

M67386.AR.000271
MCRCO KANSAS CITY
5090.3a

TECHNICAL MEMORANDUM RESULTS OF OCTOBER 2000 QUARTERLY GROUNDWATER
MONITORING AT RICHARDS GEBUR AIR FORCE BASE KANSAS CITY MO
2/26/2001
CH2M HILL

Results of October 2000 Quarterly Groundwater Monitoring at Richards-Gebaur Air Force Base

PREPARED FOR: Air Force Base Realignment and Closure (BRAC) Cleanup Team (BCT)
PREPARED BY: CH2M HILL
DATE: February 26, 2001

This technical memorandum summarizes the analytical results for the quarterly groundwater monitoring (QGM) conducted between Oct. 3 and Oct. 10, 2000 at Richards-Gebaur Air Force Base (AFB), Kansas City, Missouri. The October results are compared with the findings from the first monitoring of the complete set of current network of wells (which occurred between June 2000 and August 2000) to better understand the nature and extent of the groundwater contamination at the Base.

Introduction

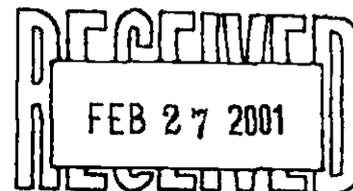
The QGM program was established at Richards-Gebaur AFB based on the results of the 1999 Basewide Remedial Investigation (RI) and 2000 RI Addendum. Consequently, QGM takes place at five sites where concentrations of chlorinated volatile organic compounds (VOCs) in groundwater are known to exceed the conservative Tier 1 Screening Levels that were set forth in the RI (generally equivalent to federal maximum contaminant levels). The five sites are:

- CS 004, UST 620A
- SS 003, Oil Saturated Area
- SS 006, Hazardous Material Storage Area
- SS 009, Fire Valve Area
- ST 005, POL Yard

From the five sites, 50 monitoring wells were selected for the QGM program. Results from the first QGM are discussed in the *Draft RI Report* (CH2M HILL, 2000). Results of the October 2000 QGM are presented below. Subsequent groundwater monitoring events are scheduled for January 2001, April 2001, July 2001, and October 2001. The monitoring well network from the five sites is summarized in Table 1.

The objectives of the quarterly groundwater monitoring at Richards-Gebaur AFB are as follows:

- assess whether the existing monitoring well network sufficiently delineates the groundwater contamination
- evaluate temporal trends of chemicals of concern (COCs) in groundwater
- investigate the potential for natural attenuation (NA) at the sites



Methodology

Standard field methodologies for groundwater sample collection – as established for the Basewide RI - were followed during the quarterly groundwater event. Detailed field procedure information is provided in the *October 1999 Basewide Remedial Investigation / Feasibility Study (RI/FS) Work Plan and the April 2000 Basewide RI Work Plan Addendum*.

Groundwater samples were analyzed for VOCs via USEPA Method SW8260B. The analytical work was performed by PEL Laboratories, Tampa Bay, Florida. In addition to VOC analyses, select groundwater samples from each site were analyzed for NA indicator parameters, including chloride, nitrate, alkalinity, total dissolved solids (TDS), sulfate, ferrous iron, methane, ethane, ethene, total organic carbon (TOC), and carbon dioxide. The NA indicator analyses were conducted by CH2M HILL's Applied Sciences Laboratory, Corvallis, Oregon. Analytical results for NA were reported on a standard 21-day turnaround time. Data were validated per methods outlined in the October 1999 *Richards-Gebaur Air Force Base (AFB) Basewide RI/FS Work Plan* (CH2M HILL, 1999).

Results

VOCs

The following paragraphs summarize the VOC analytical results from the October 2000 QGM on a site-by-site basis. Detections of VOCs in groundwater at the five sites are shown in Table 2. The results are compared against corresponding Tier I Screening Levels established for the Basewide RI project. Compounds exceeding Tier I Screening Levels in groundwater are summarized in Table 3. The October 2000 QGM results are also compared with the data from the June 2000 QGM to evaluate the temporal trends in groundwater contamination concentrations.

CS 004 – UST 620A

Twelve groundwater wells at CS 004 were sampled as part of the October QGM (see Table 1). The October results indicate that two chlorinated VOCs, cis-1,2,- DCE and vinyl chloride, exceeded their Tier I Screening Levels in two nested pairs of shallow/deep wells, MW-001/MW-008 and MW-003/MW-007, and one deep well, MW-016. The distribution of VOC exceedences at CS 004 is depicted in Figure 1.

There were two differences between the June and October QGM results. First, at MW-016, vinyl chloride was found above its Tier I Screening Level. In June 2000, well MW-016 was found to be free of COCs at concentrations above Screening Levels. Second, the measured concentration of cis-1,2-DCE at deep well MW-007 (73 ppb) exceeded its Tier I Screening Levels of 70 ppb. In June 2000, MW-007, which is located upgradient of the original UST site, did not have cis-1,2-DCE at a concentration above the Tier I Screening Level.

