Third Five-Year Review of Remedial Actions

Univar USA Inc.
3301 Edmunds Street Site
Albuquerque, New Mexico

September 2, 2005

PREPARED FOR

Univar USA Inc.

ARCADIS
Infrastructure, environment, buildings

ARCADIS

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Remedial Actions

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3301 Edmunds Street Site
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LIST OF ACRONYMS

1,1-DCE	1,1-dichloroethene
1,2-DCA	1,2-dichloroethane
1,1,1-TCA	1,1,1-trichloroethane
AEHD	Albuquerque Environmental Health Department
bls	below land surface
BTEX	benzene, toluene, ethylbenzene, xylene
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
cfm	cubic feet per minute
ELCR	excess life time cancer risk
gpm	gallons per minute
MCLs	maximum contaminant levels
NCP	National Contingency Plan
NMED	New Mexico Environment Department
NMWQCC	New Mexico Water Quality Control Commission
OSWER	Office of Solid Waste and Emergency Response
PCE	tetrachloroethene
PID	photo ionization detector
ppb	parts per billion
PRPs	potentially responsible parties
RAP	remedial action plan
ROD	Record of Decision
scfm	standard cubic feet per minute
TCE	trichloroethene
µg/L	micrograms per liter
USEPA	United States Environmental Protection Agency
VES	vapor extraction system
VOCs	volatile organic compounds

EXECUTIVE SUMMARY

On behalf of Univar USA Inc. (formerly Van Waters & Rogers Inc.), ARCADIS has prepared this third five-year review of remedial actions at the Univar facility located at 3301 Edmunds Street (the "site") in Albuquerque, New Mexico (Figure 1), as specified in Section VII paragraph 24 of the Consent Decree in the matter of the United States vs. Univar Corporation (USEPA, 1989). The purpose of this report is to summarize the remedial actions during the five year period since the previous five-year review completed September 14, 2000 (ARCADIS, 2000b), 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, modifications to the vapor extraction system (VES), and monitoring of the groundwater and presents all analytical and operation data collected during the five-year period from January 2000 through April 2005. The remedial system includes the recovery wells, groundwater treatment unit, infiltration gallery, VES, and associated equipment. Well construction details for the recovery wells and vapor extraction wells are included in Table 1 and the locations of the remedial systems are shown on Figure 2.

This five-year review was conducted pursuant to the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Section 121(c), 42 U.S.C. § 9621(c), the National Contingency Plan (NCP) (40 CFR § 300.430 (f)(4)(ii)), Office of Solid Waste and Emergency Response (OSWER) Directive 9355.7-02 (May 23, 1991), OSWER Directive 9355.7-02A (July 26, 1994), OSWER Directive 9355.7-03A (December 21, 1995), and draft OSWER Directive 9355.7-03B-P (draft Comprehensive Five-Year Review Guidance).

Section 121(c) of CERCLA requires that "*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each 5 years after initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented.*" Under the NCP, the Federal regulations which implement CERCLA, USEPA is required to conduct five-year reviews of a remedial action whenever, under the remedial action, "*hazardous substances, pollutants, or contaminants are remaining at the site above levels that allow unlimited use and unrestricted exposure.*"

This five-year review has been approved by the Director of the Superfund Division, USEPA Region 6. Although CERCLA Section 121(c) authorizes "the President" to undertake five year reviews, the President's authority was delegated to the Administrator of the USEPA by Executive Order 12580 (52 Fed. Reg. 2926, January 29, 1987), and this authority was further delegated to the USEPA's Regional Administrators on September 13, 1987, by USEPA Delegation No. 14-8-A. Finally, the authority was delegated to the Director of the Superfund Division by USEPA Region 6 Delegation No. R6-14-8-A on August 4, 1995.

The triggering action for this statutory review is the first five-year review, dated September 30, 1995 (G&M, 1995). This review is required because hazardous substances, pollutants, or contaminants remain in the subsurface at concentrations that are above levels that allow for unrestricted use of groundwater and for unrestricted exposure to groundwater.

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 (1,1-DCE); 1,1,1-trichloroethane (1,1,1-TCA); 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 City of 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. The remedial action for the site also includes operation of the VES, which was not included in the ROD.

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 (USEPA, 1989) and the remedial action plan (RAP) (G&M, 1990d) 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 have been conducted at the site since January 1991. During operation of the remedial system from June 1990 through April 2005, a total of 797,815,000 gallons of groundwater have been recovered, treated, and returned to the subsurface at an average flow rate of 101 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 (µg/L) in October 1990 and have steadily declined to 2.5 µg/L in April 2005, an overall decrease of 99.7 percent. Based on the annual average air emission rates calculated for the remedial system, approximately 752 pounds of the site related VOCs have been removed from the groundwater through April 2005. 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 April 2005.

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 declined at a rate of approximately one foot per year until 1997 when the groundwater elevations stabilized.

In November 1998, a VES was constructed at the site to improve effectiveness of the existing remedial system and more quickly reduce dissolved constituent concentrations to the maximum degree practical. Vapor samples were taken in October 1998 and January 1999 to determine the concentrations of site-related VOCs in the vapors in contact with underlying groundwater. An air quality permit to operate the VES was submitted to the City of Albuquerque Environmental Health Department, Air Quality

Division on March 19, 1999 and was approved on July 16, 1999. The VES pilot study was started on August 31, 1999. As a result of the VES pilot study, the VES system was expanded and nine additional wells were installed between October 16, 2000 and October 27, 2000. Over 1,000 pounds of VOCs were removed by the VES, through January 14, 2003. The City of Albuquerque, Environmental Health Department, Air Quality Division granted permission to discontinue the compliance sampling for the VES as required by Air Quality Permit No. 1190, NM/001/00570 on July 15, 2003 (City of Albuquerque, 2003).

The vapor extraction system testing conducted in the past has demonstrated the ability of soil vapor extraction to influence the flow of vapors in the subsurface. More importantly than the ability of this technology to influence vapor flow, operation of the VES also has been demonstrated to reduce VOC mass from the subsurface. Since initiation, the VES has removed over 1,000 pounds of site-related VOCs. Additionally, concentrations in groundwater samples have decreased in the areas targeted by the VES.

Air dispersion model calculations were performed to evaluate the location and magnitude of air stripper emissions from the treatment unit. Risk analysis using the results of the modeling indicate that air stripper emissions have not created an unacceptable health risk to site employees or local residents. The cumulative risk associated with fourteen years of air stripper emissions from the treatment unit has been calculated to be equivalent to an ELCR of 5.8×10^{-8}, which is below the USEPA acceptable guideline of 1×10^{-6}. .

