HARGIS + ASSOCIATES, INC.

SITE-WIDE GROUNDWATER MONITORING PROGRAM
THIRD AND FOURTH QUARTERS 2008 AND ANNUAL SUMMARY OF DATA

FORMER MONTROSE AND STAUFFER FACILITIES
HENDERSON, NEVADA

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ACRONYMS AND ABBREVIATIONS

BCL	NDEP Basic Comparison Level
beta-BHC	beta-Benzene hexachloride
CSM	Conceptual Site Model
de maximis	*de maximis, inc.*
EPA	U.S. Environmental Protection Agency
GWTS	Groundwater treatment system
H+A	Hargis + Associates, Inc.
MCL	Maximum Contaminant Level
Montrose	Montrose Chemical Corporation of California
msl	Mean sea level
NAPL	Non-Aqueous Phase Liquid
NDEP	Nevada Division of Environmental Protection
OCPs	Organochlorine pesticides
Olin	Olin Corporation
pCi/L	picocuries per Liter
RAS	remedial alternatives study
RCRA	Resource Conservation and Recovery Act
SOPs	Standard operating procedures
SMC	Stauffer Management Company, LLC
Stauffer	Stauffer Chemical Company
Syngenta	Syngenta Crop Protection, Inc.
TDS	Total dissolved solids
the Companies	Montrose, SMC/Syngenta, and Olin Corporation
the program	site-wide groundwater monitoring program
Tronox	Tronox, LLC
UMCc	Coarse-grained Upper Muddy Creek Formation
UMCf	Fine-grained Upper Muddy Creek Formation
VOCs	Volatile organic compounds

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THIRD AND FOURTH QUARTERS 2008 AND ANNUAL SUMMARY OF DATA

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1.0 INTRODUCTION

This report is the second of two semi-annual 2008 groundwater monitoring data submittals for the site-wide groundwater monitoring program (the program) submitted on behalf of Montrose Chemical Corporation of California (Montrose), Stauffer Management Company LLC/Syngenta Crop Protection, Inc. (SMC/Syngenta) and Olin Corporation (Olin) (the Companies). This report presents data obtained during the third and fourth quarter 2008 groundwater monitoring events from monitor wells located within an area encompassing the former Stauffer Chemical Company (Stauffer) and Montrose facilities, the operating Olin facility, and an area downgradient of the facilities to Las Vegas Wash (the study area) (Figure 1).

The third and fourth quarter events were conducted in accordance with the requirements of the 2008 program (*de maximis, inc.* [*de maximis*], 2008) as approved by the Nevada Division of Environmental Protection (NDEP) (NDEP, 2008a). Water level measurements, gauging for the presence of non-aqueous phase liquids (NAPLs), and groundwater sampling were conducted in accordance with applicable standard operating procedures (SOPs) (Hargis + Associates, Inc. [H+A], 2007).

The third quarter event was conducted during the period July 8 through 9, 2008 and the fourth quarter event was conducted during the period October 22 through 27, 2008. Both events included the collection of water level elevations and gauging for the presence of NAPL while the collection of groundwater samples was conducted solely during the fourth quarter event.

A data submittal for the first and second quarter events was submitted to NDEP on July 17, 2008 (H+A, 2008a). NDEP provided observations to the data submittal in a letter to the Companies dated July 28, 2008 (NDEP, 2008b). NDEP did not require a response to the letter.

2.0 SCOPE OF WORK

The scope of work for the third and fourth quarter events included measuring water levels at 56 monitor wells and gauging for the presence of NAPLs at a subset of 22 monitor wells. The fourth quarter monitoring event also included groundwater sampling at a subset of 47 monitor wells. The monitor wells comprising the program are completed in each of three hydrogeologic units present in the study area (Table 1). Monitor well locations are presented in Figure 1.

The program was implemented concurrently with other routine groundwater monitoring activities conducted by the Companies. These additional activities include water level monitoring and groundwater sampling at an additional 29 monitor wells and extraction wells as follows:

- Quarterly monitoring of two upgradient and three downgradient Consent Order monitor wells related to operation of the groundwater treatment system (GWTS);
- Quarterly monitoring of seven transect groundwater monitor wells related to operation of the GWTS immediately downgradient of the GWTS;
- Annual monitoring of the 13 groundwater extraction wells related to the GWTS, and
- Semi-annual monitoring of four monitor wells at the Montrose Closed Ponds (Figure 1).

