REPORTING LIMIT
 IN SAMPLES COLLECTED FROM THE RECOVERY WELLS AND MONITORING WELLS
 THROUGH JANUARY 1995

Well No.	Site-Related Volatile Organic Compounds (ug/L)	Date Sampled																		Cleanup Goals
		08/10/88 to 09/01/88	01/24/89 to 02/02/89	08/21/89 to 08/30/89	03/27/91 to 04/05/91	07/17/91 to 07/19/91	10/01/91 to 10/17/91	01/13/92 to 01/15/92	04/6/92 to 04/16/92	07/20/92 to 07/23/92	10/17/92 to 10/21/92	01/18/93 to 01/21/93	04/19/93 to 04/29/93	10/18/93 to 10/23/93	2/23/94	04/11/94 to 04/20/94	07/24/94 to 07/31/94	10/10/94 to 10/14/94	01/16/95 to 01/17/95	
GM-09D	1,1-Dichloroethene	< 5	< 5	< 5	< 5	--	--	--	< 5	--	--	--	< 5	< 5	--	< 5	--	--	--	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	< 5	--	--	--	< 5	--	--	--	< 5	< 5	--	< 5	--	--	--	60
	Trichloroethene	< 5	< 5	< 5	< 5	--	--	--	< 5	--	--	--	< 5	< 5	--	< 5	--	--	--	5
	Tetrachloroethene	< 5	< 5	< 5	< 5	--	--	--	< 5	--	--	--	< 5	< 5	--	< 5	--	--	--	20
GM-09S	1,1-Dichloroethene	480 X	270	760	280 E	--	--	--	140	--	--	--	110	--	--	60	--	--	--	5
	1,1,1-Trichloroethane	480 X	360	510	124	--	--	--	140	--	--	--	93	--	--	60	--	--	--	60
	Trichloroethene	890 X	700	1100	340 DJ	--	--	--	350 D	--	--	--	350 D	--	--	280	--	--	--	5
	Tetrachloroethene	2800 EY	2600 E	2500 E	1400 D	--	--	--	2000 DJ	--	--	--	2000 D	--	--	1600	--	--	--	20
GM-10	1,1-Dichloroethene	< 5	< 5	< 5	< 5	--	--	--	< 5 J	--	25	--	19	7	< 5 J	< 5	< 5	--	--	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	< 5	--	--	--	< 5	--	12	--	8	5 J	< 5	< 5	< 5	--	--	60
	Trichloroethene	12	8	12	7	--	--	--	8	--	44	--	31	16	9	7	6	--	--	5
	Tetrachloroethene	36	30	46	25	--	--	--	36	--	120	--	150	81	45	33	27	--	--	20
GM-11D	1,1-Dichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	--	< 5	< 5	--	< 5	< 5	--	--	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	--	--	--	--	--	--	--	--	< 5	< 5	--	< 5	< 5	--	--	60
	Trichloroethene	< 5	7	5	--	--	--	--	--	--	--	--	< 5	< 5	--	< 5	< 5	--	--	5
	Tetrachloroethene	< 5	19	15	--	--	--	--	--	--	--	--	< 5	< 5	--	< 5	< 5	--	--	20
GM-11S	1,1-Dichloroethene	210	230	270	1500 DJ	--	--	--	420 D	--	--	--	290 D	--	--	62	--	--	--	5
	1,1,1-Trichloroethane	46	67	61	105	--	--	--	19	--	--	--	15	--	--	8	--	--	--	60
	Trichloroethene	190	260	220	940 D	--	--	--	140 J	--	--	--	170	--	--	38	--	--	--	5
	Tetrachloroethene	630	900	620	2700 DJ	--	--	--	830 D	--	--	--	800 D	--	--	150	--	--	--	20
GM-12R	1,1-Dichloroethene	6	10	24	25	--	--	--	18	--	--	--	20	--	--	17	--	--	--	5
	1,1,1-Trichloroethane	< 5	< 5	8	5	--	--	--	< 5	--	--	--	6	--	--	5	--	--	--	60
	Trichloroethene	< 5	< 5	< 5	< 5	--	--	--	5 J	--	--	--	13	--	--	11	--	--	--	5
	Tetrachloroethene	7	8	17	29	--	--	--	29 J	--	--	--	62	--	--	50	--	--	--	20
GM-13	1,1-Dichloroethene	110	200	240	450 D	--	--	--	110	--	--	--	52	--	--	< 50	--	--	--	5
	1,1,1-Trichloroethane	41	110	160	155 J	--	--	--	82	--	--	--	32	--	--	< 50	--	--	--	60
	Trichloroethene	150	300	450	1690 D	--	--	--	500 D	--	--	--	230 DJ	--	--	180	--	--	--	5
	Tetrachloroethene	530 EY	1100	1500	5190 D	--	--	--	2800 DJ	--	--	--	1300 D	--	--	1000	--	--	--	20
GM-14D	1,1-Dichloroethene	< 5	< 5	< 5	11 J	6	6	5 J	< 5	< 5	< 5	< 5	< 5	< 5	--	< 5	< 5	< 5	< 5	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	--	< 5	< 5	< 5	< 5	60
	Trichloroethene	< 5	< 5	10	11 J	6	11	7	< 5	< 5	< 5	< 5	< 5	< 5	--	< 5	< 5	< 5	< 5	5
	Tetrachloroethene	< 5	8	26	71 J	26	39	34	8	6	< 5	< 5	< 5	< 5	--	< 5	< 5	< 5	< 5	20
GM-14S	1,1-Dichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	--	< 5	--	< 5	--	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	--	< 5	--	< 5	--	60
	Trichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	--	< 5	--	< 5	--	5
	Tetrachloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	--	< 5	--	< 5	--	20
GM-15D	1,1-Dichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	60
	Trichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	6	6	7	5	6	6	5
	Tetrachloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	20