The concentrations of site-related VOCs in samples collected from all but two groundwater monitoring wells at the site in April 2005 are below the established cleanup goals following fifteen years of groundwater extraction and the implementation of the vapor extraction remedial system in 1999. Routine monitoring and system flow modifications of the VES are expected to result in further improvement. A comparison of the April 2005 site-related VOC groundwater quality data with historic water-quality data shows that the concentrations of site-related VOCs have generally decreased within the area of groundwater impact. This decrease is attributable to the continued operations of the groundwater and vapor extraction remedial systems and confirms that operation of these systems is meeting the requirements of the Consent Decree (USEPA, 1989) and the RAP (Geraghty & Miller, Inc. 1990) of containment and reduction of site-related VOCs in groundwater.

The Safe Drinking Water Act and the NMWQCC Regulations were reviewed to determine if any changes had been made in the standards since the ROD (USEPA,

1988c) was completed. Two changes were identified. The cleanup goal as stated in the ROD (USEPA, 1988c) for trans-1,2-dichloroethene is 70 ppb. According to the National Primary Drinking Water Regulations, the maximum contaminant level (MCL) for trans-1,2-dichloroethene is 100 ppb. This change has not made the standard more stringent. The cleanup goal as stated in the ROD (USEPA, 1988c) for PCE is 20 ppb. According to the National Primary Drinking Water Regulations, the MCL for PCE is 5 ppb. This change does make the standard more stringent.

Representatives of USEPA and NMED took part in a site inspection on March 24, 2005. During the site inspection, the remedial system was observed.

There have not been any changes in exposure pathways and no changes in toxicity or other factors for constituents of concern. No deficiencies were discovered during this third five-year review. No additional information has come to light that could call into question the protectiveness of the remedy. No recommendations or follow-up activities are suggested at this time.

The remedial system at the site is protective of human health and the environment. The ELCR associated with the air discharge from the operation of the treatment unit during the fourteenth year of operation (June 2003 to June 2004) was 9.1×10^{-10} with a cumulative risk of 5.8×10^{-8} for the first fourteen years of operation (June 1990 to June 2004). These risks are well below the USEPA guidance of an RLCR of 1.0×10^{-6}, the maximum air discharge requirements specified by the RAP (G&M, 1990d). Based upon these risk factors and the fact that the concentration of site-related VOCs continues to decline, approval was granted by the USEPA to discontinue the air dispersion modeling. Additionally, the plume has been captured by the recovery wells and has not migrated further downgradient. The installation of the expanded VES has improved the effectiveness of the remedial system and has removed at least 1,000 additional pounds of VOCs.

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.

1.0 INTRODUCTION

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July 16, 1999. The VES pilot study was started on August 31, 1999. As a result of the VES pilot study, the VES system was expanded and nine additional wells were installed between October 16, 2000 and October 27, 2000.

In addition to operation of the groundwater remedial system and VES, 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.

2.0 SITE CHRONOLOGY

The following is a list of important site events and relevant dates. A complete site chronology is included as Appendix A.

- On June 22, 1988, the ROD for the Edmunds Street Groundwater Operable Unit was filed.
- In January 1989, the Remedial Investigation and Feasibility Study reports were submitted to the USEPA and New Mexico Environment Department (NMED).
- The Remedial Action Plan (RAP) was submitted to the USEPA and NMED on September 7, 1990.
- The system start-up program was conducted September 10, 1990 through January 14, 1991.
- On November 8, 1995, the first five-year review for the site was completed.
- In March 1996, USEPA and NMED gave verbal approval of modifications to the remedial system. These modifications included using Columbia Analytical Services as a laboratory, lower reporting limits, and elimination of analysis for benzene, toluene, ethylbenzene, and xylene (BTEX) and 1,2-dichloroethane (1,2-DCA) by USEPA Methods 8010 and 8020.
- Two groundwater monitoring wells were installed in March 1998, one as a replacement well (GM-22R) and one new well (GM-25).
- In November 1998, a VES was installed at the site.

- The air quality permit to operate the VES was submitted on March 19, 1999 and approved on July 16, 1999.
- The VES pilot study was started on August 31, 1999.
- On September 14, 2000, the second five-year review was completed.
- Between October 16 and October 27, 2000 nine additional vapor extraction wells were installed at the site.
- On July 15, 2003 the AEHD Air Quality Division granted permission to discontinue the compliance sampling for the VES as required by Air Quality Permit No. 1190, NM/001/00570.
- Univar received agreement from the USEPA and the NMED on March 25, 2004 to discontinue inorganic analysis of the groundwater treatment unit influent and effluent samples.
- On October 7, 2004 Univar received authorization from Mr. Terry Roundtree in an electronic communication to discontinue semi-annual sampling of the treatment unit influent and effluent and of the groundwater monitoring wells and to reduce the number of groundwater monitoring wells monitored annually.

3.0 BACKGROUND

3.1 Physical Characteristics

The site consists of approximately 6.5 acres located at in an industrial area in the southern portion of Albuquerque, New Mexico (Figure 1). The site is located approximately one-half mile west of the Albuquerque International Airport and approximately one-half mile east of the Rio Grande.

3.2 Land and Resource Use

The site has been used for various industrial and commercial purposes for approximately 50 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 Univar (formerly Van Waters & Rogers)

and SEC continued in the business of selling dry ice, chlorine, and ammonia gas. Univar began leasing the eastern portion of the property for its activities, while SEC continued to occupy the rest of the site. In 1974, Univar 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 Univar 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 Univar has been active at the site. In June 1988, Univar purchased the property from AmeriGas and has owned and operated the site since that time.

3.3 History of Contamination

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 (bls) and screened from 112 to 132 feet bls. 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 at the site; however, the water from well A-1 was used for non-consumptive purposes until the well was removed from service. This well was replaced by well A-2 in 1980. Well A-2 was completed to a depth of 522 feet bls and screened from 510 to 522 feet bls.

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 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 owners

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 Univar by Underground Resource Management (URM, 1982), American Ground-Water Consultants (AGC, 1983), and D'Appolonia Waste Management Services (DWMS, 1983 and 1984), respectively.

In 1985, ARCADIS (formerly 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 (G&M, 1985). 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 potential off-site migration. The work plan was submitted to the USEPA and NMED on March 26, 1987 and 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 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, 1989). A special report prepared by ARCADIS 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 Univar 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 (G&M, 1990d) and quality assurance project plan, created as an appendix to the RAP (G&M, 1990c), were prepared. 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.