While the results of these monitoring activities are routinely summarized and submitted to NDEP under separate cover, the shallow zone water level data from these wells were used in the preparation of the contour maps provided in this report as noted below.

Additionally, groundwater quality data were also collected from monitor wells in two areas within or adjacent to the program study area during the fourth quarter event:

- Groundwater samples were collected from eight Tronox, LLC (Tronox) shallow zone monitor wells located in the northeastern portion of the Tronox site generally along the Olin-Tronox property line. Data from these monitor wells were collected to help determine the eastern extent of volatile organic compounds (VOCs) in the study area (Sundberg, 2008 and NDEP, 2008c);

- Groundwater samples were collected by Montrose from five newly installed shallow zone monitor wells located northeast of the Montrose Closed Ponds area. These data provide supplemental information regarding the presence and extent of chemicals northeast of the Closed Ponds, and

- Groundwater samples from all monitor wells comprising the program, plus the additional monitor wells listed above, were analyzed for selected radiochemical parameters to resolve data gaps for the groundwater remedial alternatives study (RAS) (Sundberg, 2008).

The results of these additional sampling activities are included in this report since the data are relevant and provide a more comprehensive overview of study area conditions to evaluate needs for the scope of the program in 2009.

3.0 WATER LEVEL MEASUREMENTS

Water levels were measured at 49 of the 56 monitor wells during the third quarter event and 51 of the 56 monitor wells during the fourth quarter event. Some monitor wells could not be measured due to lack of access, were unable to be located, or were not equipped with operable pressure gauges. NAPL gauging was conducted at all 22 monitor wells during both events. A summary of the water level measurement and NAPL gauging results obtained during the third and fourth quarter events is presented in Table 2. Field forms used during water level measurements and NAPL gauging are included in Appendix A.

The water level data were used to prepare water level elevation contour maps for the shallow zone (Figures 2 and 3). These contours utilize water level data measured in Consent Order and GWTS transect monitor wells to more accurately depict water level conditions in the site area.

Water level elevation data were also plotted for the fine-grained Upper Muddy Creek Formation (UMCf) and the coarse-grained Upper Muddy Creek Formation (UMCc) (Figures 4 through 7). The data have not been contoured because: 1) productive zones within the UMCf are believed to be discontinuous and of limited areal extent; and 2) all but one of the UMCc monitor wells are located in a linear pattern, and differences in screened intervals does not readily allow the data to be contoured. However, review of the data from the Muddy Creek Formation water level maps do indicate that groundwater flow in the area is from predominately from the south to the north. This observation is consistent with data collected in previous monitoring events. Hydrographs of the groundwater elevations for monitor wells located along each of six monitoring transects are presented in Figures 8 through 16.

4.0 GROUNDWATER SAMPLING

4.1 FIELD SAMPLING

Groundwater samples were successfully obtained from 45 of the 47 monitor wells designated for sampling in the fourth quarter event. Additionally, as a one-time addition to the program, groundwater quality data were also collected from monitor wells in two areas adjacent to the normal study area during the fourth quarter event as follows:

Groundwater samples were collected from eight Tronox shallow zone monitor wells M-014, M-057A, M-092, M-123, M-124, M-125, M-127, and M-142. These monitor wells are located in the northeastern portion of the Tronox site generally along the Olin-Tronox property line. Data from these monitor wells were collected to help determine the eastern extent of VOCs in the study area (Sundberg, 2008 and NDEP, 2008c).

Groundwater quality data was also collected by Montrose concurrent with the fourth quarter site-wide monitoring program from five newly installed shallow zone monitor wells northeast of the Closed Ponds area (AA-MW-20 through AA-MW-24). These data provide supplemental information regarding the presence and extent of chemicals northeast of the Montrose Closed Ponds.

The additional Tronox and Montrose Closed Ponds wells brought the total number of wells sampled during the fourth quarter event to 58.

