AHTNA

Government Services Corporation

Draft Final
Annual Evaluation Report
January through December 2002
OU 1 Groundwater Remedy
Former Fort Ord, California

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ACRONYMS AND ABBREVIATIONS

1,1-DCE	1,1-Dichloroethene
1,2-DCA	1,2-Dichloroethane or ethylene dichloride
1,2-DCE	1,2-Dichloroethene
µg/L	Micrograms per liter (parts per billion)
ACL	Aquifer cleanup level
AGSC	AHTNA Government Services Corporation
CDQMP	Chemical data quality management plan
COC	Chemical of concern
EFF	Effluent
EPA	U.S. Environmental Protection Agency
EW	Extraction Well
GAC	Granular activated carbon
gpm	Gallons per minute
GWTP	Groundwater treatment plant
Harding ESE	Harding ESE, Inc. (formerly known as Harding Lawson Associates [HLA])
IN	Influent
INF	Influent
IT	IT Corporation
L	Liter
OU 1	Operable Unit 1
PCE	Perchloroethene or tetrachloroethene
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
SAP	Sampling and analysis plan
TCE	Trichloroethene
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
VOC	Volatile organic compound
VC	Vinyl Chloride

EXECUTIVE SUMMARY

On behalf of the U.S. Army Corps of Engineers (USACE) Sacramento District, AHTNA Government Services Corporation (AGSC) operated the former Fort Ord Sites Operable Unit 1 (OU 1) groundwater remedy for the period from March 1 through December 2002 under contract number DACA05-01-D-0003 DO-0005. Harding ESE, Inc. (Harding ESE) operated the groundwater remedy from January 1 through February 28, 2002.

This report presents the OU 1 system operation data, treatment system chemistry data, groundwater extraction/recharge data, and chemical mass removal data for the reporting period. The report also includes groundwater chemicals of concern (COC) monitoring data and an assessment of the hydraulic capture of the OU 1 groundwater COC plume area, which consists primarily trichloroethene (TCE).

The OU 1 Groundwater Remedy was operated for the annual reporting period of December 28, 2001, through December 27, 2002, (2002 annual period) with a cumulative plant operability of 97.1 percent, which is defined as the percentage of time the OU 1 groundwater treatment plant (GWTP) was in operation. The treatment system was 100 percent effective with all COCs below the allowable treated-water discharge limits in samples obtained from the discharge compliance point for the entire period. System operation treated 4.2 million gallons and removed 0.39 pounds of COCs (primarily TCE) during the 2002 annual period. A total of 105.1 million gallons have been treated by the system to date, with a cumulative COC mass removal of 25.7 pounds, since remediation began in July 1988.

System operation during the 2002 annual period consisted of extraction from Extraction Well EW-OU1-17-A to create a total average extraction rate of 8.0 gallons per minute (gpm). Extraction Well EW-OU1-18-A was turned off on June 20, 2001 because remediation of the plume captured by this well was complete based on the 5-Year Status Report and Effectiveness Evaluation (*HLA, 1999b*) and is only operated during sampling events. Review of the 2002 annual COC concentrations indicates TCE ranging from 5.6 to 13 µg/L and all other COCs were below 1.0 µg/L.

Evaluation and comparison of TCE isoconcentration contours from March, June, September, and December 2002 with those presented in the previous annual evaluation report (*IT, 2002*), suggest that the OU 1 A-Aquifer TCE plume has similar size, shape, and composition as noted in the previous annual evaluation report, and that the OU 1 A-Aquifer COC plume is larger than originally interpreted during the OU 1 groundwater remedy design.

Statistical analyses of extraction well COC data using the Mann Kendall test of trend indicated that COC concentrations monitored at Extraction Wells EW-OU1-17-A and EW-OU1-18-A are generally decreasing with 9 significant negative (decreasing concentration) trends and no significant positive (increasing concentration) trends. This indicates that COC mass is being removed and no significant additional COC source is being added to the plume.

Groundwater flow modeling indicates that the 2002 annual system operation captured the A-Aquifer groundwater with COCs above aquifer cleanup levels (ACLs) in the vicinity of the original source area, although the plume area located northwest of EW-OU1-17-A is not hydraulically captured. In-situ remedial alternatives were evaluated (*AGSC, 2002c*) and a pilot study of the selected remedial alternative is in progress.