Other than the differences mentioned above, concentrations of COCs in October 2000 were similar or slightly lower than those measured in June 2000. Although TCE was detected above Tier I Screening Levels in well MW-006, this well was not sampled during this QGM. It is recommended that MW-006 be added to the future QGM.

SS 003 – Oil Saturated Area

Seven groundwater wells at SS 003 were sampled during the October QGM (see Table 1). The results indicated that trichloroethene (TCE) was the only VOC that was detected above Tier I Screening Levels. This result is consistent with the June 2000 QGM results.

The October 2000 QGM showed concentrations of TCE exceeding Screening Level in MW-004 and MW-007. In June 2000, TCE concentrations were measured above screening levels in MW-004, MW-007, and also in MW-018. The wells where concentrations of TCE exceeded Screening Level are shown in Figure 2. Other VOCs were detected, but at concentrations below Tier 1 Screening Levels. In general, TCE concentrations at SS 003 in October 2000 were slightly lower than those measured in June 2000.

Although TCE was detected above Tier I Screening Level in well MW-006 in June 2000, the well was not sampled during this QGM. It is recommended that well MW-006 be added to the future QGM.

SS 006 – Hazardous Material Storage Area

Ten groundwater wells at SS 006 were sampled in October 2000 (see Table 1). Three chlorinated VOCs – TCE, cis-1,2-DCE, and vinyl chloride – were detected at concentrations above their corresponding Tier I Screening Levels. The locations of wells at SS 006 with VOC concentrations exceeding applicable Tier 1 Screening Levels are presented in Figure 3.

TCE was detected above its Tier I Screening Level in five wells: MW-005, MW-009, MW-010, MW-015, and MW-018. When compared to the first set of QGM data, it is apparent that concentrations of TCE in wells MW-005, MW-009, MW-010, and MW-008 had not changed significantly since June 2000. Regarding MW-015, this well was not sampled during the first QGM because the monitoring well was dry at that time. Therefore, the October QGM result is the first time that VOCs have been detected at this well.

As in June, cis-1,2-DCE was detected in one well, MW-010, at a level exceeding its Tier1 Screening Level of 70 ppb. The concentration of cis-1,2-DCE at MW-010 was 150 ppb in October 2000, slightly higher than the reported level of 130 ppb in June 2000. Though detected in well MW-005, cis-1,2-DCE concentration for MW-005 did not exceed the corresponding Screening Level as in June 2000.

Vinyl chloride was also detected in well MW-010 at a concentration above its Tier I Screening Level of 2 ppb. The concentration of vinyl chloride at MW-010 was 12 ppb in October 2000, which is lower than the reported concentration of 34 ppb in June 2000. Vinyl chloride was also detected in MW-005 (similar to cis-1,2-DCE) but at a concentration below the applicable Screening Level of 2 ppb.

Although TCE and its daughter products were detected above Tier I Screening Levels in wells MW-001, MW-006, MW-007, MW-011, and MW-012 in June 2000, these five wells were not sampled during this QGM. It is recommended that the above wells be included in the future QGM.

SS 009 – Fire Valve Area

Five groundwater wells were sampled at SS 009 in October 2000 (see Table 1). The QGM results show that five VOCs were detected in well MW-003 at concentrations exceeding Tier 1 Screening Levels (Figure 4), and that the remaining wells were free of COCs at concentrations

above Screening Levels. The five VOCs are 1,1-DCE, cis-1,2-DCE, tetrachloroethene (PCE), TCE, and vinyl chloride. This data is consistent with the results of the first QGM conducted in June 2000.

Results from the October 2000 QGM are generally at lower concentrations than those detected during the June 2000 QGM. The results are shown in Figure 4. Although vinyl chloride was detected above Tier I Screening Level in well MW-009 in June 2000, this well was not sampled during this QGM. It is recommended that well MW-009 be included in the future QGM.

ST 005 – POL Storage Area

Sixteen groundwater wells were sampled at ST 005 in October 2000 (see Table 1). As before, TCE was the only VOC detected at concentrations exceeding Tier 1 Screening Levels. However, the distribution of TCE has changed, and TCE was found in 9 of the 16 wells. The distribution of TCE at ST 005 is shown in Figure 5.

Several differences can be seen between the first and second QGM results. First, TCE concentrations in the five wells at the center of contaminated zone (MW-003, MW-010, MW-012, MW-013, and MW-014) appears to have decreased since June 2000. However, counter to this trend, the TCE concentration at well MW-018 has increased from 226 ppb in June 2000 to 1,200 ppb in October 2000. Well MW-018 is located upgradient of the TCE contaminated zone at the site and is located on property that belongs to the Kansas City Aviation Department (KCAD).

In June 2000, no TCE exceedances were associated with the perimeter wells MW-020, MW-021, and MW-022. The October 2000 TCE concentrations at the three wells, however, were found above the corresponding Screening Level of 5 ppb (see Table 1). On the contrary, well MW-016, which was found with TCE exceedance in June 2000, did not have TCE at a concentration above the Tier I Screening Level.