4.1.1 Analytes

All groundwater samples were analyzed for the following chemical groups, consistent with previous sampling events:

- VOCs using U.S. Environmental Protection Agency (EPA) Method 8260B;
- Semi-VOCs using EPA Method 8270C;

- Organochlorine pesticides (OCPs) using EPA Method 8081A;
- Resource Conservation and Recovery Act (RCRA) metals using various EPA Methods;
- Total dissolved solids (TDS) using EPA Method 160.1, and
- Organic acids using high performance liquid chromatography for: dimethyl phosphorodithioic acid, benzenesulfonic acid, phthalic acid, diethyl phosphorodithioic acid, and 4-chlorobenzenesulfonic acid (for five selected monitor wells only).

Additionally, analyses of radiochemical parameters were included in the fourth quarter event as a one-time modification to the program (Sundberg, 2008). Groundwater samples from all monitor wells comprising the program, plus the additional monitor wells listed above, were analyzed for selected radiochemical parameters to resolve data gaps for the groundwater RAS (Sundberg, 2008). Radiochemical analyses included:

- Uranium, using EPA Method 200.8;
- Radium-226 using EPA Method 903.1;
- Radium-288 using EPA Method 904.0, and
- Radon 222 Method EITR.

All analyses were conducted by Test America Laboratories, Inc., or other State of Nevada certified subcontractor laboratories and the analytical results are presented in Appendix B.

4.1.2 Water Quality Data

Water quality data obtained during the fourth quarter event are presented in Table 3. The prevalent VOCs in the study area include chlorobenzene, benzene, chloroform, 1,2-dichlorobenzene, and 1,4-dichlorobenzene. The analytical data were used to prepare maps of the prevalent VOCs, beta-benzene hexachloride (beta-BHC), arsenic, and TDS for each of the hydrogeologic units in the study area (Figures 17 through 40). Figures depicting the distribution of uranium were also prepared to graphically present the one-time radiological data from the fourth quarter event (Figures 41 through 43).

4.1.3 Quality Assurance/Quality Control

Quality assurance/quality control sampling for the fourth quarter event consisted of the following:

- A trip blank for VOC analysis was submitted with each site-wide shipment to the laboratory and analyzed for VOCs. Review of the analytical data indicates that no VOCs were detected in the trip blanks during the monitoring event (Appendix B).
- When non-dedicated groundwater sampling equipment is used, one equipment rinsate blank was collected at the beginning and end of the sampling event. The equipment rinsate blanks were analyzed for VOCs, semi-VOCs, OCPs, RCRA metals, TDS, and radiochemicals. Review of the analytical data indicates that no compounds were detected in the equipment rinsate blanks (Appendix B).
- Field duplicate samples were collected at a minimum frequency of one per 20 samples. Field duplicate samples were analyzed by the same analytical methods as was the original sample (Appendix B). The results of the field duplicate sample analyses will be evaluated as part of data validation.

4.1.4 Management of Investigation Derived Waste

Purge water generated during groundwater sampling was contained and characterized. After characterization, all purge water was disposed off-site at a licensed facility in accordance with federal, state, and local requirements.

5.0 VARIATIONS

Variations in scope occurred during the third and fourth quarter events. These variations included:

- Water levels for four shallow zone monitor wells and three UMCc monitor wells were not measured during the third quarter 2008 due to restricted access or lack of operating pressure gauges.
- Water levels at shallow zone monitor well H-13 and four UMCc monitor wells were not measured during the fourth quarter 2008 due to damaged, restricted access or lack of operating pressure gauges.
- Monitor wells B-7 and H-13 were not sampled in the fourth quarter 2008 event. Monitor well B-7 was dry and H-13 was apparently destroyed by off-site construction activities.

6.0 WATER LEVEL AND NON-AQUEOUS PHASE LIQUID CONDITIONS – 2008

Four water level measurement and NAPL gauging events were conducted from the first quarter (January) through fourth quarter (October) 2008. For the purposes of this report, this period is referred to as the period of record. A summary of all water level and NAPL data collected during the period of record and water level maps from previous quarters are provided in Appendix C.

The following sections discuss NAPL gauging data and water level conditions for each of the three hydrogeologic units present in the study area. The discussions are based on the data collected during the period of record. Water quality conditions are discussed in Section 7.0.

6.1 SHALLOW ZONE

Shallow zone water levels were measured on a quarterly basis during the period of record. Data from these monitor wells indicated that shallow zone water level conditions varied temporally within the study area.