1.0 INTRODUCTION

On behalf of the U.S. Army Corps of Engineers (USACE) Sacramento District, AHTNA Government Services Corporation (AGSC) operated the former Fort Ord Operable Unit 1 (OU 1) groundwater remedy for the period from March 1 through December 2002 under contract number DACA05-01-D-0003 DO-0005. Harding ESE operated the groundwater remedy from January 1 through February 28, 2002. This 2002 annual evaluation report presents a discussion of system performance and an evaluation of monitoring data, including treatment plant operation data and hydrogeologic information, for the January through December 2002 annual period.

The OU 1 groundwater remedy addresses volatile organic compounds (VOCs) in groundwater at the site. The VOCs were introduced into the subsurface at the former burn pit area (Plate 1) as a result of activities associated with fire-fighting practice exercises, which were discontinued in the mid-1980's (*HLA, 1986, 1995*). The OU 1 groundwater remediation system consists of two extraction wells and the GWTP. The GWTP was installed in 1988 and operated continuously until May 1989, when it was shutdown for modifications. After modifications were completed in November 1989 (*HLA, 1989*), the GWTP was restarted and has operated nearly continuously except for brief shutdowns for repairs and routine maintenance. On June 20, 2001, pumping at Extraction Well MW-OU1-18-A was discontinued because remediation of the plume area captured by the well was complete in accordance with the *5-Year Status Report and Effectiveness Evaluation* (*HLA, 1999b*).

The specific remedial objectives and cleanup criteria for OU 1 are in accordance with the Record of Decision (OU 1 ROD) that was issued on July 25, 1995, by the U.S. Department of the Army (Army), and subsequently signed by the U.S. Environmental Protection Agency (EPA) and the California Environmental Protection Agency (Cal/EPA) (*Army, 1995*). The OU 1 ROD specifies the remedial method and ACLs for the chemicals of concern (COCs) at the site. The purpose of the GWTP monitoring program is to maintain the OU 1 system in an operating capacity consistent with the remedial objectives, to evaluate the impact of groundwater extraction on local groundwater flow, and to monitor the effectiveness of the system by sampling and analyzing groundwater at various points throughout the treatment process. Table 1 presents the ACLs and treated water discharge levels for the OU 1 treatment system COCs that were in effect during the 2002 annual period.

Subsequent to the OU 1 ROD, TCE was detected to the north and northwest of the original recognized OU 1 plume area (*Army, 1997*). Additional investigations (*HLA, 1999a; Harding ESE, 2001b*) indicated the occurrence of TCE at concentrations above ACLs in downgradient and apparently contiguous areas of the original OU 1 plume. A conceptual design of an expansion of the existing OU 1 groundwater pump and treat was prepared (*Harding ESE, 2001a*) and distributed for review. A *Draft Final Engineering Evaluation, In-Situ Plume Migration Control Alternatives Pilot Study Workplan* (*AGSC, 2002c*) was issued in October 2002. The pilot study was started in November 2002 to evaluate the effectiveness of the selected in-situ remedial technology.

2.0 TREATMENT PLANT OPERATIONS

This section of the report describes treatment plant operations and interprets monitoring data and system performance for the 2002 annual period. Treatment plant sampling and analysis was conducted in accordance with the site specific Chemical Data Quality Management Plan (CDQMP) (*IT Corporation, 2001a*) and the Sampling and Analysis Plan (SAP) (*IT Corporation, 2001b*). Issues discussed below are treatment system configuration, operating performance, system monitoring data summary, and treatment system operations.