4.0 REMEDIAL ACTIONS

4.1 Remedy Selection

As stated in the ROD (USEPA, 1988c), the remedial action selected consisted of the following parts " containment and collection of the contaminated groundwater through the use of an extraction well system, treatment of the recovered groundwater through packed tower aeration, and return the treated water to the aquifer through infiltration galleries." The ROD also states "The selected remedy would also include monitoring of groundwater, treated water and ambient air to ensure the effectiveness of the remedy." The selected remedial action was implemented in accordance with the Consent Decree (USEPA, 1989) and 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). A groundwater monitoring plan to determine the effectiveness of the remedial actions also was included in the RAP (G&M, 1990d).

4.2 Remedy Implementation

Extraction wells RW-01, RW-02, RW-03, and RW-04 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 bls, 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 is 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 of 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 are 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.

4.3 Groundwater Remedial System Operation and Maintenance

The groundwater treatment system for the site has been operating since June 4, 1990. The remedial system was started using a phased approach to ensure 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 conducted to determine the optimum range of flow rates for the remedial system. The details of the pilot programs and the startup program are described in the Five-Year Review of Remedial Actions (G&M, 1995).

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 April 2005, as specified in the RAP (G&M, 1990d). The following is a summary of the average flow rates for each year from January 2000 through April 2005, as well as any operational problems that occurred during this period of time. A more detailed chronology of events is included in Appendix A.

The groundwater remedial system operated at an average flow rate of 113 gallons per minute (gpm), excluding the approximately 10 days that the treatment unit was not operational, and an average annual flow rate of 110 gpm including the 10 inoperable days for the period February 2000 through April 2001. Operational problems that occurred during this time period included the repair of the effluent line, ball valve, and the electrical line to recovery well RW-04, the replacement of the pump and motor from recovery well RW-01 due to a loss of capacity, and the installation of a new motor in recovery well RW-02.

The groundwater remedial system operated at an average flow rate of 115 gpm, excluding the approximately three days the treatment unit was not operational, and at an average flow rate of 114 gpm including the three inoperable days for the period May 2001 through April 2002. Operational problems that occurred during this time period included the replacement of the modem used to download the total flow information for the groundwater treatment system in September 2001 and again in November 2001, repair of a leak in the Aquamag line, and the replacement of the starter for recovery well RW-02.

The groundwater remedial system operated at an average flow rate of 115 gpm, excluding the approximately nine days the treatment unit was not operational, and an average annual flow rate of 112 gpm including the nine inoperable days for the period May 2002 through April 2003. Operational problems included the replacement of fuses in RW-04, the subsequent replacement of the motor on the pump for RW-04, the replacement of a section of drop pipe and the addition of a sounding tube in well A-01, and the replacement of the pump and motor in RW-03.

The groundwater remedial system operated at an average flow rate of 113 gpm, excluding the approximately nine days the treatment unit was not operational, and at an average flow rate of 110 gpm including the nine inoperable days for the period May 2003 through April 2004. Operational problems that occurred during this time period included replacement of the starter for the pump in RW-03.

The groundwater remedial system operated at an average flow rate of 110 gpm, excluding the approximately four days the treatment unit was not operational, and at an average flow rate of 109 gpm including the four inoperable days for the period May 2004 through April 2005. Operational problems included the resetting a tripped breaker in RW-03.

4.4 Vapor Extraction System Expansion

Given the success of the VES pilot program as described in the Second Five-Year Review of Remedial Actions (AG&M, 2000b), the VES was expanded to target a larger area of the site. The Scope of Work for Vapor Extraction System Expansion (2000) was approved by the USEPA and NMED in October 2000. The expansion included drilling, installation, and connection of nine new vapor extraction wells designated VE-5, VE-6, VE-7, VE-8, VE-9, VE-10, VE-11, VE-12, and VE-13, connection of two existing vapor extraction wells designated VE-1 and VE-4, and connection of groundwater monitoring wells GM-11S and GM-26 to the VES. The locations of these wells are shown on Figure 2.

The VES pilot study was implemented to evaluate the applicability of using a VES to improve the existing remedial action of the groundwater extraction/treatment system operating at the site and to provide design details for possible future expansion of the system.

The system was initially connected through underground piping to monitoring wells GM-02, GM-05, and GM-09S and vapor well VE-3. Vapor well VE-1 was temporarily connected to the system during a portion of the pilot study. The valve configuration of the system was designed to withdraw vapors from each well individually or in any combination.

The VES installed at the site consists of a self-contained extraction blower, vapor-liquid separator (knockout pot) and associated controls, valves and piping (Figure 3). The system has a maximum throughput of approximately 450 standard cubic feet per minute (scfm). The blower is a 15-horsepower, rotary-lobe blower equipped with a variable speed drive. The system is housed within a wheel-mounted and locked trailer positioned in the southeast corner of the Univar property (Figure 4).

The pilot study was divided into three separate tests: 1) flow response test, 2) vacuum response test, and 3) long-term performance test. These tests and their results are described in detail in the Second Five-Year Review of Remedial Actions (AG&M, 2000b).

The long-term performance test began upon completion of the vacuum response test on September 2, 1999. Given the success of the VES pilot program, it was appropriate to expand the pilot system and effect removal of VOC mass to the degree practical. During April 2000, additional testing was performed at the site to evaluate the potential for using existing groundwater monitoring wells in an expanded VES pilot study. The plan for this supplemental testing was discussed at meeting with the USEPA and NMED in February 2000.

The supplemental testing performed in April 2000 consisted of using a portable blower to extract vapors from monitoring wells GM-01, GM-11S, GM-12R, GM-13, GM-16, GM-21, GM-22 and vapor well VE-4. The objective of the test was to determine if adequate vapor flow could be withdrawn from these existing wells, and to monitor the VOC concentrations in the soil vapor extracted from each location. In most cases three vacuums were applied at each well location and flow rates were measured for each vacuum using a pitot tube and digital manometer. Field screening of the extracted soil vapor was performed at each location using a mini-Rae Photo Ionization Detector (PID). Table 2 provides the calculated flow rate under the maximum applied vacuum along with the field screening results for each location tested.

Vapor samples were collected from monitoring wells GM-13 and GM-16, and vapor well VE-4 in conjunction with this test. The samples were analyzed outside the method recommended holding time. The samples were originally shipped to the Phoenix laboratory of Orange Coast Analytical for analysis by USEPA Method 8260. However, due to equipment problems at the Phoenix laboratory, the samples were later sent to the lab's Tustin, California facility. ARCADIS authorized the sample analysis outside of the hold time in an effort to obtain qualitative data for informational purposes. However, the reported results did not correlate with the field screening results. Therefore, the results are considered suspect and were not used in the evaluation.

It should be noted that each of the monitoring wells included in this test were installed during the site investigation stage of the project (or as replacement wells) with the well constructions designed for groundwater monitoring. These monitoring wells were installed using mud rotary drilling techniques. Vapor well VE-4 was installed using a hollow stem auger drill rig and was designed for the purpose of vapor extraction.