6.1.1 Groundwater Elevations

Groundwater elevations in the shallow zone were highest in the southern portion of the study area decreasing in elevation to the north and northeast across the study area (Table 2; Figures 2 and 3). Groundwater elevations in the southern portion of the study area ranged from approximately 1,800 feet mean sea level (msl) near Lake Mead Parkway to approximately 1,550 feet msl near Las Vegas Wash. These conditions are similar to that reported for 2007 (H+A, 2008c).

The overall slope of the shallow zone groundwater surface is similar in nature to the slope of the land surface in the study area. Land surface elevations in the southern portion of the study area range from approximately 1,860 to 1,850 feet msl. Land surface elevations in the extreme

northern portion of the study area, near Las Vegas Wash, range from approximately 1,560 to 1,550 feet msl (Table 2).

6.1.2 Quarterly Variations

Shallow zone groundwater elevations varied somewhat from quarter to quarter during the period of record. The direction (increase or decrease in elevations) and magnitude of changes in groundwater elevations varied based on location within the study area. Shallow zone groundwater elevations in the southern portion of the study area and in the area of the former Montrose and Stauffer facilities both slightly increased and decreased in elevation during the four quarters of the period of record. These changes in elevations are illustrated in the water level hydrographs for Transects Nos. 1 through 4 (Figures 8, 9, 11, and 13). Both the increases and decreases in groundwater elevations from quarter to quarter were generally less than one foot. However, changes in elevation of greater than one foot were occasionally measured. This condition is similar to the quarterly variations reported for 2007 (H+A, 2008c).

A review of historic water level data indicates that there is an overall, long-term increase in groundwater elevations in the southern portion of the study area and in the area of the former Montrose and Stauffer facilities. Water level data from monitor well MW-1 indicates increases in elevation by more than 10 feet since the mid-late 1990s. This increase is supported by data from other monitor wells completed in the southern portion of the study area (Figure 8). This condition is similar to the trend reported for 2007 (H+A, 2008c).

Shallow zone groundwater elevations in the northern portion of the study area have fluctuated during the period of record. However, since 2007, groundwater elevations in the northern portion of the study area have declined. These changes in elevations are illustrated in the water level hydrographs for Transects Nos. 5 and 6 (Figures 15 and 16). Changes in groundwater elevations from quarter to quarter were greater in the north compared to other portions of the study area. Changes in elevation were typically greater than one foot from quarter to quarter.

6.1.3 Non-Aqueous Phase Liquid

It was initially reported that NAPL may have been detected in shallow zone monitor wells EC-7 and EC-10 on February 8, 2008 during the first quarter event (Appendix C). Confirmation gauging and bailer monitoring conducted on February 27, 2008 indicated that no NAPL was detected in either of these wells and suggests a false positive detection using the interface probe on February 8. NAPL has not been detected at either of these monitor wells, or any other shallow zone monitor wells during the second, third, or fourth quarters 2008 (Appendix C).

6.2 FINE-GRAINED UPPER MUDDY CREEK FORMATION

UMCf water levels were measured on a quarterly basis during the period of record. These monitor wells are located only in the area of the former Montrose facility (Figure 1). Data from these monitor wells indicated that UMCf water level conditions are generally similar in this area from monitor well to monitor well.

6.2.1 Groundwater Elevations

Groundwater elevations in the UMCf were highest near the Montrose Closed Ponds decreasing in elevation to the north. Groundwater elevations ranged from approximately 1,790 feet msl at monitor well CP-1 to approximately 1,725 feet msl at monitor well MCF-BW-11A (Figures 4 and 5). These conditions are similar to that reported for 2007 (H+A, 2008c).

6.2.2 Quarterly Variations

UMCf groundwater elevations varied slightly from quarter to quarter during the period of record. UMCf groundwater elevations in the area of the former Montrose facility remained relatively constant or slightly increased in elevation during the four quarters of the period of record. These changes in elevations are illustrated in the water level hydrographs for Transects Nos. 2, 3, and 4 (Figures 10, 12, and 14). Both the increases and decreases in groundwater elevations from quarter to quarter were less than one foot, with the exception of monitor well MCF-BW-11A. Monitor well MCF-BW-11A exhibited fluctuations in groundwater levels of up to

three feet during the period of record. This condition is somewhat similar to the quarterly variations reported for 2007 (H+A, 2008c).