2.1 Treatment System Configuration

The OU 1 GWTP equipment sequences and sampling locations are shown in the OU 1 Groundwater Treatment Schematic (Plate 2). The components of the GWTP include three 1,000-pound granular activated carbon (GAC) adsorption beds, system piping, and two groundwater extraction wells. During treatment, groundwater is pumped from the extraction wells and piped directly through two of the 1,000-pound GAC beds in series to remove VOCs and hydrocarbons. The third GAC bed remains inactive until rotated into service when a carbon changeout is required in one of the other two GAC beds. The treated water flows into a surge tank that discharges, when filled, to the ground surface in the excess spray area to supplement groundwater recharge to the A-Aquifer. Chemical concentrations are monitored at up to five sampling locations. The sample station designations are as listed in the table below:

OU 1 GWTP Sample Station Designation

Station Designation	Description
TS-OU1-INF-1	EW-OU1-17-A; untreated influent water for monitoring treatment effectiveness and for calculating total contaminant removal.
TS-OU1-INF-2	EW-OU1-18-A (currently off-line); untreated influent water for monitoring treatment effectiveness and for calculating total contaminant removal.
TS-OU1-INF-A	Composite of untreated influent water for monitoring treatment effectiveness and for calculating total contaminant removal (station designation changed from TS-OU1-INF-C to TS-OU1-INF-A in October 2002 when EW-OU1-18-A was taken off-line).
TS-OU1-INTER	Effluent from lead carbon bed for monitoring contaminant breakthrough. Beds alternate between lead and lag positions.
TS-OU1-EFF	Point for monitoring water after treatment.

2.2 Operating Performance

Operating performance is discussed in terms of extraction and treatment flow rates and totals, aquifer recharge flow rates and totals, on-line effectiveness, non-routine operations, and indirect waste stream production. Weekly data are presented in Tables 2 and 3.

2.2.1 Groundwater Extraction and Treatment System Performance

For the 2002 annual period, the GWTP operated continuously except for times of routine maintenance or unscheduled downtime. The weekly averages for the total treated-water flow rates for the 2002 annual period are presented in Tables 2 and 3. The reported average weekly flow rate is the total volume pumped averaged over the period of time between measurements, usually seven days. The reported average weekly flow rate varies depending on flow rates for individual wells and any downtime experienced at the plant or the extraction wells. The total volume of treated water from December 28, 2001, through December 27, 2002 was 4.2 million gallons. The average annual extraction and treatment system flow rate was 8.0 gallons per minute (gpm).

Cumulative treated water since remediation began in July 1988 through December 27, 2002, is 105.1 million gallons. The 2002 annual system flow rates are shown graphically on Plate 3.

2.2.2 Groundwater Recharge System Performance

The treated water flows into a surge tank that discharges, when filled, to the ground surface in the excess spray area to supplement groundwater recharge to the A-Aquifer.

2.2.3 Operability and Planned and Non-Routine Operations Interruptions

The 2002 annual OU 1 GWTP weekly operability rates are summarized in Table 3. Operability rate is defined as the percentage of time that the plant is in operation. For the 2002 annual period (December 28, 2001, through December 27, 2002) the weekly operability rate ranged from 0.0 to 100 percent, with an annual average of 98.8 percent. The GWTP's cumulative operability rate as of December 27, 2002 was 97.1 percent. Plant downtime included all scheduled and unscheduled operational outages.

2.2.3.1 System Shutdown Evaluation

The evaluation summarizes system shutdowns affecting system performance. The following table summarizes the events resulting in OU 1 GWTP downtime during this reporting period.

Date	Event	Duration
September 12 – 23, 2002	GWTP shutdown because of potential discharge exceedance (it was later determined that no exceedance occurred), carbon change out, and reconfiguration of the piping system.	264 hours

2.2.3.2 Extraction Well Performance

The weekly extraction well flow rates are summarized in Table 2. Extraction well EW-OU1-17-A operated nearly continuously and EW-OU1-18-A was not operated during the monitoring period except intermittently before and during sampling. As noted above, because remediation of the plume area captured by well EW-OU1-18-A is complete, pumping was discontinued on June 20, 2001, in accordance with the recommendation made in the *5-Year Status Report and Effectiveness Evaluation* (*HLA, 1999b*).

During the week of January 18, 2002, a broken seal in the basket strainer associated with EW-OU1-18-A caused water from EW-OU1-17-A to discharge to the ground surface within the OU 1 groundwater extraction capture zone. Approximately 61,730 gallons of water pumped from EW-OU1-17-A flowed past the meter at EW-OU1-18-A (Table 2). The basket piping was repaired and a check valve was installed to prevent future back flow. For approximately nine days starting September 20, 2003, the GWTP was shut down for a GAC replacement and to retrofit and repair the piping system.