As shown in Table 2, vapor flow from vapor well VE-4 (hollow stem auger installation) was comparable with the flow rates observed from vapor wells VE-1 and VE-3 during the Long Term Monitoring Test (AG&M, 2000a). In contrast, the majority of the monitoring wells (mud rotary installation) showed low to no flow under

the maximum vacuum applied during this test. In most cases, the unsaturated zone of the borehole wall does not appear conducive to vapor flow. This finding is potentially due to mud cake on the borehole wall which is an artifact of the mud rotary drilling method. Although the saturated portions of these wells were successfully developed for groundwater sampling and the wells remain suitable for that purpose, test results indicate these monitoring wells are not ideal for vapor extraction. Monitoring wells GM-11S and GM-16 were the only monitoring wells that produced measurable flow during the supplemental testing.

Drilling and well installation took place from October 16 through 27, 2000. The locations of the vapor extraction wells are shown on Figure 2. Rodgers Environmental, Inc. drilled the soil borings using a hollow stem auger drill rig. ARCADIS personnel observed the drilling and well installation. Soil samples were collected every 5 feet from vapor extraction well VE-10 and every 10 feet from vapor extraction well VE-7 using a split-spoon sampler for the purpose of logging the soil. The soil from vapor extraction wells VE-5, VE-6, VE-8, VE-9, VE-11, VE-12, and VE-13 were logged from the drill cuttings every 5 feet. Well construction details are provided in Table 1.

On October 27, 2000, existing vapor extraction well VE-1 was filled with bentonite pellets which were hydrated to 58 feet bls to seal off the bottom 43 feet of the vapor extraction well. This vapor extraction well is now screened from 9 feet bls to 58 feet bls.

Rodgers Environmental was contracted to complete the trenching and pipe installation. The work was completed from November 6 through 15, 2000. ARCADIS personnel observed the operations.

The trenches for the piping ranged from 2 to 4 feet in depth and were sloped from the wellhead toward the trailer housing the VES blower. Four-inch schedule-40 poly vinyl chloride piping was used for each individual extraction line. Individual sumps were installed at the end of each extraction line for collection of condensate water. The individual lines were connected to a valve manifold located adjacent to the trailer housing the VES blower. The manifold was connected to the VES blower by a 4-inch diameter pipe.

Common trenches were used where possible to minimize the amount of trenching. Trench locations are provided on Figure 4. After the pipe was placed, the trenches were backfilled with native material and compacted.

Startup of the expanded VES began on December 6, 2000. A flow response test was conducted during startup to evaluate achievable flow rates under various levels of

applied vacuum. A total of 11 tests were performed which consisted of individual tests for each of the new vapor extraction wells (VE-1, VE-4, VE-5, VE-6, VE-7, VE-8, VE-9, VE-10, VE-11, VE-12, and VE-13). Although groundwater monitoring wells GM-26 and GM-11S were connected to the system for possible future vapor extraction use, these wells were not opened initially.

The flow response test consisted of measuring the flow rate achieved from each individual well under 3 vacuum levels. The applied vacuum was adjusted using a dilution air valve. The highest vacuum was applied by completely closing the dilution air valve. The lowest vacuum was applied by completely opening the dilution air valve. A middle vacuum was achieved by adjusting the dilution air valve to obtain a vacuum between the low and high vacuums. The results of the flow response test are provided on Table 3.

A sample of the extracted soil vapor was obtained from each vapor extraction well under the high vacuum scenario and submitted for laboratory analysis by USEPA Method 8260. A summary of the analytical results is included in Table 4. As expected, PCE was the constituent identified at the highest concentrations.

Results of the expansion test confirmed adequate flow response from each of the new vapor extraction wells and detection of PCE in several vapor samples. The system was left operating with 11 new wells and 2 of the original wells (GM-09S and VE-3) open. Total system flow for this configuration was measured at approximately 530 cubic feet per minute (cfm) at a vacuum of 3.2 inches of mercury. Air samples were then collected on December 6, 2000 from the combined air stream to confirm compliance with the air permit. Results confirmed that measured VOC concentrations were well below permit limits. The City of Albuquerque agreed to reduce the compliance-sampling schedule from quarterly to semiannually following the sampling event conducted on December 6, 2000.

4.5 Vapor Extraction System Operation and Maintenance

Routine operation and maintenance of the vapor extraction system has been conducted on a monthly basis since completion of the system startup for the expansion program in December 2000. The condensate collection sumps were drained as needed and discharged to the groundwater treatment unit through the influent line for recovery well RW-01. Monitoring included monthly field measurements of flow through May 2005 and the calculated flow rates are provided in Table 5. Based on the evaluation of the flow rates, the well network was adjusted as needed to balance the flow contribution from the extraction wells.

The following is a summary of the major operational problems for the VES that occurred from December 2000 through April 2005. A more detailed chronology of operation and maintenance events is included in Appendix A. The blower for the VES stopped working on December 7, 2001, and was replaced with the exact same model on January 4, 2002. The piping for vapor well VE-01 was run over on November 12, 2002 and the piping was cut off at ground level and capped. The VES was shutdown on August 12, 2003 due to a loose drive shaft in the blower unit and the unit was sent in for repairs. The blower unit was reinstalled and restarted on September 16, 2003. On February 12, 2004, the VES seized and was shutdown for the second time. The blower unit was repaired and reinstalled and restarted on March 9, 2004.

4.6 Operation and Maintenance Costs

The annual operations and maintenance costs as stated in the ROD (USEPA, 1988c) for the pumps and recovery wells, aeration tower, and infiltration gallery were estimated to be approximately $37,000 per year. Table 6 is a summary of the actual costs from January 1, 2000 through December 31, 2004. Based on the actual costs, the average annual cost for operation and maintenance of the remedial system is approximately $63,350. The costs were higher than the estimated average in for 2000, 2001, and 2002 due to the expansion of the vapor extraction system. These costs included trenching and installation costs and additional monitoring during integration of the additional VES wells. These costs as stated in the ROD did not include installation, operation and maintenance of a vapor extraction system. The average costs for operation and maintenance of the groundwater remedial system for the period 2000 to 2004 were approximately $13,150 per year. The O&M costs for 2003 and 2004 for both the VES and the groundwater systems averaged $28,200 annually, which is below the estimated $37,000 per year.