Groundwater Levels

Prior to sampling, groundwater levels were measured at each of the 50 monitoring wells listed in Table 1. The water level readings were incorporated into the monthly groundwater level measurement program that is being conducted for the Air Force by Booz-Allen & Hamilton.

NA Potential

Results of the NA indicator parameter analyses are summarized in Table 4. The results are similar to earlier data collected at the sites during the Basewide RI.

In general, the NA indicators measured at the five sites are not at optimal values for anaerobic biodegradation (Wiedemeier et al., 1998). However, the presence of TCE degradation products such as cis-1,2-DCE and vinyl chloride at CS 004, SS 006, and SS 009 indicates that some natural attenuation has likely occurred at these sites in the past.

Conclusions

The October 2000 GWM is the second quarter of data. Although some wells in the QGM have data from earlier sampling events, the majority of wells have two or less data points. As such, it is somewhat premature to draw conclusions regarding concentration gradients or contaminant distribution on such a limited data set. Nonetheless, based upon the results of the October 2000 QGM, groundwater contamination at sites SS 003 and SS 009 appears to have been

successfully delineated during the 2000 RI. At both sites, VOC concentrations were found to be consistent with and lower than those measured in June 2000.

For the remaining three sites, CS 004, SS 006, and ST 005, the situation is less conclusive, and further delineation may be warranted in the future. The October 2000 QGM data indicates that one or more (hydraulically) downgradient wells at these sites have concentrations of VOCs above applicable Tier I Screening Levels. However, because of the generally low concentrations detected in groundwater, and the fact that many of the October 2000 data reflect first-time detections, it is recommended that decisions about further delineation of VOCs in groundwater at these sites be deferred until the results of the January 2001 QGM have been evaluated.

Table 1: Quarterly Groundwater Monitoring Wells at Richards-Gebaur AFB

| CS 004 (UST 620 A) | SS 003 (Oil Saturated Area) | SS 006 (Hazardous Material Storage Area) | SS 009 (Fire Valve Area) | ST 005 (POL Storage Yard) |
|-----------------------|--------------------------------|--|-----------------------------|-------------------------------|
| MW-001(S) / MW-008(D) | MW-001 | MW-005 | MW-002(S) | MW-003 (S) / MW-010(D) |
| MW-002(S) | MW-002 | MW-008 | MW-003(S) | MW-011(D) / MW-012(S) |
| MW-003(S) / MW-007(D) | MW-003 | MW-009 | MW-005(S) | MW-013(D) / MW-014(S) |
| MW-005(S) | MW-004 | MW-010 | MW-008(D) | MW-015(D) / MW-016(S) |
| MW-009(S) / MW-010(D) | MW-007 | MW-013 | MW-010(D) | MW-017(D) / MW-018(S) |
| MW-012(S) | MW-008 | MW-014 | | MW-019 (S) |
| MW-013(S) | MW-002 (CS 002) | MW-015 | | MW-020 (S) |
| MW-014(S) | | MW-016 | | MW-021 (S) |
| MW-016(D) | | MW-017 | | MW-022 (S) |
| | | MW-018 | | MW-023 (S) |
| | | | | MW-1207 (S) |

Note: S = Shallow; D = Deep

Table 2: Compounds Detected in Groundwater, October 2000 Quarterly Monitoring Event