2.2.4 Indirect Waste Streams

Chemical breakthrough is monitored to determine when a change out of the GAC in the lead vessel is required. The lead vessel is then taken off line, and the system is reconfigured to move the lag vessel into the lead position and bring the reserve vessel (containing fresh) carbon into the lag position. The carbon change out occurs while the third vessel is inactive.

One carbon change out occurred in the period. The 8 x 30-mesh carbon and change out service was supplied by US Filter/Westates. Spent OU 1 GWTP carbon is returned to the carbon vendor as non-Resource Conservation and Recovery Act (RCRA) hazardous waste on the basis of a self-determination test (i.e., a test performed at the direction of the generator to demonstrate the characteristics of the waste are not hazardous). This test was performed on spent carbon collected from OU 1 and submitted to Westates Laboratory in Los Angeles, California, on October 26, 1999. The spent carbon from the change outs was transported by US Filter/Westates to their facility in Red Bluff, California, for regeneration. The spent carbon in GAC-B was removed and replaced with regenerated carbon from a previous change out in 2001. The following table presents carbon changeout dates, groundwater treated, and total COC mass removal:

OU 1 GWTP Carbon Changeout Data

Carbon Change out Date[1, 3]	Volume Treated (gallons)	Total COC's mass removed (lb)[2]
September 23, 2002	3,123,600	0.294
Period End [3]	1,083,210	0.092
Annual Period	4,206,870	0.386

Notes:
(1) Meter readings ordinarily read each Friday. If Friday data are not available, next closest complete set of meter readings is used. The volume of water was extrapolated to the nearest day.
(2) Volumes treated and mass removed were estimated to the nearest weekend.
(3) Period start is December 28, 2001, and period end is December 27, 2002.

2.3 Treatment System Monitoring Data Summary

This section presents an evaluation of treatment system monitoring data for the 2002 annual period and is divided into influent, effluent, and GAC performance monitoring. Treatment plant system organic COC analytical data is presented in Table 4 and extraction well organic COC analytical data is presented in Table 5. All analytical data generated during this review period were subject to data validation as described in the CDQMP and project SAP, and were considered to be acceptable and suitable for use. The quality control summary reports (QCSRs) for these data can be found in the Appendixes to the 2002 Quarterly Groundwater Treatment Systems Operation Data Summary Reports (*AGSC, 2002a, 2002b, 2002d,* and *2003*).

2.3.1 Influent Monitoring

Influent monitoring includes monitoring of COCs for the combined treatment plant influent. Monitoring data for the individual extraction wells are discussed in Section 3.

The combined treatment plant influent from both extraction wells is sampled at TS-OU1-INF-A (station designation changed from TS-OU1-INF-C in October 2002) prior to entering the carbon adsorption units (Table 4). A historical summary of influent COC concentration is presented in Appendix A (Table A2) and shown graphically on Plate 4. The highest concentration of any COC was TCE, which averaged 8.6 micrograms per liter (µg/L) for the 2002 annual period.

The total mass of COCs removed during the reporting period by the remediation system is approximately 0.4 pounds (Appendix A, Table A3). The predominate COC at OU 1 is TCE, which represents approximately 95 percent by weight of COC in the untreated effluent. The remaining 5 percent is a combination of:

- 1,1-dichloroethane (DCA)
- 1,1,1-trichloroethane (TCA)
- chloroform
- total 1,2-dichloroethene (DCE), and
- tetrachloroethene (PCE)

2.3.2 Treatment System Effluent and Discharge Compliance Monitoring

Effluent monitoring (TS-OU1-EFF) during normal operation is conducted to document compliance with treated discharge water requirements for spray irrigation. TS-OU1-EFF data is presented in Table 4. The GWTP effluent was sampled bi-monthly during the reporting period as described in the SAP (*IT Corporation, 2001b*). All COCs were below discharge limits in all samples obtained from the TS-OU1-EFF sampling point.