4.7 Progress Since the Last Five-Year Review

Since the first five-year review completed on September 14, 2000, the remedial system has operated as designed and is still protective of human health and the environment. In order to improve the existing remedial action of groundwater extraction/treatment, a VES was installed in November 1998 and the long term performance test portion of the pilot study was concluded in January 2001. Additional VES wells were installed between October 16 and October 27, 2000 based on the success of the initial portion of the VES pilot test. The addition of the VES to the groundwater treatment system has contributed to a dramatic reduction in the concentration of site-related VOCs in groundwater as will be shown in the data analysis section of this report.

5.0 FIVE-YEAR REVIEW PROCESS

The third five-year review for the site was led by Mr. Greg Lyssy of the USEPA. The following team members assisted in the review:

- Terry Roundtree, USEPA
- Susan Morris, NMED Superfund Section
- George Sylvester, Univar USA, Inc.
- Kathryn Brantingham, ARCADIS G & M, Inc.
- Tiffany Looff, ARCADIS G & M, Inc.

This third five-year review consisted of the following activities: a site inspection, a review of relevant documents, and data review.

6.0 FIVE-YEAR REVIEW FINDINGS

6.1 Site Inspection

Representatives of USEPA and NMED took part in a site inspection on March 24, 2005. During the site inspection, the remedial system was observed.

6.2 Changes to Standards

The Safe Drinking Water Act and the NMWQCC Regulations were reviewed to determine if any changes had been made in the standards since the ROD (USEPA, 1988c) was completed. No changes were identified since the Second Five-Year Review of Remedial Actions (AG&M, 2000b).

A comparison between the cleanup goals as stated in the ROD (USEPA, 1988c) and the current standards are summarized as follows:

Constituent	Cleanup Goal as stated in the ROD		Current Standards (ppb)	
	Concentration (ppb)	Source	NMWQCC[1]	MCL[2]
acetone	NE	NA	NE	NE
carbon tertrachloride	5	MCL	10	5
chloroform	100	NMWQCC	100	NE
1,2-dichloroethane	5	MCL	10	5
trans-1,2-dichloroethene	70	MCLG	NE	100
1,1-dichloroethene	5	NMWQCC	5	7
methyl chloride	100	NMWQCC	100	NE
tetrachloroethene	20	NMWQCC	20	5
1,1,1-trichloroethane	60	NMWQCC	60	200
trichloroethene	5	MCL	100	5

TABLE NOTES:

NE	not established
NA	not applicable
ROD	Record of Decision
ppb	parts per billion
NMWQCC	New Mexico Water Quality Control Commission discharge regulations
MCL	maximum contaminant level under the Safe Drinking Water Act
(1)	NMWQCC Regulations, September 15, 2002
(2)	National Primary Drinking Water Regulations as of July, 2002

6.3 Changes in Exposure Pathways, Toxicity and Other Contaminant Characteristics

There were no changes in exposure pathways, toxicity, or other contaminant characteristics.

6.4 Data Evaluation

6.4.1 Groundwater 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). Groundwater remedial system monitoring included collecting samples from the treatment unit influent and effluent, collecting samples from the individual recovery wells, continuously recording the influent flow rate and total amount of water treated, and measuring the depth to groundwater in the recovery wells and monitoring wells.

Monitoring of the groundwater remedial system is conducted to assess the overall effectiveness of the treatment unit in achieving the discharge criteria as specified in Section 3.2.2.2 of the RAP (G&M, 1990).

Monthly monitoring of the remedial system was conducted from February through July 1991, continued on a quarterly basis from July 1991 through April 1995, semiannually from April 1995 through January 2004, and annually beginning April 2004. The constituents analyzed during the sampling events from April 2000 through April 2005 are summarized in Table 7. This information also has been summarized in the Annual Progress Reports prepared for the site (AG&M, 2000a and 2001, ARCADIS 2002, 2003, 2004, and 2005) and is discussed below. The analytical results for samples collected from the groundwater remedial system from April 2000 through April 2005 are summarized in Tables 8 through 11. A summary of site-related VOCs from June 1990 through April 2005 is presented in Tables 12 and 13.

The VOC analytical results for the samples collected from the treatment unit in April 2005 are consistent with previously reported data in that concentrations of the site-related VOCs are continuing to decrease in the treatment unit influent and remain below detectable levels in the treatment unit effluent.

The analytical results show that the concentrations of site-related VOCs detected in samples collected from the treatment unit influent have decreased through the operation of the groundwater remedial system. To illustrate this fact, the concentrations of site-related VOCs detected in samples collected from the treatment unit influent were plotted against time (Appendix B). The time trend plots of the analytical results indicate that the concentrations of site-related VOCs detected in samples collected from the treatment unit influent reached a maximum during the first year of operation and have continued to decrease since that time. The maximum concentration of total site-related VOCs detected in samples collected from the treatment unit influent, 925 micrograms per liter (µg/L), was reported in October 1990 and the concentration of total site-related VOCs detected in samples collected from the treatment unit influent decreased to 2.5 µg/L in April 2005, an overall decrease of 99.7 percent.

The time trend plots also show that the concentration of 1,1,1-TCA and 1,1-DCE detected in samples collected from the treatment unit influent are currently below the clean up goals of 60 µg/L and 5 µg/L, respectively and below the laboratory detection limit of 1 µg/L. Concentrations of 1,1,1-TCA in samples collected from the treatment unit influent have always been below the clean up goal of 60 µg/L and have been below the laboratory reporting limit of 1 µg/L since 1997. Concentrations of 1,1-DCE

have been below the cleanup goal of 5 µg/L since December 1996 and below the laboratory detection limit of 1 µg/L since April 2002. The concentration of trichloroethene (TCE) in the sample collected from the treatment unit influent was below the laboratory detection limit of 1 µg/L for the April 2005 sampling event. The tetrachloroethene (PCE) in the sample collected from the treatment unit influent in April 2005 was 2.5 µg/L. The concentrations of TCE and PCE are below their respective cleanup goals of 5 µg/L and 20 µg/L and are at or below their respective MCLs.

The concentrations of site-related VOCs detected in samples collected from the treatment unit effluent also were plotted against time (Appendix B). The time trend analyses show the concentrations of VOCs in the samples collected from the treatment unit effluent remained below the reporting limits in April 2005 and have been consistently below the reporting limits since the startup of the groundwater remedial system in June 1990. Based on these results, the treatment unit effluent has been in compliance with the groundwater discharge criteria, as specified in the Consent Decree (USEPA, 1989) and the RAP (Geraghty & Miller, Inc. 1990).