| Site | Media | Location | Sample Date | Detected Concentration | Analyte | Units |
|-------------|-------------|------------|-------------|--------------------------|--------------------------|-------|
| CS-002 | Groundwater | CS02-MW02R | 10/05/2000 | 0 85 F | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | CS02-MW02R | 10/05/2000 | 4 3 | Tnchloroethene | UG/L |
| CS-004 | Groundwater | CS04-MW01 | 10/06/2000 | 0 72 | Benzene | UG/L |
| | Groundwater | CS04-MW01 | 10/06/2000 | 88 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW01 | 10/06/2000 | 8 1 | Trans-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW01 | 10/06/2000 | 0 4 F | Tnchloroethene | UG/L |
| | Groundwater | CS04-MW01 | 10/06/2000 | 13 | Vinyl chloride | UG/L |
| | Groundwater | CS04-MW02 | 10/10/2000 | 0 78 F | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW02 | 10/10/2000 | 0,3 F | Tnchloroethene | UG/L |
| | Groundwater | CS04-MW03 | 10/10/2000 | 230 M | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW03 | 10/10/2000 | 37 M | Trans-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW03 | 10/10/2000 | 2 8 | Tnchloroethene | UG/L |
| | Groundwater | CS04-MW03 | 10/10/2000 | 24 M | Vinyl chloride | UG/L |
| | Groundwater | CS04-MW07 | 10/10/2000 | 73 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW07 | 10/10/2000 | 10 | Trans-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW07 | 10/10/2000 | 4 8 | Tnchloroethene | UG/L |
| | Groundwater | CS04-MW07 | 10/10/2000 | 8 8 | Vinyl chloride | UG/L |
| | Groundwater | CS04-MW08 | 10/06/2000 | 0 75 | Benzene | UG/L |
| | Groundwater | CS04-MW08 | 10/06/2000 | 82 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW08 | 10/06/2000 | 7 1 | Trans-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW08 | 10/06/2000 | 16 | Vinyl chloride | UG/L |
| | Groundwater | CS04-MW09 | 10/06/2000 | 8 4 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW09 | 10/06/2000 | 0 99 J | Trans-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW09 | 10/06/2000 | 0 4 F | Tnchloroethene | UG/L |
| | Groundwater | CS04-MW09 | 10/06/2000 | 1 3 | Vinyl chloride | UG/L |
| | Groundwater | CS04-MW10 | 10/06/2000 | 3 4 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW10 | 10/06/2000 | 0 44 F | Trans-1,2-Dichloroethene | UG/L |
| | Groundwater | CS04-MW12 | 10/06/2000 | 0 26 F | Benzene | UG/L |
| | Groundwater | CS04-MW12 | 10/06/2000 | 0 66 F | Vinyl chloride | UG/L |
| | Groundwater | CS04-MW14 | 10/06/2000 | 1 6 | Benzene | UG/L |
| Groundwater | CS04-MW16 | 10/06/2000 | 0 58 | Benzene | UG/L | |
| Groundwater | CS04-MW16 | 10/06/2000 | 6 2 | Cis-1,2-Dichloroethene | UG/L | |
| Groundwater | CS04-MW16 | 10/06/2000 | 4 6 | Trans-1,2-Dichloroethene | UG/L | |
| Groundwater | CS04-MW16 | 10/06/2000 | 6 | Vinyl chloride | UG/L | |
| SS-003 | Groundwater | SS03-MW01 | 10/05/2000 | 1 7 | 1,2-Dichloroethane | UG/L |
| | Groundwater | SS03-MW01 | 10/05/2000 | 2 7 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | SS03-MW01 | 10/05/2000 | 1 3 | Tnchloroethene | UG/L |
| | Groundwater | SS03-MW03 | 10/05/2000 | 2 3 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | SS03-MW03 | 10/05/2000 | 3 4 | Tnchloroethene | UG/L |
| | Groundwater | SS03-MW04 | 10/05/2000 | 7 7 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | SS03-MW04 | 10/05/2000 | 0 23 F | Trans-1,2-Dichloroethene | UG/L |
| | Groundwater | SS03-MW04 | 10/05/2000 | 58 | Trichloroethene | UG/L |
| | Groundwater | SS03-MW07 | 10/05/2000 | 0 31 F | Benzene | UG/L |
| | Groundwater | SS03-MW07 | 10/05/2000 | 31 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | SS03-MW07 | 10/05/2000 | 13 | Tnchloroethene | UG/L |
| | Groundwater | SS03-MW07 | 10/05/2000 | 0 51 F | Vinyl chloride | UG/L |
| | Groundwater | SS03-MW08 | 10/05/2000 | 2 4 | Tnchloroethene | UG/L |

U-flagged and R-flagged data are not included in this table

Qualifier Description

J = The analyte was positively identified, the quantitation is an estimate

F = The analyte was positively identified but the associated numerical value is below the reporting limit (RL).