TABLE 3
 CONCENTRATIONS OF SITE-RELATED VOLATILE ORGANIC COMPOUNDS
 DETECTED ABOVE THE REPORTING LIMIT
 IN SAMPLES COLLECTED FROM THE RECOVERY WELLS AND MONITORING WELLS
 THROUGH JANUARY 1995

Well No.	Site-Related Volatile Organic Compounds (ug/L)	Date Sampled																	Cleanup Goals	
		08/10/88 to 09/01/88	01/24/89 to 02/02/89	08/21/89 to 08/30/89	03/27/91 to 04/05/91	07/17/91 to 07/19/91	10/01/91 to 10/17/91	01/13/92 to 01/15/92	04/6/92 to 04/16/92	07/20/92 to 07/23/92	10/17/92 to 10/21/92	01/18/93 to 01/21/93	04/19/93 to 04/29/93	10/18/93 to 10/23/93	2/23/94	04/11/94 to 04/20/94	07/24/94 to 07/31/94	10/10/94 to 10/14/94		01/16/95 to 01/17/95
GM-15S	1,1-Dichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	-	< 5	-	< 5	-	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	8	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	-	< 5	-	< 5	-	60
	Trichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	-	< 5	-	< 5	-	5
	Tetrachloroethene	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	-	< 5	-	< 5	-	20
GM-16	1,1-Dichloroethene	8	15	14	-	-	-	-	-	-	-	-	< 5	-	-	-	-	-	-	5
	1,1,1-Trichloroethane	22	35	27	-	-	-	-	-	-	-	-	< 5	-	-	-	-	-	-	60
	Trichloroethene	18	26	26	-	-	-	-	-	-	-	-	< 5	-	-	-	-	-	-	5
	Tetrachloroethene	61	90	98	-	-	-	-	-	-	-	-	10	-	-	-	-	-	-	20
GM-17D	1,1-Dichloroethene	< 5	< 5	< 5	< 5	-	-	-	< 5	-	-	-	< 5	< 5	-	< 5	-	-	-	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	< 5	-	-	-	< 5	-	-	-	< 5	< 5	-	< 5	-	-	-	60
	Trichloroethene	< 5	< 5	< 5	< 5	-	-	-	< 5	-	-	-	< 5	< 5	-	< 5	-	-	-	5
	Tetrachloroethene	< 5	< 5	< 5	< 5	-	-	-	< 5	-	-	-	< 5	< 5	-	< 5	-	-	-	20
GM-17S	1,1-Dichloroethene	< 5	< 5	< 5	< 5	-	-	-	< 5	-	< 5	-	< 5	< 5	-	< 5	-	-	-	5
	1,1,1-Trichloroethane	13	6	< 5	< 5	-	-	-	< 5	-	< 5	-	< 5	< 5	-	< 5	-	-	-	60
	Trichloroethene	< 5	< 5	< 5	< 5	-	-	-	< 5	-	< 5	-	< 5	< 5	-	< 5	-	-	-	5
	Tetrachloroethene	6	< 5	< 5	< 5	-	-	-	< 5	-	< 5	-	< 5	< 5	-	< 5	-	-	-	20
GM-18	1,1-Dichloroethene	< 5	< 5	< 5	-	-	-	-	< 5	-	-	-	-	-	-	-	-	-	-	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	-	-	-	-	< 5	-	-	-	-	-	-	-	-	-	-	60