2.3.3 GAC Performance Monitoring

Treatment system monitoring activities during the period consisted of GAC performance monitoring. The stream between the two activated carbon beds (lead bed effluent sample point TS-OU1-INTER) is sampled and analyzed to monitor for contaminant breakthrough. Data for the lead bed outlet, reported in Table 4, show up to 5 of the 10 COCs breaking through prior to carbon change out. These compounds are:

- 1,1,1-TCA
- 1,1-DCA
- 1,2-DCE
- chloroform, and
- TCE

GAC-B functioned as the lead bed from January 1, 2002 to September 23, 2002. GAC-A functioned as the lead bed for the remainder of the period. Data from the lead bed outlet (TS-OU1-EFF), reported in Table 4, shows four of the ten COCs breaking through prior to the carbon change out. These compounds are:

- 1,1,1-TCA
- 1,1-DCA
- 1,2-DCE, and
- chloroform

Only one carbon bed is changed at a time. After a change out, the sequence of the beds is reversed (i.e., the previous lead bed filled with freshly activated carbon becomes the lag bed and the bed previously used in lag position becomes the lead bed). Thus, residual COCs from the loading of the polishing bed are immediately detected as lead bed breakthrough after a carbon change out. The OU 1 breakthrough COCs detected from the lead bed after a carbon change out are usually 1,1-DCA, chloroform, cis-1,2-DCE, and 1,2-DCA. Either cis-1,2-DCE or 1,2-DCA is typically the first COC that approaches the discharge limits and initiates a carbon change out.

3.0 GROUNDWATER MONITORING AND HYDRAULIC CAPTURE EVALUATION

OU 1 groundwater hydraulic capture performance for the 2002 annual period was evaluated through:

- Inspection of maps showing the distribution of COCs above ACLs in A-Aquifer groundwater.
- Statistically evaluating the concentration trends of COCs in the extracted groundwater over time.
- Conducting groundwater flow modeling of system operation using average January through December 2002 OU 1 system pumping rates. Groundwater flow model results are then used to estimate the aquifer areas hydraulically captured as a result of system operation (Appendix B).

Groundwater plume monitoring data collected during OU 1 operation activities and basewide groundwater monitoring activities are presented in Section 3.1. Statistical evaluation of the extracted groundwater COC concentration trends is presented in Section 3.2. An evaluation of the hydraulic capture of the OU 1 A-Aquifer COC groundwater plume is presented in Appendix B.

3.1 Groundwater Plume Monitoring

Organic chemical data generated during the March 2002, June 2002, September 2002 and December 2002 groundwater monitoring events are reported in *Draft Report of Annual Monitoring, October 2001 through September 2002, Fort Ord, California* (*MACTEC, 2003a*) and *Draft Report of Quarterly Monitoring, October through December 2002, Fort Ord, California* (*MACTEC*, *2003b*), respectively. Plates 7 through 10 show TCE concentrations with isoconcentration contours from March 2002, June 2002, September 2002, and December 2002, respectively. Plates 11 through 14 display A-Aquifer groundwater elevation contour maps for March 2002, June 2002, September 2002, and December 2002, respectively.

3.1.1 Chemicals of Concern above Aquifer Cleanup Levels

Inspection of Plate 6 shows extraction wells with COCs detected in groundwater at or above ACLs for January through December 2002. The compound TCE was present above ACLs in Extraction Well EW-OU1-17-A during each sampling event during the 2002 annual period as shown on Plate 6. No other COCs were detected above ACLs in samples from Extraction Wells EW-OU1-17-A or EW-OU1-18-A.

The compound TCE is the most frequently detected COC, detected at the highest concentration at OU 1, and is generally present at the highest concentration when detected with other compounds. Because of the previously described distribution of TCE, the TCE isoconcentration plots (Plates 7 through 10) are used to approximate the OU 1 A-Aquifer groundwater plume.