B = The analyte was found in an associated blank, as well as in the sample

M = A matrix effect was present

| Site | Media | Location | Sample Date | Detected Concentration | Analyte | Units |
|---------------|-------------|------------|-------------|------------------------|--------------------------|-------|
| SS-006 | | | | | | |
| | Groundwater | SS06-MW05 | 10/04/2000 | 0.69 J | Chlorobenzene | UG/L |
| | Groundwater | SS06-MW05 | 10/04/2000 | 49 M | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | SS06-MW05 | 10/04/2000 | 2.7 J | Trans-1,2-Dichloroethene | UG/L |
| | Groundwater | SS06-MW05 | 10/04/2000 | 310 | Tnchloroethene | UG/L |
| | Groundwater | SS06-MW05 | 10/04/2000 | 1.8 | Vinyl chloride | UG/L |
| | Groundwater | SS06-MW08 | 10/04/2000 | 1.3 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | SS06-MW08 | 10/04/2000 | 0.9 F | Tnchloroethene | UG/L |
| | Groundwater | SS06-MW09 | 10/04/2000 | 0.64 | Benzene | UG/L |
| | Groundwater | SS06-MW09 | 10/04/2000 | 21 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | SS06-MW09 | 10/04/2000 | 73 | Tnchloroethene | UG/L |
| | Groundwater | SS06-MW09 | 10/04/2000 | 0.64 F | Vinyl chloride | UG/L |
| | Groundwater | SS06-MW10 | 10/04/2000 | 0.74 | 1,1-Dichloroethane | UG/L |
| | Groundwater | SS06-MW10 | 10/04/2000 | 0.18 F | 1,2-Dichlorobenzene | UG/L |
| | Groundwater | SS06-MW10 | 10/04/2000 | 0.3 F | Benzene | UG/L |
| | Groundwater | SS06-MW10 | 10/04/2000 | 150 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | SS06-MW10 | 10/04/2000 | 11 | Trans-1,2-Dichloroethene | UG/L |
| | Groundwater | SS06-MW10 | 10/04/2000 | 220 | Tnchloroethene | UG/L |
| | Groundwater | SS06-MW10 | 10/04/2000 | 12 | Vinyl chloride | UG/L |
| | Groundwater | SS06-MW15 | 10/04/2000 | 3 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | SS06-MW15 | 10/04/2000 | 85 | Tnchloroethene | UG/L |
| | Groundwater | SS06-MW18 | 10/04/2000 | 32 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | SS06-MW18 | 10/04/2000 | 15 | Tnchloroethene | UG/L |
| SS-009 | | | | | | |
| | Groundwater | SS09-MW03 | 10/05/2000 | 63 | 1,1-Dichloroethane | UG/L |
| | Groundwater | SS09-MW03 | 10/05/2000 | 49 | 1,1-Dichloroethane | UG/L |
| | Groundwater | SS09-MW03 | 10/05/2000 | 1 | 1,2-Dichloroethane | UG/L |
| | Groundwater | SS09-MW03 | 10/05/2000 | 1.9 | Benzene | UG/L |
| | Groundwater | SS09-MW03 | 10/05/2000 | 200 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | SS09-MW03 | 10/05/2000 | 21 | Tetrachloroethylene | UG/L |
| | Groundwater | SS09-MW03 | 10/05/2000 | 1.1 | Toluene | UG/L |
| | Groundwater | SS09-MW03 | 10/05/2000 | 24 | Tnchloroethene | UG/L |
| | Groundwater | SS09-MW03 | 10/05/2000 | 6.6 | Vinyl chloride | UG/L |
| | Groundwater | SS09-MW05 | 10/05/2000 | 1.3 | 1,1-Dichloroethane | UG/L |
| | Groundwater | SS09-MW05 | 10/05/2000 | 0.78 | Benzene | UG/L |
| | Groundwater | SS09-MW05 | 10/05/2000 | 1.1 F | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | SS09-MW05 | 10/05/2000 | 2.6 | Tetrachloroethylene | UG/L |
| | Groundwater | SS09-MW05 | 10/05/2000 | 1 F | Tnchloroethene | UG/L |
| ST-005 | | | | | | |
| | Groundwater | ST05-MW010 | 10/10/2000 | 8.1 | Tnchloroethene | UG/L |
| | Groundwater | ST05-MW010 | 10/10/2000 | 3 J | Tnchlorofluoromethane | UG/L |
| | Groundwater | ST05-MW011 | 10/06/2000 | 1.3 | Tnchloroethene | UG/L |
| | Groundwater | ST05-MW012 | 10/06/2000 | 0.32 F | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | ST05-MW012 | 10/06/2000 | 84 | Tnchloroethene | UG/L |
| | Groundwater | ST05-MW012 | 10/06/2000 | 22 | Tnchlorofluoromethane | UG/L |
| | Groundwater | ST05-MW013 | 10/06/2000 | 1.3 | Tnchloroethene | UG/L |
| | Groundwater | ST05-MW013 | 10/06/2000 | 1.4 | Tnchlorofluoromethane | UG/L |
| | Groundwater | ST05-MW014 | 10/06/2000 | 1.9 | 1,1-Dichloroethene | UG/L |
| | Groundwater | ST05-MW014 | 10/06/2000 | 0.63 | Chloroform | UG/L |
| | Groundwater | ST05-MW014 | 10/06/2000 | 5.9 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | ST05-MW014 | 10/06/2000 | 180 | Tnchloroethene | UG/L |
| | Groundwater | ST05-MW014 | 10/06/2000 | 60 | Trichlorofluoromethane | UG/L |

U-flagged and R-flagged data are not included in this table

Qualifier Description

J = The analyte was positively identified, the quantitation is an estimate

F = The analyte was positively identified but the associated numerical value is below the reporting limit (RL)