	Trichloroethene	< 5	< 5	< 5	-	-	-	-	< 5	-	-	-	-	-	-	-	-	-	-	5
	Tetrachloroethene	< 5	< 5	< 5	-	-	-	-	< 5	-	-	-	-	-	-	-	-	-	-	20
GM-19	1,1-Dichloroethene	< 5	< 5	< 5	< 5	-	-	-	< 5	-	-	-	< 5	-	-	< 5	-	-	-	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	< 5	-	-	-	< 5	-	-	-	< 5	-	-	< 5	-	-	-	60
	Trichloroethene	< 5	< 5	< 5	< 5	-	-	-	< 5	-	-	-	< 5	-	-	< 5	-	-	-	5
	Tetrachloroethene	5	< 5	6	< 5	-	-	-	< 5	-	-	-	< 5	-	-	< 5	-	-	-	20
GM-20	1,1-Dichloroethene	< 5	< 5	< 5	< 5	-	-	-	< 5	-	-	-	< 5	< 5	-	< 5	-	-	-	5
	1,1,1-Trichloroethane	5	< 5	8	< 5	-	-	-	< 5	-	-	-	< 5	< 5	-	< 5	-	-	-	60
	Trichloroethene	< 5	< 5	< 5	< 5	-	-	-	< 5	-	-	-	< 5	< 5	-	< 5	-	-	-	5
	Tetrachloroethene	8	< 5	16	< 5	-	-	-	< 5	-	-	-	< 5	< 6	-	< 5	-	-	-	20
GM-21	1,1-Dichloroethene	32	84	58	22	17	25	16	13	10	8	6	11	10	-	12	-	18	-	5
	1,1,1-Trichloroethane	10	18	14	< 5 J	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	5 J	-	< 5	-	7	-	60
	Trichloroethene	11	38	23	8	< 5	6	< 5	5 J	< 5	< 5	< 5	< 5	11	-	11	-	13	-	5
	Tetrachloroethene	44	140	100	43	21	30	22	22	19	15	12	19	42	-	45	-	58	-	20
GM-22	1,1-Dichloroethene	< 5	< 5	< 5	< 5	-	-	-	< 5	-	-	-	< 5	< 5	-	< 5	-	< 5	-	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	< 5	-	-	-	< 5	-	-	-	< 5	< 5	-	< 5	-	< 5	-	60
	Trichloroethene	< 5	< 5	< 5	< 5	-	-	-	< 5	-	-	-	< 5	< 5	-	< 5	-	< 5	-	5
	Tetrachloroethene	< 5	< 5	< 5	7	-	-	-	5 J	-	-	-	8	6 J	-	6	-	14	-	20
GM-23	1,1-Dichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	-	< 5	-	-	-	< 5	< 5	-	< 5	-	-	-	5
	1,1,1-Trichloroethane	< 5	< 5	< 5	13 J	< 5	< 5	-	< 5	-	-	-	< 5	< 5	-	< 5	-	-	-	60
	Trichloroethene	< 5	< 5	< 5	< 5	< 5	< 5	-	< 5	-	-	-	< 5	< 5	-	< 5	-	-	-	5
	Tetrachloroethene	< 5	< 5	< 5	< 5	< 5	< 5	-	< 5	-	-	-	< 5	< 5	-	< 5	-	-	-	20

TABLE 3
 CONCENTRATIONS OF SITE-RELATED VOLATILE ORGANIC COMPOUNDS
 DETECTED ABOVE THE REPORTING LIMIT
 IN SAMPLES COLLECTED FROM THE RECOVERY WELLS AND MONITORING WELLS
 THROUGH JANUARY 1995