6.2.3 Non-Aqueous Phase Liquid

NAPL was reported to have been detected in UMCf monitor well MC-MW-11 during the first and second quarter events (Appendix C). The NAPL was detected at the bottom of monitor well MC-MW-11 during both events at thicknesses of less than two feet. NAPL was not detected at monitor well MC-MW-11 or any other UMCf monitor wells during the third or fourth quarter events (Appendix A).

6.3 COARSE-GRAINED UPPER MUDDY CREEK FORMATION

UMCc water levels were measured on a quarterly basis during the period of record. UMCc monitor wells are located in a generally linear pattern along the southeastern boundary of the study area.

6.3.1 Groundwater Elevations

Groundwater elevations in the UMCc were highest in the southern portions of the study area decreasing in elevation to the north near the GWTS. Groundwater elevations ranged from approximately 1,810 feet msl in the southern portion of the study area to approximately 1,725 feet msl near the GWTS (Appendix C). This condition is similar to that reported for 2007 (H+A, 2008c). There are no UMCc monitor wells located toward Las Vegas Wash.

6.3.2 Quarterly Variations

UMCc groundwater elevations varied somewhat from quarter to quarter based on available data during the period of record. In general UMCc groundwater elevations in the area of the former Montrose and Stauffer facilities either remained relatively unchanged or increased in elevation during the period of record. This condition is similar to that reported for 2007 (H+A, 2008c). Available water level data are illustrated in the water level hydrographs for Transects Nos. 2 and

3 (Figures 10 and 12). Variations in groundwater elevations from quarter to quarter were generally greater less than one foot, based on available data.

6.4 GROUNDWATER MOVEMENT

6.4.1 Shallow zone

The direction of groundwater movement and gradient in the shallow zone remained consistent during the period of record. The direction of groundwater movement is to the north from the southern portion of the study area to the GWTS, thence to the northeast toward Las Vegas Wash. Water level contour maps prepared with data from each of the four water level monitoring events are provided (Figures 2 and 3 and Appendix C). These conditions are similar to those reported for 2007 (H+A, 2008c).

The gradient in the southern portion of the study area to the former Montrose and Stauffer facilities has remained approximately 0.02 during the period of record. The gradient decreases to approximately 0.01 north of the former facilities to the Las Vegas Wash (Figures 2 and 3 and Appendix C). The change in gradient across the study area is likely due to the changes in the lithologic nature of the shallow zone and the slope of the land surface. A review of historic well data and recent drilling and well construction within the study area indicate that the shallow zone becomes thicker and generally coarser-grained in the area north of the former Montrose and Stauffer facilities compared to the southern portion of the study area (H+A, 2008b).

6.4.2 Upper Muddy Creek Formation

Water level data are generally limited for the UMCf and UMCc. To date, UMCf monitor wells are located only in a relatively small area near the former Montrose facility. A review of water level data from these monitor wells indicates that the apparent direction of groundwater movement in the UMCf is consistently to the north, similar to the overlying shallow zone (Figure 4 and 5 and Appendix D). The gradient in the UMCf typically ranges from 0.02 to 0.03, relatively similar to the overlying shallow zone.

The areal distribution of water level data for the UMCc is greater than for the UMCf. A review of water level data from the UMCc monitor wells indicates that the apparent direction of groundwater movement in the UMCc is consistently to the north-northeast, generally similar to the overlying UMCf and shallow zone (Figures 6 and 7 and Appendix C). The gradient in the UMCc is typically 0.01, similar in nature to the overlying units.

6.4.3 Vertical Movement Between Units

Groundwater occurs in the UMCf under confined or semi-confined conditions. Groundwater levels rise in monitor wells completed in the UMCf to levels above the top of the Upper Muddy Creek Formation (H+A, 2008b). In most locations, groundwater elevations determined at monitor wells completed in the UMCf are approximately five to 10 feet higher in elevation compared to groundwater elevations at nearby shallow zone monitor wells (Table 2 and Appendix C). This indicates that an upward vertical gradient exists between the UMCf and the shallow zone.