B = The analyte was found in an associated blank, as well as in the sample

M = A matrix effect was present

| Site | Media | Location | Sample Date | Detected Concentration | Analyte | Units |
|--------|-------------|------------|-------------|------------------------|------------------------|-------|
| ST-005 | Groundwater | ST05-MW015 | 10/10/2000 | 0.7 F | Trichloroethene | UG/L |
| | Groundwater | ST05-MW015 | 10/10/2000 | 3.9 | Trichlorofluoromethane | UG/L |
| | Groundwater | ST05-MW016 | 10/10/2000 | 3.6 | Trichloroethene | UG/L |
| | Groundwater | ST05-MW016 | 10/10/2000 | 7.6 | Trichlorofluoromethane | UG/L |
| | Groundwater | ST05-MW018 | 10/10/2000 | 0.7 | Benzene | UG/L |
| | Groundwater | ST05-MW018 | 10/10/2000 | 3 | Chloroform | UG/L |
| | Groundwater | ST05-MW018 | 10/10/2000 | 1200 | Trichloroethene | UG/L |
| | Groundwater | ST05-MW018 | 10/10/2000 | 640 | Trichlorofluoromethane | UG/L |
| | Groundwater | ST05-MW019 | 10/10/2000 | 0.38 F | 1,2-Dichloroethane | UG/L |
| | Groundwater | ST05-MW019 | 10/10/2000 | 0.34 F | Benzene | UG/L |
| | Groundwater | ST05-MW020 | 10/10/2000 | 0.69 | Benzene | UG/L |
| | Groundwater | ST05-MW020 | 10/10/2000 | 18 | Cis-1,2-Dichloroethene | UG/L |
| | Groundwater | ST05-MW020 | 10/10/2000 | 12 | Trichloroethene | UG/L |
| | Groundwater | ST05-MW021 | 10/10/2000 | 0.53 | Benzene | UG/L |
| | Groundwater | ST05-MW021 | 10/10/2000 | 6.9 | Trichloroethene | UG/L |
| | Groundwater | ST05-MW021 | 10/10/2000 | 5 | Trichlorofluoromethane | UG/L |
| | Groundwater | ST05-MW022 | 10/10/2000 | 0.6 | Benzene | UG/L |
| | Groundwater | ST05-MW022 | 10/10/2000 | 5.7 | Trichloroethene | UG/L |
| | Groundwater | ST05-MW023 | 10/10/2000 | 0.6 F | Trichloroethene | UG/L |
| | Groundwater | ST05-MW03 | 10/10/2000 | 0.67 | Chloroform | UG/L |
| | Groundwater | ST05-MW03 | 10/10/2000 | 180 | Trichloroethene | UG/L |
| | Groundwater | ST05-MW03 | 10/10/2000 | 140 | Trichlorofluoromethane | UG/L |

U-flagged and R-flagged data are not included in this table.

Qualifier Description

J = The analyte was positively identified, the quantitation is an estimate

F = The analyte was positively identified but the associated numerical value is below the reporting limit (RL)

B = The analyte was found in an associated blank, as well as in the sample

M = A matrix effect was present

Table 3: Compounds Exceeding Tier 1 Screening Levels in Groundwater, October 2000 Quarterly Monitoring Event

| Site | Media | Location | Sample Date | Units | Analyte | Detected Concentration | Screening Level |
|---------------|-------------|------------|-------------|-------|------------------------|------------------------|-----------------|
| CS-004 | | | | | | | |
| | Groundwater | CS04-MW03 | 10/10/2000 | UG/L | Cis-1,2-Dichloroethene | 230 M | 70 |
| | Groundwater | CS04-MW01 | 10/06/2000 | UG/L | Cis-1,2-Dichloroethene | 88 | 70 |
| | Groundwater | CS04-MW08 | 10/06/2000 | UG/L | Cis-1,2-Dichloroethene | 82 | 70 |
| | Groundwater | CS04-MW07 | 10/10/2000 | UG/L | Cis-1,2-Dichloroethene | 73 | 70 |
| | Groundwater | CS04-MW03 | 10/10/2000 | UG/L | Vinyl chloride | 24 M | 2 |
| | Groundwater | CS04-MW08 | 10/06/2000 | UG/L | Vinyl chloride | 16 | 2 |
| | Groundwater | CS04-MW01 | 10/06/2000 | UG/L | Vinyl chloride | 13 | 2 |
| | Groundwater | CS04-MW07 | 10/10/2000 | UG/L | Vinyl chloride | 88 | 2 |
| | Groundwater | CS04-MW16 | 10/06/2000 | UG/L | Vinyl chloride | 6 | 2 |
| SS-003 | | | | | | | |
| | Groundwater | SS03-MW04 | 10/05/2000 | UG/L | Trichloroethene | 58 | 5 |
| | Groundwater | SS03-MW07 | 10/05/2000 | UG/L | Trichloroethene | 13 | 5 |
| SS-006 | | | | | | | |
| | Groundwater | SS06-MW10 | 10/04/2000 | UG/L | Cis-1,2-Dichloroethene | 150 | 70 |
| | Groundwater | SS06-MW05 | 10/04/2000 | UG/L | Trichloroethene | 310 | 5 |
| | Groundwater | SS06-MW10 | 10/04/2000 | UG/L | Trichloroethene | 220 | 5 |
| | Groundwater | SS06-MW15 | 10/04/2000 | UG/L | Trichloroethene | 85 | 5 |
| | Groundwater | SS06-MW09 | 10/04/2000 | UG/L | Trichloroethene | 73 | 5 |
| | Groundwater | SS06-MW18 | 10/04/2000 | UG/L | Trichloroethene | 15 | 5 |
| | Groundwater | SS06-MW10 | 10/04/2000 | UG/L | Vinyl chloride | 12 | 2 |
| SS-009 | | | | | | | |
| | Groundwater | SS09-MW03 | 10/05/2000 | UG/L | 1,1-Dichloroethene | 49 | 7 |
| | Groundwater | SS09-MW03 | 10/05/2000 | UG/L | Cis-1,2-Dichloroethene | 200 | 70 |
| | Groundwater | SS09-MW03 | 10/05/2000 | UG/L | Tetrachloroethylene | 21 | 5 |
| | Groundwater | SS09-MW03 | 10/05/2000 | UG/L | Trichloroethene | 24 | 5 |
| | Groundwater | SS09-MW03 | 10/05/2000 | UG/L | Vinyl chloride | 66 | 2 |
| ST-005 | | | | | | | |
| | Groundwater | ST05-MW018 | 10/10/2000 | UG/L | Trichloroethene | 1200 | 5 |
| | Groundwater | ST05-MW014 | 10/06/2000 | UG/L | Trichloroethene | 180 | 5 |
| | Groundwater | ST05-MW03 | 10/10/2000 | UG/L | Trichloroethene | 180 | 5 |
| | Groundwater | ST05-MW012 | 10/06/2000 | UG/L | Trichloroethene | 84 | 5 |
| | Groundwater | ST05-MW013 | 10/06/2000 | UG/L | Trichloroethene | 13 | 5 |
| | Groundwater | ST05-MW020 | 10/10/2000 | UG/L | Trichloroethene | 12 | 5 |
| | Groundwater | ST05-MW010 | 10/10/2000 | UG/L | Trichloroethene | 81 | 5 |
| | Groundwater | ST05-MW021 | 10/10/2000 | UG/L | Trichloroethene | 69 | 5 |
| | Groundwater | ST05-MW022 | 10/10/2000 | UG/L | Trichloroethene | 57 | 5 |