Well No.	Site-Related Volatile Organic Compounds (ug/L)	Date Sampled																	Cleanup Goals
		08/10/88 to 09/01/88	01/24/89 to 02/02/89	08/21/89 to 08/30/89	03/27/91 to 04/05/91	07/17/91 to 07/19/91	10/01/91 to 10/17/91	01/13/92 to 01/15/92	04/06/92 to 04/16/92	07/20/92 to 07/23/92	10/17/92 to 10/21/92	01/18/93 to 01/21/93	04/19/93 to 04/29/93	10/18/93 to 10/23/93	2/23/94	04/11/94 to 04/20/94	07/24/94 to 07/31/94	10/10/94 to 10/14/94	
GM-24D	1,1-Dichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	< 5	< 5	--	< 5	--	--	--	5
	1,1,1-Trichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	< 5	< 5	--	< 5	--	--	--	60
	Trichloroethene	6	< 5	< 5	--	--	--	--	--	--	--	< 5	< 5	--	< 5	--	--	--	5
	Tetrachloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	< 5	< 5	--	< 5	--	--	--	20
GM-24S	1,1-Dichloroethene	< 5	< 5	< 5	--	--	--	--	--	< 5	--	< 5	< 5	--	< 5	--	--	--	5
	1,1,1-Trichloroethene	< 5	< 5	< 5	--	--	--	--	--	< 5	--	< 5	< 5	--	< 5	--	--	--	60
	Trichloroethene	< 5	< 5	< 5	--	--	--	--	--	< 5	--	< 5	< 5	--	< 5	--	--	--	5
	Tetrachloroethene	< 5	< 5	< 5	--	--	--	--	--	< 5	--	< 5	< 5	--	< 5	--	--	--	20
HL-01	1,1-Dichloroethene	--	< 5	--	--	--	--	--	--	--	--	--	< 5	--	< 5	--	--	--	5
	1,1,1-Trichloroethene	--	< 5	--	--	--	--	--	--	--	--	--	< 5	--	< 5	--	--	--	60
	Trichloroethene	--	< 5	--	--	--	--	--	--	--	--	--	< 5	--	< 5	--	--	--	5
	Tetrachloroethene	--	< 5 J	--	--	--	--	--	--	--	--	--	< 5	--	< 5	--	--	--	20
I-01	1,1-Dichloroethene	180	150	83	71	--	--	--	30	--	--	--	100	--	< 50	--	--	--	5
	1,1,1-Trichloroethene	77	75	22	18	--	--	--	9	--	--	--	44	--	< 50	--	--	--	60
	Trichloroethene	430	470	220	270	--	--	--	95	--	--	--	480 D	--	230	--	--	--	5
	Tetrachloroethene	1300	1400	600	580	--	--	--	330 D	--	--	--	1900 D	--	720	--	--	--	20
I-04	1,1-Dichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	--	< 50	--	--	--	--	--	5
	1,1,1-Trichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	--	< 50	--	--	--	--	--	60
	Trichloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	--	< 50	--	--	--	--	--	5
	Tetrachloroethene	< 5	< 5	< 5	--	--	--	--	--	--	--	--	< 50	--	--	--	--	--	20
RW-01	1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	26	< 25	--	9	--	11	--	5
	1,1,1-Trichloroethene	--	--	--	--	--	--	--	--	--	--	10	< 25	--	6	--	< 5	--	60
	Trichloroethene	--	--	--	--	--	--	--	--	--	--	52	59	--	32	--	33	--	5
	Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	280 D	290	--	170	--	170	--	20
RW-02	1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	22	< 25	--	18	--	17	--	5
	1,1,1-Trichloroethene	--	--	--	--	--	--	--	--	--	--	6	< 25	--	5 J	--	< 5	--	60
	Trichloroethene	--	--	--	--	--	--	--	--	--	--	52	46	--	42	--	40	--	5
	Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	220 D	200	--	170	--	170	--	20
RW-03	1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	17	10	--	8	--	7	--	5
	1,1,1-Trichloroethene	--	--	--	--	--	--	--	--	--	--	< 5	< 5	--	< 5	--	< 5	--	60
	Trichloroethene	--	--	--	--	--	--	--	--	--	--	53	37	--	29	--	21	--	5
	Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	180	130	--	98	--	71	--	20
RW-04	1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	25	12	--	10	--	9	--	5
	1,1,1-Trichloroethene	--	--	--	--	--	--	--	--	--	--	< 5	< 5	--	< 5	--	< 5	--	60
	Trichloroethene	--	--	--	--	--	--	--	--	--	--	17	12	--	10	--	10	--	5
	Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	61	43	--	34	--	31	--	20

Notes:

D - Concentration determined at a secondary dilution factor.
 E - Concentration exceeded the calibration range of the instrument.
 J - Estimated value.