3.1.2 A-Aquifer TCE Plume

TCE isoconcentration maps for March 2002, June 2002, September 2002, and December 2002 TCE concentrations are provided on Plates 7 through 10. The northern perimeter of the OU 1 plume in the A-Aquifer has been approximated by analytical results for TCE indicating nondetectable concentrations or concentrations below the TCE reporting limit (< 0.5 µg/L) from samples collected from Monitoring Wells MW-OU1-42-A, MW-OU1-41-A, and MW-OU1-45-A. The western perimeter of the OU 1 plume in the A-Aquifer has been approximated by analytical results for TCE indicating nondetectable concentrations or concentrations below the TCE reporting limit (< 0.5 µg/L) from samples collected from Monitoring

Wells MW-OU1-46-A, MW-OU1-24-A, and MW-OU1-10-A. The southern perimeter of the OU 1 plume in the A-Aquifer has been approximated by analytical results for TCE indicating nondetectable concentrations or concentrations below the TCE reporting limit (< 0.5 µg/L) from samples collected from Monitoring Wells MW-OU1-01-A and MW-BW-10-A. The eastern perimeter of the OU 1 plume in the A-Aquifer has been approximated by analytical results for TCE indicating nondetectable concentrations or concentrations below the TCE reporting limit (< 0.5 µg/L) from samples collected from Monitoring Wells MW-OU1-34-A, MW-OU1-28-A, MW-OU1-30-A and MW-OU1-21-A.

3.1.3 A-Aquifer Water-Level Elevation Maps

Plates 11 through 14 are A-Aquifer water-level elevation maps of the OU 1 area for March 2002, June 2002, September 2002, and December 2002, respectively. Inspection of Plates 11 through 14 shows the seasonal fluctuations in water level elevations at OU 1, which is generally less than 0.5 feet. The generalized groundwater flow direction is to the northwest, which was consistent throughout the monitoring period.

3.2 Extracted Groundwater COC Trend Evaluation

Extraction well COC data were evaluated by trend analysis to identify whether COC concentrations are likely increasing or decreasing at each well. As chemical mass is removed from the aquifers, COC concentrations are expected to exhibit a decreasing trend, especially for compounds that exceed ACLs. If COC concentrations are consistently increasing at a well, significant chemical mass may be upgradient of the well and additional extraction from the well or other upgradient wells may be warranted. Non-significant trends indicate that area of the plume is in steady state or equilibrium and the mass removal is neither increasing nor decreasing, and is also in equilibrium. If an extraction well continues to have a non-significant trends, continues to be below ACLs, and does not contribute to plume capture, the extraction well should be considered for shut-down.

3.2.1 Statistical Evaluation Method

A statistical analysis was conducted of COC concentration data for the two OU 1 extraction wells using the Mann Kendall test for trend. The Mann Kendall test for trend is a nonparametric statistical evaluation that uses only the relative magnitudes of the data rather than actual data values to evaluate the probability that a trend exists *(Gilbert, 1987)*. The computer program used by URS to calculate the statistical trends was written in 1990 and has been modified periodically, as necessary, although the fundamentals of the Mann-Kendall test for trend have not been modified.

The data are ordered by time, and each data point is compared to data points corresponding to earlier sampling dates. The number of earlier data points that are higher or lower than a given test data point is used to calculate the Mann Kendall statistic (S). The statistic is used, in conjunction with the total number of data points (n), to look up the probability that a trend (positive or negative) exists; however, the statistic does not indicate the magnitude (rate of increase or decrease) of the trend. Chemical data are considered to show a significant concentration trend (i.e., that a trend very likely exists) when the Mann Kendall probability exceeds 95 percent.

The general formula used to calculate the Mann Kendall statistic is:

$$S = \sum_{k=1}^{n-1} \sum_{j=k+1}^{n} \operatorname{sgn}(x_j - x_k)$$

where:

sgn (x_j-x_k) is dependent on the number of positive and negative sums for each data comparison

and

j and k are simply variable names for each data point (and j > k).

3.2.2 Statistical Evaluation Results

Table 6 summarizes the applicable Mann Kendall trend probability for COCs in the two extraction wells and 10 COCs. The direction of the concentration trend is described with the Mann Kendall probability as either increasing (+) or decreasing (-). In a number of cases, not enough data points were available for a statistical analysis, therefore a trend could not be calculated. The data used for the Mann Kendall statistical evaluation consisted of 40 sets of quarterly data collected from the extraction wells since the system began operation in January 1989 (Table A4, Appendix A).