Groundwater occurs in the UMCc under confined conditions. Groundwater levels in monitor wells completed in the UMCc rise to levels significantly higher than the top of the Upper Muddy Creek Formation and in some localities rise above land surface. Groundwater elevations measured in UMCc monitor wells are typically 50 feet higher than groundwater elevations measured at nearby shallow zone monitor wells. Groundwater elevations measured in UMCc are approximately 30 feet higher than groundwater elevations measured at nearby UMCf monitor wells (Table 2 and Appendix C). These data indicate that there is an upward vertical groundwater gradient between the UMCc and the overlying UMCf and shallow zone. These data also indicate that the finer-grained sediments of the UMCf act as a confining unit, or aquitard, above the UMCc.

The Companies plan to conduct additional investigation in 2009 to characterize the vertical delineation of hydrogeologic units in the study area (H+A, 2008d). The results of these characterization activities will be reported to NDEP.

7.0 GROUNDWATER QUALITY CONDITIONS – 2008

For the purposes of this submittal, the following sections discuss general groundwater quality conditions for selected organic and inorganic compounds and constituents; and any changes and/or trends in groundwater quality conditions for each of the three hydrogeologic units present in the study area. The discussions are based on the data collected as part of the program during the period of record. A summary of all groundwater quality data collected during the period of record, analytical laboratory reports, and groundwater quality maps from previous events are provided in Appendix D.

Study area groundwater quality conditions were discussed in detail in the conceptual site model (CSM) submitted by the Companies to NDEP in January 2008 (H+A, 2008b). The CSM presented data obtained from several monitoring programs and focused investigations conducted by the Companies to characterize the nature and distribution of site-related chemicals throughout the study area. Groundwater quality data from this groundwater monitoring program, collected through April 2007, were incorporated into the CSM.

7.1 SHALLOW ZONE

Groundwater samples were collected from 35 shallow zone monitor wells during the second quarter (April) event and 33 monitor wells during the fourth quarter (October) event 2008. In addition, groundwater samples were also collected from eight shallow zone monitor wells located near the Olin and Tronox property boundary, and five shallow zone monitor wells recently installed by Montrose northeast of the closed ponds area during the fourth quarter sampling event (Section 4.0). The discussions below incorporate water quality data from these additional monitor wells.

7.1.1 Organic Compounds

Concentrations of VOCs greater than their respective primary maximum contaminant levels (MCLs) were detected in groundwater samples from shallow zone monitor wells located

immediately north of the Montrose Closed Ponds, extending north into the area of the former Montrose and Stauffer facilities, and continuing north to the GWTS (Figures 17, 20, 23, 26, and 28 and Appendix D). With the exception of chloroform, concentrations of VOCs immediately north of the GWTS are either not detected or are significantly lower than those observed upgradient of the GWTS; indicating the effectiveness of the system in removing organic compounds from the shallow zone. This distribution of VOCs is consistent to that defined in the CSM and reported in 2007 (H+A, 2008b and c).

Concentrations of chloroform above its MCL are detected north of the GWTS and to the northeast of the study area on Tronox property (Figure 23 and Appendix D). Concentrations of VOCs were generally not detected, or were detected at very low concentrations in the upgradient areas in the southern portion of the study area, and along the eastern and western margins of the study area.

Within study area, concentrations of the prevalent VOCs chlorobenzene, benzene, chloroform, 1,2-dichlorobenzene, and 1,4-dichlorobenzene varied at each individual monitor well during the period of record. However, the concentrations of these VOCs measured in 2008 generally remained within their historic range of concentrations. Figures illustrating the concentrations of chlorobenzene, benzene, and chloroform, as well as other constituents from 2006 to date have been prepared (Figures 44 through 52).

Concentrations of beta-BHC greater than the NDEP Basic Comparison Level (BCL) were detected in groundwater samples from eight shallow zone monitor wells located predominantly in the western portion of the Olin property and at the GWTS (Figure 32 and Appendix D). Within study area, concentrations of beta-BHC varied at each individual monitor well during the period of record. However, the concentrations of beta-BHC measured in 2008 generally remained within their historic range of concentrations. Figures illustrating the concentrations of beta-BHC, as well as other constituents from 2006 to date have been prepared (Figures 44 through 52).

7.1.2 Inorganic Constituents

Arsenic is present above the MCL in groundwater samples collected from shallow zone monitor wells throughout the study area. These data suggest that arsenic is a naturally occurring

constituent in shallow zone groundwater. However, concentrations of arsenic increase to their highest levels in the area of the former Montrose and Stauffer facilities and generally decrease in concentration to the north (Figure 35 and Appendix D). This distribution of arsenic is consistent to that defined in the CSM (H+A, 2008b).