The April 2005 analytical results for samples collected from the recovery wells indicate that all site-related VOCs remained below the cleanup goals and have been below the cleanup goals since October 2003. The analytical results for the samples collected from the recovery wells in April 2005 indicated that 1,1-DCE and 1,1,1-TCA are below the laboratory detection limit of 1.0 µg/L for all four recovery wells (RW-01, RW-02, RW-03, RW-04). The results also indicated that PCE and TCE were below the laboratory detection limit of 1.0 µg/L in recovery well RW-01. Additionally, the April 2005 analytical results for all four recovery wells indicate that TCE and PCE are below the cleanup goals of 5 and 20 µg/L, respectively. The time trend analyses for the four recovery wells are shown in Appendix B.

The analytical results for petroleum related compounds (BTEX and 1,2-DCA) in samples collected from the treatment unit influent and effluent and recovery wells from April 2000 through April 2005 are summarized in Table 10. These results show that BTEX were never detected above reporting limits in samples collected from the treatment unit influent and effluent or the recovery wells.

Analytical results for cations and anion concentrations have been consistent throughout the operation of the remedial system. The data for the period of April 2000 through April 2003 are summarized in Table 11. In February 2004, ARCADIS requested on behalf of Univar to discontinue inorganic compounds analysis of Treatment Unit influent and effluent samples. Univar received agreement from the USEPA and the

NMED on March 25, 2004 to discontinue inorganic analysis of the Treatment Unit influent and effluent samples.

The treatment unit influent and effluent streams, the individual recovery wells, and the groundwater monitoring samples collected in April 2005 were analyzed for 1,4-dioxane using USEPA Method SW8270C as requested by the USEPA during a meeting with Univar on June 16, 2004. The results are summarized in Table 14.

From June 4, 1990 through April 30, 2005, a total of approximately 797,815,000 gallons of groundwater have been recovered, treated, and returned to the subsurface at an average flow rate of 101 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 and maintenance problems discussed previously.

The average annual air emission rates were calculated for each year of treatment unit operations and are reported in the annual progress reports. These average air emission rates for each year are lower than those initially calculated, based on a maximum design flow rate of 150 gpm and 100 percent removal efficiency, as presented in Table 2 of the RAP (Geraghty & Miller, Inc. 1990). Therefore, the groundwater remedial system has been in compliance with the air discharge criteria as specified in the RAP (Geraghty & Miller, Inc. 1990).

The average air emission rates were used to calculate the pounds of site-related VOCs from the aquifer annually. The groundwater remedial system has removed a total of approximately 752 pounds of site-related VOCs from the aquifer from June 1990 through April 2005. A summary of the pounds of site-related VOCs removed over the fifteen years of operation is shown on Figure 5. As shown, the majority of mass was removed during the first nine years of operation and has reached an asymptotic level since that time with only 1 pound being removed from April 2004 through April 2005.

As specified in Section 3.5 of the RAP (Geraghty & Miller, Inc. 1990), air dispersion model calculations have been performed annually through June 2004, using the method described in 40 CFR, Part 50, Appendix W, to evaluate both the location and magnitude of maximum exposure to the air stripper emissions from the treatment unit. These calculations were necessary to ensure that operation of the treatment unit was not creating an unacceptable health risk to local residents and site employees. To evaluate worst-case conditions, the conservative SCREEN3 air quality dispersion model was used to predict the maximum ambient 1-hour average concentration

resulting from source operation. The SCREEN3 model uses assumed worst-case meteorology and assumes a direct downwind receptor alignment.

The modeling results for 2004 are shown in Table 15 and indicated that the excess lifetime cancer risk (ELCR) associated with the operation of the air stripper was 9.1 x 10^{-10} with a cumulative risk of 5.8 x 10^{-8} for the 14-year period of operation (1990 to 2004). These risks are well below the USEPA guidance of an ELCR of 1 x 10^{-6} and the maximum air discharge requirements specified by the Consent Decree and the RAP (Geraghty & Miller, Inc. 1990) indicating that the air emissions from the operation of the remedial system are in compliance with these guidelines. Since the concentrations of site-related VOCs in the groundwater in samples collected in 2005 are lower than the concentrations reported in 2004 and have always been below the AEHD discharge criteria, ARCADIS received permission to discontinue air dispersion modeling from the Mr. Gregory Lyssy of the USEPA in an electronic communication dated May 13, 2005.

6.4.2 Vapor Extraction System Monitoring

Monitoring of the VES consisted of field screening of extracted soil vapors and collection of vapor samples. The results of the field screening measurements from the time of system startup in September 1999 through May 2004 are summarized in Table 16. These results indicate that concentrations of VOCs in the extracted soil vapor were consistently below the detection capability of the field instrument starting in July 2001 and therefore were discontinued in June 2004.

Vapor samples were collected from the VES effluent and individual vapor extraction wells from the time of system startup in September 1999 through Janaury 2003. A summary of the site-related VOCs and toluene for this period of time is included as Table 17. Because these samples were collected under different vacuum conditions, the results cannot be directly compared. However, the analytical results concur with the field screening results showing a decline in the concentration of extracted vapors since initiation of the pilot study with current concentrations at or below the laboratory reporting limit. The AEHD Air Quality Division granted permission to discontinue the compliance sampling for the VES as required by Air Quality Permit No. 1190, NM/001/00570 on July 15, 2003.

The mass recovery rate calculated for each site-related VOCs detected in the VES effluent samples and the combined total site-related VOC mass recovery rate for the system from initiation of the pilot study through January 2003 are summarized in Table

18. These calculations are based on the analytical results for the VES effluent and the measured VES flow rate for each sampling event.

The trend in total mass recovery rate during the period from August 31, 1999 through January 2003 is illustrated in Figure 6. Mass recovery rates between sampling events were estimated using a straight-line interpolation. The distribution of mass removed by constituent through January 2003 is illustrated in Figure 7. As shown on this figure, over 1,000 pounds of VOCs have been removed by the VES.

6.4.3 Groundwater Monitoring

Depth to groundwater measurements were collected monthly from January 1991 to July 1991 and quarterly from July 1991 through April 2005 in all of the recovery 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 C. Calculated groundwater elevations through April 2005 also were plotted as a function of time to illustrate groundwater elevation trends and these graphs are in Appendix D. These graphs indicate groundwater elevations at the site have declined at a rate of approximately one foot per year until 1997 when the groundwater elevations stabilized. Monitoring wells GM-19 and GM-20 increased in groundwater elevations upon startup of the remedial system but stabilized in 1996. These two monitoring wells are located near the southern end of the infiltration gallery (Figure 2) and show the effect of the infiltrated water mounding on the water table.

The groundwater elevations in shallow monitoring wells and the recovery wells were mapped to illustrate the configuration of the water-table surface and are included in the annual progress reports. The maps for March 13, 1991, April 1995, April 2000, April 2001, April 2002, April 2003, April 2004, and April 2005 are in included in Appendix E. 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 and supports there is a hydraulic capture zone that includes the area of documented groundwater impact from the site.