Qualifier Description

J = The analyte was positively identified, the quantitation is an estimate

F = The analyte was positively identified but the associated numerical value is below the reporting limit (RL)

B = The analyte was found in an associated blank, as well as in the sample

M = A matrix effect was present

Table 4: Natural Attenuation Indicator Parameters in Groundwater at Richards-Gebaur AFB - October 2000

| Well ID | Chloride (ppm) | Nitrate (ppm) | Alkalinity (ppm) | TDS (ppm) | Sulfate (ppm) | Iron, ferrous (ppm) | Methane (ppb) | Ethane (ppb) | Ethene (ppb) | DO (ppm) | PH | Conductivity (umhos/cm) | TOC (ppm) | Carbon Dioxide (ppb) |
|-------------|----------------|---------------|------------------|-----------|---------------|---------------------|---------------|--------------|--------------|----------|------|-------------------------|-----------|----------------------|
| CS04-MW-003 | 25.44 | 0.06 F | 440 | 483 B | 37.22 | 0.5 U | 29.2 | 0.20 U | 0.32 F | 1.45 | 6.89 | 0.698 | 3.1 | 194,000 B |
| CS04-MW-007 | 33.46 | 0.02 U | 540 | 601 B | 31.8 | 0.5 U | 28.1 | 0.19 U | 0.21 F | 2.23 | 7.00 | 0.707 | 2.49 | 134,000 B |
| SS03-MW-004 | 54.74 | 1.787 | 270 | 434 | 24.8 J | 0.5 U | 0.17 F | 0.24 U | 0.24 U | 9.00 | 7.42 | 0.545 | 2.42 J | 38,300 |
| SS03-MW-008 | 10.08 | 0.622 | 190 | 130 | 104.4 | 0.5 U | 0.09 U | 0.18 U | 0.18 U | 6.34 | 7.31 | 0.499 | 1.29 | 21,400 |
| SS06-MW-018 | 260.45 | 1.729 M | 230 | 1533 | 85 M | 0.5 U | 0.19 F | 0.18 U | 0.19 U | 5.07 | 7.22 | 1.590 | 1.86 | 21,700 |
| SS06-MW-005 | 243.15 M | 0.815 | 270 | 757 | 90.15 | 0.5 U | 0.14 U | 0.19 U | 0.20 F | 4.37 | 7.13 | 1.080 | 2.03 | 22,800 |
| SS09-MW-003 | 62.06 | 0.059 | 570 | 994 | 214.1 | 0.5 U | 25.5 | 0.26 U | 0.27 U | 1.67 | 7.58 | 1.510 | 5.86 | 41,300 |
| SS09-MW-008 | 22.21 | 0.031 F | 240 | 472 B | 146.5 | 0.5 U | 51.1 | 0.18 U | 0.19 U | 5.50 | 7.56 | 0.660 | 3.52 | 14,200 |
| ST05-MW-019 | 37.34 M | 0.02 U | 530 | 591 | 11.2 | 0.5 U | 498 J | 1.56 | 0.19 U | 1.13 | 7.51 | 0.671 | 4.16 | 38,500 B |
| ST05-MW-003 | 15.27 | 3.4 F | 260 | 422 B | 90.65 | 0.5 U | 0.1 U | 0.2 U | 0.2 U | NA | 7.8 | 0.460 | 1.07 | 10,100 B |

Qualifier Description.