Chromium is present above the MCL in groundwater samples collected from shallow zone monitor wells in the area north of the GWTS. Samples collected during the April 2008 and October 2008 sampling events from monitor wells ARP-06B, PC-028, PC-064, PC-067, and M-048 all contained chromium above the MCL (Table 3).

Cadmium and selenium were also detected above their respective MCLs in a small number of groundwater samples collected from the shallow zone. Selenium was detected above the MCL in both the third and fourth quarter sampling events in groundwater samples from monitor well PC-002. Cadmium was detected above the MCL in the third quarter groundwater sample collected from monitor well ARP-06B.

Similar to organic compounds, concentrations of metals, primarily arsenic, fluctuated between sampling events during the period of record. However, in general, concentrations of metals remained relatively constant. Figures illustrating the concentrations of arsenic, the most prevalent metal in the study area, and other constituents from 2006 to date have been prepared (Figures 44 through 52).

7.1.3 Radiochemical Constituents

Groundwater samples collected during the fourth quarter event were analyzed for the radiochemical constituents uranium, radium-226, radium-228, and radon-222. A summary of the results is as follows:

- Uranium was the only radiochemical detected above its MCL of 30 micrograms per liter (ug/l). Concentrations ranged from less than the detection limit of 2.0 ug/l to 290 ug/l (Figure 41).
- Radium-226 and -228 were not detected above the MCL in samples collected from the shallow zone monitor wells (Table 3).

- Radon-222 was observed throughout the study area at concentrations ranging from less than the limit of detection of -1.98±11 to 3,070±160 picoCuries per liter (pCi/l) (Table 3). There is no established groundwater MCL or BCL for radon-222.

7.2 FINE-GRAINED UPPER MUDDY CREEK FORMATION

Groundwater samples were collected from seven UMCf monitor wells present in the study area during the period of record. These monitor wells are located in the vicinity of the former Montrose and Stauffer facilities (Figure 1).

7.2.1 Organic Compounds

Concentrations of the VOCs greater than their respective MCLs were detected in groundwater samples from UMCf monitor wells located in the area near the former Montrose and Stauffer facilities (Figures 18, 21, 24, 27, and 30 and Appendix D). Concentrations of VOCs were generally not detected, or were detected at low concentrations in the southernmost UMCf monitor well CP-1, located immediately north of the Montrose Closed Ponds. This distribution of VOCs is consistent to that defined in the CSM (H+A, 2008b).

Similar to shallow zone conditions, concentrations of VOCs varied at each individual monitor well during the period of record. However, the concentrations of these VOCs measured in 2008 generally remained within their historic range of concentrations. Figures illustrating the concentrations of VOCs, and other constituents from 2006 to date have been prepared (Figures 44 through 52 and Appendix D).

Concentrations of beta-BHC greater than the BCL were detected in groundwater samples from four UMCf monitor wells (Figure 33). Concentrations of beta-BHC were either not detected, or fluctuated somewhat during the period of record. However, similar to other organic compounds, concentrations of beta-BHC generally remained within their historic range of concentrations. Figures illustrating the concentrations of beta-BHC in the UMCf, and other constituents from 2006 to date have been prepared (Figures 44 through 52 and Appendix D).

7.2.2 Inorganic Constituents

Arsenic was the only inorganic constituent detected at concentrations consistently greater than its primary MCL in the study area. Arsenic is present in groundwater samples above the MCL in groundwater samples collected from UMCf monitor wells throughout the area near the former Montrose and Stauffer facilities. This distribution of arsenic is consistent to that defined in the CSM and in 2007 (H+A, 2008b and c).

Concentrations of arsenic fluctuated somewhat during the period of record. However, in general, concentrations of arsenic remained relatively constant. Figures illustrating the concentrations of arsenic in the UMCf, and other constituents from 2006 to date have been prepared (Figures 44 through 52 and Appendix D).