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 2003, and

annually beginning in April 2004. Samples were collected from the monitoring wells to monitor the overall effectiveness of the remedial system in achieving the cleanup objectives. This monitoring information has been summarized in the Annual Progress Reports prepared for the site (AG&M 2000 and 2001, ARCADIS 2002, 2003, 2004, and 2005) and is discussed below.

The construction information for the groundwater recovery wells and monitoring wells is summarized in Table 1. Sampling locations and analytical parameters for each sampling event from April 2000 through April 2005 are summarized in Table 7 and the analytical results are summarized in Table 9. The analytical results for petroleum related compounds (BTEX and 1,2-DCA) in samples collected from April 2000 through April 2005 are summarized in Table 10. A summary of site-related VOCs from June 1990 through April 2005 is presented in Table 13.

To evaluate VOC 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 B). Additionally, distribution maps were prepared annually for the four site-related compounds and were included in the annual progress reports. The distribution maps for the site-relate compounds for the August 1989 (prior to construction of the groundwater remedial system), April 1995, April 2000, April 2001, April 2002, April 2003, April 2004, and April 2005 sampling events are included in Appendices F, G, H, and I.

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 since the startup of the groundwater remedial system in June 1990 and the addition of the VES enhancement to the remedial system (Table 13 and Appendix B):

- Concentrations of site-related VOCs have been less than the laboratory reporting limits or occasionally just above the laboratory reporting limits in samples collected from monitoring wells GM-07, GM-09D, GM-11D, GM-14S, GM-15D, GM-15S, GM-17D, GM-17S, GM-19, GM-20, GM-23, GM-24D, GM-24S, GM-25, GM-26, HL-01, A-1, and A-2.

- Concentrations of site-related VOCs appear to have peaked and are now below the laboratory reporting limits in samples collected from monitoring wells GM-03, GM-04, GM-05, GM-06, GM-10, GM-14D, and GM-22R.

- Concentrations of site-related VOCs appear to have peaked and are now below the cleanup goals but not below the laboratory reporting limit in

samples collected from monitoring wells GM-01, GM-02, GM-08, GM-09S, GM-11S, GM-13, GM-16, GM-22, and I-01.

- Concentrations of site-related VOCs appear to have peaked and shown appreciable reduction in the concentrations but are still above the cleanup goals in samples collected from monitoring wells GM-12R and GM-21.

- The VOC analytical results indicate that the groundwater remedial system designed for the site has been and continues to be effective at capturing and reducing the concentrations of site-related compounds present in the aquifer.

- The VES operating at the site is specifically designed to enhance the groundwater remedial system and a significant reduction in concentrations of site-related compounds has been observed since the start up of the VES.

7.0 ASSESSMENT

7.1 Is the remedy functioning as intended by decision documents?

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 remedial system has been operating within the limits set by the Consent Decree (USEPA 1989) and the RAP (G&M, 1990d). As discussed, routine operations and maintenance of the system has occurred since operation began in January 1991. Additional operation and maintenance problems have been addressed as they have become known. The costs associated with operation and maintenance of the remedial system are within the amount originally estimated in the ROD (USEPA, 1988c).

From June 4, 1990 through April 30, 2005, a total of approximately 797,815,000 gallons of groundwater have been recovered, treated, and returned to the subsurface at an average flow rate of 101 gpm. The groundwater remedial system has successfully treated site-related VOCs to below the groundwater discharge criteria specified in Table 1 of the RAP (Geraghty & Miller, Inc. 1990). A historic evaluation of the treatment unit influent water quality shows that the maximum concentrations of site-

related compounds were measured in samples collected in October 1990 (925 µg/L, total) and have decreased to 2.5 µg/L in April 2005. The recovery system for the site has removed approximately 1 pound of the site-related VOCs from the aquifer from May 1, 2004 through April 30, 2005 and over 750 pounds of the site-related VOCs over the fifteen years of operation, based on calculations of system performance. The analytical results collected from the remedial system indicated that the treatment unit continues to operate within the applicable groundwater discharge criteria.

The vapor extraction system testing conducted in the past has demonstrated the ability of soil vapor extraction to influence the flow of vapors in the subsurface. More importantly than the ability of this technology to influence vapor flow, operation of the VES also has been demonstrated to reduce VOC mass from the subsurface. Since initiation, the VES has removed over 1,000 pounds of site-related VOCs. Additionally, concentrations in groundwater samples have decreased in the areas targeted by the VES.

Evaluation of water-level measurements taken throughout the fifteen years of operating the groundwater remedial system indicates that a hydraulic gradient towards the recovery wells has been created within the area impacted by site-related VOCs.

Air dispersion model calculations were performed to evaluate the location and magnitude of air stripper emissions from the treatment unit. Risk analysis using the results of the modeling indicate that air stripper emissions have not created an unacceptable health risk to site employees or local residents. The cumulative risk associated with fourteen years of air stripper emissions from the treatment unit has been calculated to be equivalent to an ELCR of 5.8×10^{-8}, which is below the USEPA acceptable guideline of 1×10^{-6}.

The concentrations of site-related VOCs in samples collected from all but two groundwater monitoring wells at the site in April 2005 are below the established cleanup goals following fifteen years of groundwater extraction and the implementation of the vapor extraction remedial system in 1999. Routine monitoring and system flow modifications of the VES are expected to result in further improvement. A comparison of the April 2005 site-related VOC groundwater quality data with historic water-quality data shows that the concentrations of site-related VOCs have generally decreased within the area of groundwater impact. This decrease is attributable to the continued operations of the groundwater and vapor extraction remedial systems and confirms that operation of these systems is meeting the requirements of the Consent Decree (USEPA, 1989) and the RAP (Geraghty & Miller, Inc. 1990) of containment and reduction of site-related VOCs in groundwater.

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.

7.2 Are the assumptions used at the time of the remedy selection still valid?

The Safe Drinking Water Act and the NMWQCC Regulations were reviewed to determine if any changes had been made in the standards since the ROD (USEPA, 1988c) was completed. Two changes were identified. The cleanup goal as stated in the ROD (USEPA, 1988c) for trans-1,2-dichloroethene is 70 ppb. According to the National Primary Drinking Water Regulations, the MCL for trans-1,2-dichloroethene is 100 ppb. This change has not made the standard more stringent. The cleanup goal as stated in the ROD (USEPA, 1988c) for PCE is 20 ppb. According to the National Primary Drinking Water Regulations, the MCL for PCE is 5 ppb. This change does make the standard more stringent.

There have not been any changes in exposure pathways and no changes in toxicity or other factors for constituents of concern.