A significant trend in changing concentration, as determined from the Mann Kendall statistical test for trend, is indicated by probabilities exceeding 95 percent. Of the two extraction wells and 10 COCs (for a data set with 20 potential results) 9 results had Mann Kendall probabilities greater than 95 percent, of which all were negative (decreasing concentrations). The remaining results did not follow a significant trend, or there was insufficient detected results to calculate trends.

The Mann-Kendall test of trend indicated that there were significantly decreasing trends in the concentrations of 1,1-DCA, chloroform, and TCE in the operating extraction well, EW-OU1-17-A. No trends could be established for the remaining COCs detected in the well, since there are not enough detected COC results.

Extraction Well EW-OU1-18-A was not operated during the 2002 annual reporting period. However, samples were collected at the well and the results were analyzed for COCs. The current and historical results were used in the Mann-Kendall trend analysis. Extraction Well EW-OU1-18-A displayed significantly decreasing concentration trends for:

- 1,1,1-TCA
- 1,1-DCA
- 1,1-DCE
- 1,2-DCE (total)
- chloroform, and
- TCE

No trends were established for the remaining COCs detected in the well.

3.3 Groundwater Capture Evaluation

Groundwater flow modeling was conducted to evaluate hydraulic capture of the A-Aquifer COC plume by the OU 1 groundwater remedy. Hydraulic capture was estimated using the updated Fort Ord

groundwater flow model to simulate aquifer water levels and groundwater flow paths resulting from system operation.

The model predicts that the majority of the southwestern part of the OU 1 plume is captured when simulating average pumping rates for 2002. The northern portion of the A-Aquifer plume in OU 1 that is northwest of extraction well EW-OU1-17A, however, is not captured.

Appendix B describes the origin and development of the Fort Ord groundwater flow model and the groundwater modeling process and contains detailed results of the groundwater hydraulic capture evaluation.

4.0 SYSTEM EVALUATION SUMMARY OF FINDINGS AND RECOMMENDATIONS

4.1 Summary of Findings

The OU 1 Groundwater Remedy was operated for the 2002 annual reporting period with a cumulative plant operability rate, defined as the fraction of elapsed time the OU 1 GWTP was in operation, of 97.1 percent. The treatment system was 100 percent effective with all COCs below the allowable treated-water discharge limits in samples obtained from the discharge compliance point for the entire period. The treatment system has treated 4.2 million gallons and removed approximately 0.39 pounds of COCs during the 2002 annual period. System operation mainly consisted of extraction from well EW-OU1-17-A for an average annual extraction rate of 8.0 gallons per minute (gpm). Well EW-OU1-18-A was turned off on June 20, 2001 because remediation of the plume captured by this well was complete based on the *5-Year Status Report and Effectiveness Evaluation* (*HLA, 1999b*). This well was only operational for sampling and no ACLs were exceeded in this well. COC concentrations for Well EW-OU1-18-A indicate TCE ranging from 13 to 20 µg/L and all other COCs were all below ACLs.

December 2002 analytical results of samples from the A-Aquifer monitoring wells reconfirm previous observations (*IT Corporation, 2002b*) that the Upper 180-Foot Aquifer is not affected in the OU 1 area and that the OU 1 A-Aquifer COC plume is larger than originally interpreted during the OU 1 groundwater remedy design. The OU 1 plume area located to the northwest of EW-OU1-17-A is downgradient from the existing OU 1 groundwater remedy and is not being hydraulically captured or treated by the existing system. An expansion or modification of the existing OU 1 groundwater remedy is currently being evaluated as well as alternative, in-situ remedies.

Statistical analyses of extraction well COC data using the Mann Kendall test of trend indicated that COC concentrations monitored at the two active or partially active extraction wells (EW-OU1-17-A and EW-OU1-18-A) are all decreasing with 9 significant negative (decreasing concentration) trends. Extraction Well EW-OU1-17-A displayed significant decreasing trends for: 1,1-DCA; chloroform; and TCE. Extraction Well EW-OU1-18-A displayed significant decreasing trends for: 1,1,1-TCA; 1,1-DCA; 1,1-DCE; 1,2-DCE (total); chloroform; and TCE. Decreasing trends indicate mass is being removed and no significant additional source of COCs is being added to the plume.