7.2.3 Radiochemical Constituents

A summary of the radiochemical results is as follows:

- Uranium concentrations ranged from less than the detection limit of 1 ug/l to 38 ug/l (Figure 42). Uranium was detected above its MCL in the groundwater sample collected from monitor well MC-MW-10 (Figure 42).
- Radium-226 and -228 were not detected above the MCL in samples collected from the UMCf monitor wells (Table 3).
- Radon-222 was observed throughout the study area at concentrations ranging from less than the limit of detection of -7.84±8.2 to 266±21 pCi/l (Table 3). There is no established groundwater MCL or BCL for radon-222.

7.3 COARSE-GRAINED UPPER MUDDY CREEK FORMATION

Groundwater samples were collected from five UMCc monitor wells during the period of record. These monitor wells are located along the southeastern boundary of the study area (Figure 1).

7.3.1 Organic Compounds

VOCs were predominantly not detected, or were only detected at sporadic, low level concentrations in groundwater samples from UMCc monitor wells in the study area (Figures 19, 22, 25, 28, and 31 and Appendix D). Beta-BHC was also not detected in groundwater samples from UMCc monitor wells (Figure 34 and Appendix D).

7.3.2 Inorganic Constituents

Arsenic was the only inorganic constituent detected at concentrations consistently greater than its primary MCL in the study area. Arsenic is present in groundwater samples above the MCL in groundwater samples collected from all UMCc monitor wells in the study area. This distribution of arsenic is consistent to that defined in the CSM (H+A, 2008b).

Concentrations of arsenic fluctuated somewhat during the period of record. However, in general, concentrations of arsenic remained relatively constant. Figures illustrating the concentrations of arsenic, and other constituents from 2006 to date have been prepared (Figures 44 through 52).

Chromium was also detected at concentrations greater than its MCL is samples collected from UMCc well MW-8 (Table 3 and Appendix D). No other metals were detected greater than their respective MCLs in groundwater samples collected from UMCc monitor wells.

7.3.3 Radiochemical Constituents

No radiochemical constituents were detected in the UMCc monitor wells above their respective MCLs or BCLs during the fourth quarter event (Table 3).

8.0 SUMMARY OF CONCLUSIONS AND FUTURE MONITORING ACTIVITIES

Field activities completed as part of third and fourth quarter events included:

- Water levels were measured at 49 of 56 monitor wells during the third quarter event and 51 of 56 monitor wells during the fourth quarter event. NAPL gauging was also conducted at 22 monitor wells during both events. Water level maps were prepared for the three water bearing zones in the study area including the shallow zone, UMCf and UMCc.

- Groundwater samples were obtained from 45 of the 47 monitor wells designated for sampling in the fourth quarter event, groundwater quality data were also collected on a one-time basis from monitor wells near the Tronox/Olin property boundary and northeast of the Montrose Closed Ponds area. Groundwater samples were analyzed for radiochemical constituents during the fourth quarter event on a one-time basis. Groundwater quality maps were prepared for the three water bearing zones in the study area.

The data collected during the field activities were analyzed and indicate the following:

- The direction and gradient, or apparent direction and gradient, of groundwater flow in each of the three hydrogeologic units was generally consistent from event to event in 2008 and with previous data collected in the study area.

- The distribution of organic and inorganic chemicals was generally similar from event to event in 2008 and to previous data collected in the study area. Some organic and inorganic chemicals were detected at concentrations greater than their respective MCLs in 2008. This is also consistent with previously collected data.

- Radiochemical constituents were detected in groundwater samples collected from monitor wells completed throughout the study area. Uranium was the only radiochemical detected at concentrations greater than its MCL, predominately in the shallow zone and at one monitor well in the UMCf.

The site-wide groundwater monitoring program is evolving. Starting in 2006, the program focused on defining the general characteristics and distributions of chemicals in study area groundwater as well as the potential for seasonal changes. The distributions of chemicals and migration pathways have been found to be generally consistent from monitoring period to

monitoring period. Therefore, the program is now becoming more of a long term routine monitoring activity to identify trends that may alter the remedial program for the study area.

A review of all groundwater monitoring program data collected from 2006 through 2008 and other study area characterization activities indicates that groundwater quality and water level conditions are generally consistent in the study area. Accordingly, the Companies recommend modifications to the objectives and scope of the groundwater monitoring program for 2009. The exact scope of these modifications will be transmitted to NDEP under separate cover by February 11, 2009.

9.0 REFERENCES

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