7.3 Has any other information come to light that could call into question the protectiveness of the remedy?

No additional information has come to light that could call into question the protectiveness of the remedy.

8.0 DEFICIENCIES

No deficiencies were discovered during this third five-year review.

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIVITIES

No recommendation or follow-up activities are required at this time.

10.0 PROTECTIVENESS STATEMENT

The remedial system at the site is protective of human health and the environment. The ELCR associated with the air discharge from the operation of the treatment unit during the fourteenth year of operation (June 2003 to June 2004) was 9.1×10^{-10} with a cumulative risk of 5.8×10^{-8} for the first fourteen years of operation (June 1990 to June 2004). These risks are well below the USEPA guidance of an RLCR of 1.0×10^{-6}, the

maximum air discharge requirements specified by the RAP (G&M, 1990d). Based upon these risk factors and the fact that the concentration of site-related VOCs continues to decline, approval was granted by the USEPA to discontinue the air dispersion modeling. Additionally, the plume has been captured by the recovery wells and has not migrated further downgradient. The installation of the expanded VES has improved the effectiveness of the remedial system and has removed at least 1,000 additional pounds of VOCs.

11.0 NEXT REVIEW

The next five-year review is scheduled to be conducted in 2010 in accordance with policy.

12.0 REFERENCES

American Groundwater Consultants (AGC), 1983. Hydrogeology of the AmeriGas Property, Albuquerque, New Mexico: Prepared for Counsel to AmeriGas, Inc., Valley Forge Pennsylvania, 1983.

ARCADIS Geraghty & Miller, Inc. (AG&M), 2000a. 2000 Annual Progress Report for Remedial Actions at the Van Waters & Rogers Inc., 3301 Edmunds Street Site, Albuquerque, New Mexico, July 2000.

ARCADIS Geraghty & Miller, Inc. (AG&M), 2000b. Second Five-Year Review of Remedial Actions, Van Waters & Rogers Inc., 3301 Edmunds Street Site, Albuquerque, New Mexico, September 14, 2000.

ARCADIS Geraghty & Miller, Inc. (AG&M), 2001. 2001 Annual Progress Report for Remedial Actions at the Vopak USA Inc., 3301 Edmunds Street Site, Albuquerque, New Mexico, July 2001.

ARCADIS G & M, Inc. (ARCADIS), 2002. 2002 Annual Progress Report for Remedial Actions at the Vopak USA Inc., 3301 Edmunds Street Site, Albuquerque, New Mexico, July 2002.

ARCADIS G & M, Inc. (ARCADIS), 2003. 2003 Annual Progress Report for Remedial Actions at the Univar USA Inc., 3301 Edmunds Street Site, Albuquerque, New Mexico, July 2003.

ARCADIS G & M, Inc. (ARCADIS), 2004. 2004 Annual Progress Report for Remedial Actions at the Univar USA Inc., 3301 Edmunds Street Site, Albuquerque, New Mexico, July 2004.

ARCADIS G & M, Inc. (ARCADIS), 2005. 2005 Annual Progress Report for Remedial Actions at the Univar USA Inc., 3301 Edmunds Street Site, Albuquerque, New Mexico, July 2005.

D'Appolonia Waste Management Services (DWMS), 1983. Geophysical Survey of Van Waters & Rogers Inc. Facility, Albuquerque, New Mexico, March 24, 1983.

D'Appolonia Waste Management Services (DWMS), 1984. Evaluation of Soil and Water Contamination at the AmeriGas Property, South Valley, Albuquerque, New Mexico (Final Report). Prepared for Counsel to Van Waters & Rogers Inc. (Univar Corporation), Seattle, Washington, 1984.

Geraghty & Miller, Inc. (G&M), 1985. Source Control Investigation at 3301 Edmunds Street, S.E., Albuquerque, New Mexico, 1985.

Geraghty & Miller, Inc. (G&M), 1989a. Remedial Investigation Report, 3301 Edmunds Street Site, S.E., Albuquerque, New Mexico, January 1989.

Geraghty & Miller, Inc. (G&M), 1989b. Feasibility Study Report, 3301 Edmunds Street Site, Albuquerque, New Mexico, January 1989.

Geraghty & Miller, Inc. (G&M), 1990a. Remedial Design Report, Groundwater Remediation Project, 3301 Edmunds Street Site, Albuquerque, New Mexico, April 1990.

Geraghty & Miller, Inc. (G&M), 1990b. Quality Assurance Project Plan for Ground-Water Sampling and Analyses During Remedial Action Activities at 2201 Edmunds Street, Albuquerque, New Mexico, July 1990.

Geraghty & Miller, Inc. (G&M), 1990c. Remedial Action Plan, 3301 Edmunds Street Site, Albuquerque, New Mexico, September 1990.

Geraghty & Miller, Inc. (G&M), 1995. Five Year Review of Remedial Actions at the Van Waters & Rogers Inc. 3301 Edmunds Street Site, Albuquerque, New Mexico, November 8, 1995.

Geraghty & Miller, Inc. and Harding Lawson Associates, Inc., (G&M/HLA) 1989. SJ-6 Study Area Groundwater Flow and Contaminant Transport Analysis, Van Waters & Rogers Inc., Inc., Edmunds Street Site, Albuquerque, New Mexico, February 10, 1989.

Gorrod, H.M., 1995. United States Environmental Protection Agency. Letter to George Sylvester, Univar Corporation, and Katy Brantingham, Geraghty & Miller, Inc., April 20, 1995.

Harding Lawson Associates, Inc., 1989. Public Health Evaluation, Van Waters & Rogers Inc., Edmunds Street Site, Albuquerque, New Mexico, January 20, 1989.

Underground Resources Management (URM), 1982. Hydrogeologic Investigation in the Vicinity of a Chemical Handling Facility, Albuquerque, New Mexico, 1982.

United States Environmental Protection Agency (USEPA), 1984. Final Focused Feasibility Study, South Valley Hazardous Waste Site, Albuquerque, New Mexico, July 25, 1984.

United States Environmental Protection Agency (USEPA), 1988a. Remedial Investigation Report, SJ-6 Superfund Site, South Valley Area, Albuquerque, New Mexico, May 1988.

United States Environmental Protection Agency (USEPA), 1988b. Feasibility Study Report, SJ-6 Superfund Site, South Valley Area, Albuquerque, New Mexico, June 1988.

United States Environmental Protection Agency (USEPA), 1988c. Record of Decision, South Valley Superfund Site, Edmunds Street Groundwater Operable Unit, Albuquerque, New Mexico, August 1988.

United States Environmental Protection Agency (USEPA). 1989. Consent Decree in the matter of the United States of America versus Univar Corporation, August 29, 1989.