Groundwater flow modeling indicates that the annual 2002 system operation captured the A-Aquifer groundwater with COCs above ACLs in the vicinity of the original source area. Groundwater flow modeling indicates that the OU 1 plume area located northwest of EW-OU1-17-A is not hydraulically captured by the existing groundwater extraction system. In-situ remedial alternatives were evaluated (*AGSC, 2002c*) and a pilot study of the selected alternative (Enhanced Reductive Dechlorination) is in progress.

4.2 Recommendations

Recommendations made at this time are generally consistent with the most recent Annual Evaluation Report (*IT Corporation, 2002)*:

1. The OU 1 groundwater remedy operation should continue at the current groundwater extraction rates to remove COC mass from the source area.

2. Continue evaluation of groundwater remedy modifications and/or alternative in-situ remedies for the downgradient portion of the OU 1 plume that is not currently being captured by the existing extraction wells. A pilot test for an in-situ remediation technology is currently being performed in the downgradient portion of the plume.

5.0 REFERENCES

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HISTORICAL FLOW, CHEMICAL AND STATISTICAL EVALUATION DATA

APPENDIX B

HYDRAULIC CAPTURE MODELING ANALYSIS

APPENDIX C

RESPONSES TO AGENCY COMMENTS

APPENDIX C

RESPONSES TO AGENCY COMMENTS

Agency comments are listed below regarding the Draft Annual Report January through December 2002, OU1Groundwater Remedy (*AGSC, June 16, 2003*) and AGSC responses are shown in **bold.**

Comments by the US Environmental Protection Agency:

NO COMMENT RECEIVED

Comments by the Regional Water Quality Control Board, dated July 7, 2003:

We have reviewed the subject document prepared by AHTNA Government Services Corporation and received June 18, 2003. This report describes the Operable Unit 1 system operations data. This includes water chemistry, extraction/recharge and contaminant mass removal data. A hydraulic capture assessment was also included.

We accept the report as submitted. As noted in the hydraulic capture assessment, the newer/northern area of the plume is not hydraulically contained. A remediation pilot project is in progress to evaluate enhanced reductive dechlorination of this area. Should results not be encouraging for a larger scale application, we will request re-examination of cleanup strategies. As the original/southern part of the plume was largely remediated in approximately ten years by pump and treat technology, we consider this proved technology to still be competitive with other remedies being examined.

Our office had previously requested the tabulation of contaminant mass removal data to assist us in evaluating and describing system effectiveness. AHTNA has done a commendable job of presenting this data in both Appendix A and the Executive Summary. However, we do have some questions regarding the beginning date used for cumulative contaminant mass removal. We will bring these questions for discussion at our next BRAC Cleanup Team meeting. **The start date for the mass contaminant removal calculations was clarified at the BCT meeting and will be clarified in future reports.**

Comments by the California Department of Toxic Substances Control dated September 5, 2003:

COMMENTS:

The GSU concurs with the recommendations found on page 11 of the report that:
1) the OU1 groundwater remedy should continue at its current extraction rates; and,
2) That the portion of the contamination plume to the northwest not currently captured by the existing extraction system should be evaluated for modifications/alterations to the remedy after considering the caveat below:

The GSU finds a strong downward vertical gradients exist between the A-Aquifer (shallowest) and the next water bearing zone, the Upper 180-Foot. Only three monitoring wells are screened in the Upper 180-foot zone in OU1, all located near the suspected source. These deeper wells have not shown contamination: however, the contamination plume now extends 4000 feet to the northwest beyond these three wells. Currently the highest contamination has been found in monitoring well MW-OU1-27A located 3000 feet northeast of the suspected source area. Also this well has shown slightly higher contamination levels in sample bags lower in the well. Groundwater flow directions in the Upper 180-Foot zone trend toward the south as opposed to the predominate northwest flow direction in the A-Aquifer.

The GSU recommends that any modifications to the remedy investigate possible contamination migration in the Upper 180-Foot zone at A-Aquifer locations downgradient (near MW-OU1-27A) from the suspected source area. **Comment noted.**