X - Quantitation biased high.
 Y - Quantitation biased low.

TABLE 4
Air Dispersion Modeling Results
Van Waters & Rogers Inc.
3301 Edmunds Street, Albuquerque, New Mexico

Site-Related Compounds	Annual Average		SCREEN Predicted Maximum 1-Hour		Unit Risk Factor (risk/[$\mu\text{g}/\text{m}^3$])	Carcinogenic Risk Screening Evaluation		
	Influent Concentration ($\mu\text{g}/\text{l}$)	Mass Emission Rate ¹ (g/s)	Concentration ² ($\mu\text{g}/\text{m}^3$) (ppb _v)			April 1993 through April 1994 ³	August 1990 through June 1993 ⁴	Total August 1990 through April 1994
1,1-Dichloroethene	12.4	0.000076	0.0731	0.01811	2.8E-05	2.9E-09	6.5E-08	6.8E-08
1,1,1-Trichloroethane	2.0	0.000012	0.0118	0.00212	NDC	NDC	NDC	NDC
Trichloroethene	30.7	0.000188	0.1806	0.03303	1.0E-06	2.6E-10	3.6E-09	3.9E-09
Tetrachloroethene	126.7	0.000774	0.7449	0.10801	3.2E-07	3.4E-10	7.2E-09	7.5E-09
					Total Risk	3.5E-09	7.6E-08	7.9E-08

- 1 Water flow rate is 96.8 gallons per minute (GPM). Entire concentration gradient is assumed to be emitted. Groundwater influent is an arithmetic average value derived from four rounds of sampling data (seven samples).
- 2 SCREEN modeling performed assuming a 34-foot stack height, 3.2-foot exit diameter, and a 1,500 cubic feet per minute (CFM) exhaust as flow rate. Modeling performed on an arbitrary basis of 1 g/s yielded a maximum predicted 1-hour average of 962.6 $\mu\text{g}/\text{m}^3$ at a downwind distance of 115 meters. The potential impact of building downwash on plume dispersion was not considered. Flat rural dispersion coefficients and regulatory default options were assumed.
- 3 Screening risk analysis assumes the annual average concentration will be 10 percent of the 1-hour maximum and a 1-year exposure period. Unit risk factors are from USEPA Region III Risk-Based Concentrations table dated April 20, 1994, which refers to the IRIS database, HEAST, and EPA-ECAO.
- 4 Data referenced in previous annual reports. Risks have not been recalculated.

$\mu\text{g}/\text{l}$ Micrograms per liter.
g/s Grams per second.
ppb_v Parts per billion by volume.
risk/ $\mu\text{g}/\text{m}^3$ Risk by micrograms per cubic meter.
NDC Not determined to be carcinogenic.
USEPA United States Environmental Protection Agency.
 $\mu\text{g}/\text{m}^3$ Micrograms per cubic meter.
OHEA Office of Health and Environmental Assessment.



TABLE 5
Summary of Groundwater Elevation Statistics
from December 1990 through October 1994
Van Waters & Rogers Inc.
3301 Edmunds Street, Albuquerque, New Mexico

Well Number	Mean	Standard Error	Median	Standard Deviation	Sample Variance	Minimum	Maximum	Confidence Limit (95%)	1997 Projected Elevation
A-01	4904.00	0.41	4904.31	1.59	2.51	4901.25	4906.24	0.8780	4897.23
GM-1	4900.11	0.36	4900.36	1.71	2.92	4897.09	4903.00	0.7570	4895.30
GM-2	4900.23	0.41	4900.74	1.88	3.52	4896.70	4902.61	0.8545	4894.20
GM-3	4903.90	0.43	4904.31	1.96	3.83	4899.81	4906.71	0.8914	4897.55
GM-4	4903.34	0.41	4903.65	1.94	3.78	4899.36	4906.08	0.8618	4896.84
GM-5	4902.97	0.42	4903.32	1.93	3.73	4899.07	4905.70	0.8787	4896.71
GM-6	4903.26	0.48	4903.73	2.19	4.81	4897.52	4906.17	0.9981	4896.33
GM-7	4900.37	0.51	4900.50	2.28	5.19	4895.78	4903.80	1.0663	4893.34
GM-8	4902.10	0.40	4902.45	1.86	3.48	4898.46	4904.64	0.8269	4895.94
GM-9D	4899.96	0.43	4900.43	1.98	3.92	4895.86	4903.04	0.9015	4893.85
GM-9S	4899.50	0.42	4899.79	1.94	3.77	4894.79	4902.05	0.8843	4893.91
GM-10	4900.97	0.41	4901.26	1.94	3.76	4897.04	4903.29	0.8603	4894.44
GM-11D	4897.51	0.44	4898.04	1.98	3.91	4893.44	4899.82	0.9257	4891.51
GM-11S	4897.55	0.43	4898.14	1.96	3.86	4893.40	4899.80	0.8940	4891.48
GM-12R	4899.32	0.42	4899.93	1.91	3.65	4895.36	4901.67	0.8693	4893.22
GM-13	4897.96	0.44	4898.42	2.03	4.13	4893.88	4900.31	0.9249	4891.91
GM-14D	4896.54	0.44	4896.83	2.04	4.16	4892.40	4899.45	0.9046	4889.89
GM-14S	4896.82	0.43	4897.27	2.02	4.08	4892.81	4899.88	0.8953	4890.13
GM-15D	4895.80	0.47	4896.04	2.20	4.85	4891.49	4898.66	0.9760	4888.39
GM-15S	4896.45	0.44	4897.60	2.00	4.02	4892.28	4899.02	0.9123	4889.32
GM-16	4904.56	0.45	4905.07	2.03	4.12	4900.04	4907.54	0.9500	4898.20
GM-17D	4904.26	0.39	4904.61	1.83	3.36	4901.31	4907.14	0.8129	4898.26
GM-17S	4904.93	0.42	4905.56	1.98	3.92	4900.60	4907.84	0.8774	4898.54
GM-19	4912.81	0.43	4912.74	2.03	4.14	4907.16	4915.95	0.9021	4916.58
GM-20	4911.30	0.23	4911.35	1.03	1.06	4909.11	4913.31	0.4695	4910.32



TABLE 5
Summary of Groundwater Elevation Statistics
from December 1990 through October 1994
Van Waters & Rogers Inc.
3301 Edmunds Street, Albuquerque, New Mexico

Well Number	Mean	Standard Error	Median	Standard Deviation	Sample Variance	Minimum	Maximum	Confidence Limit (95%)	1997 Projected Elevation
GM-21	4898.87	0.45	4899.49	2.12	4.51	4894.54	4901.66	0.9421	4892.01
GM-22	4898.73	0.51	4898.95	2.33	5.41	4894.65	4904.96	1.0590	4892.34
GM-23	4899.56	0.40	4899.89	1.88	3.52	4895.83	4902.07	0.8317	4893.68
GM-24D	4903.43	0.48	4903.97	2.19	4.78	4898.58	4906.46	0.9950	4896.43
GM-24S	4903.92	0.42	4904.23	1.93	3.74	4899.85	4906.75	0.8806	4897.81
I-1	4898.71	0.42	4899.37	1.92	3.70	4894.74	4901.04	0.8757	4892.57
I-4	4904.93	0.56	4905.55	2.16	4.68	4900.59	4907.79	1.1977	4897.90
HL-1	4892.87	1.46	4893.70	3.26	10.66	4887.93	4896.10	4.0534	4875.92
RW-1	4896.49	0.74	4896.49	2.96	8.74	4889.91	4902.00	1.5749	4890.71
RW-2	4894.20	0.63	4894.60	2.51	6.30	4889.51	4897.18	1.3370	4886.94
RW-3	4895.38	0.81	4895.38	3.25	10.54	4890.95	4904.79	1.7299	4887.88
RW-4	4892.60	0.64	4892.29	2.57	6.59	4888.66	4898.22	1.3675	4888.31

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