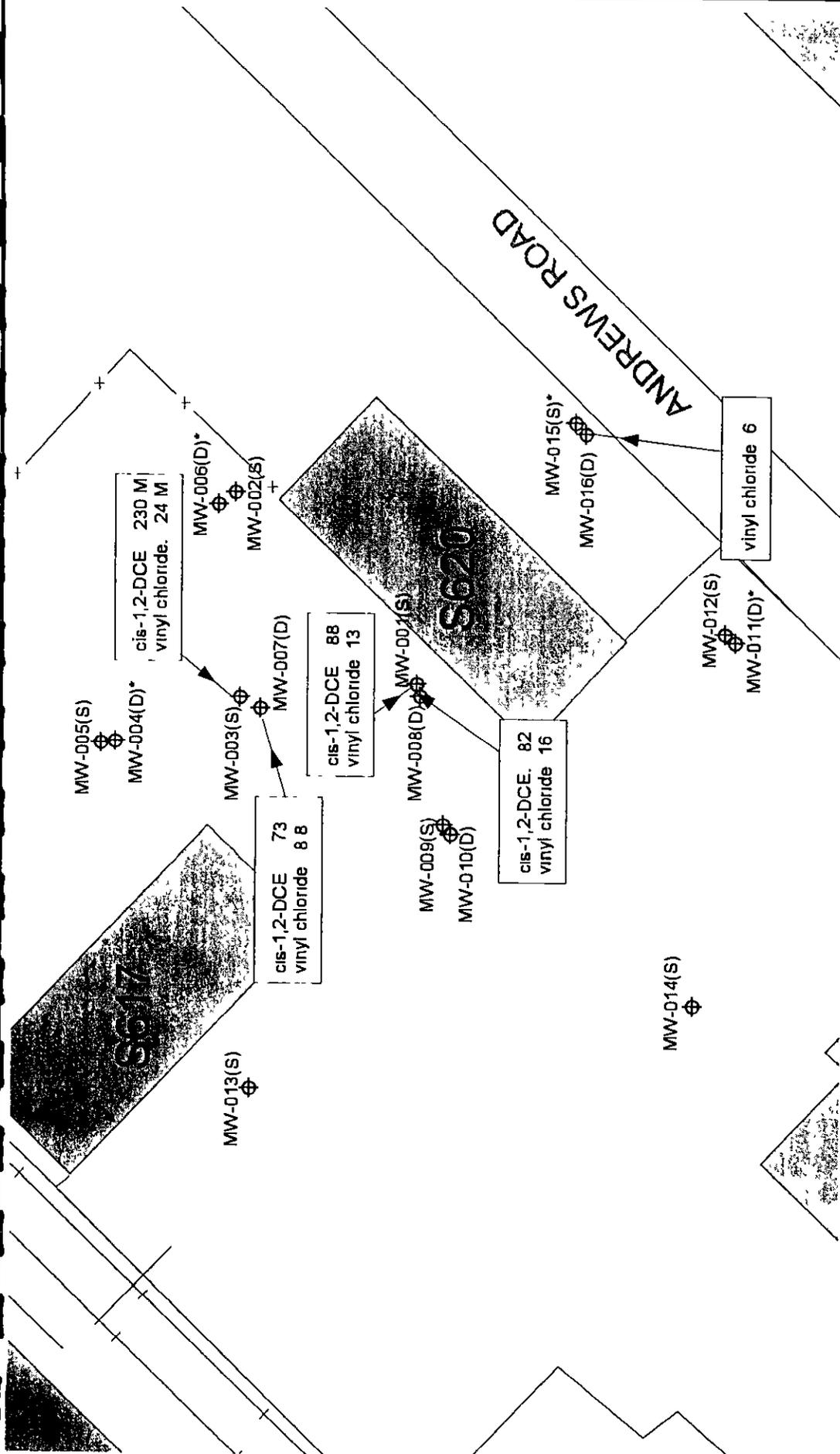
J = The analyte was positively identified, the quantitation is an estimate.

F = The analyte was positively identified but the associated numerical value is below the reporting limit (RL)

B = The analyte was found in an associated blank, as well as in the sample.

M = A matrix effect was present.

U = The analyte was not detected above the method detection limit (MDL).



CH2MHILL **FIGURE 1**

CS 004 - UST 620 A
 COCs > Tier I Screening Levels
 (October, 2000)
 Richards - Gebaur AFB, Kansas City, MO

LEGEND

- Monitoring Well Location
- Chemical Concentration in ppb
- Building Number
- Existing Building and Structure
- Well Not Sampled

vinyl chloride 6
 S620
 S620
 *

80 0 80 160 Feet



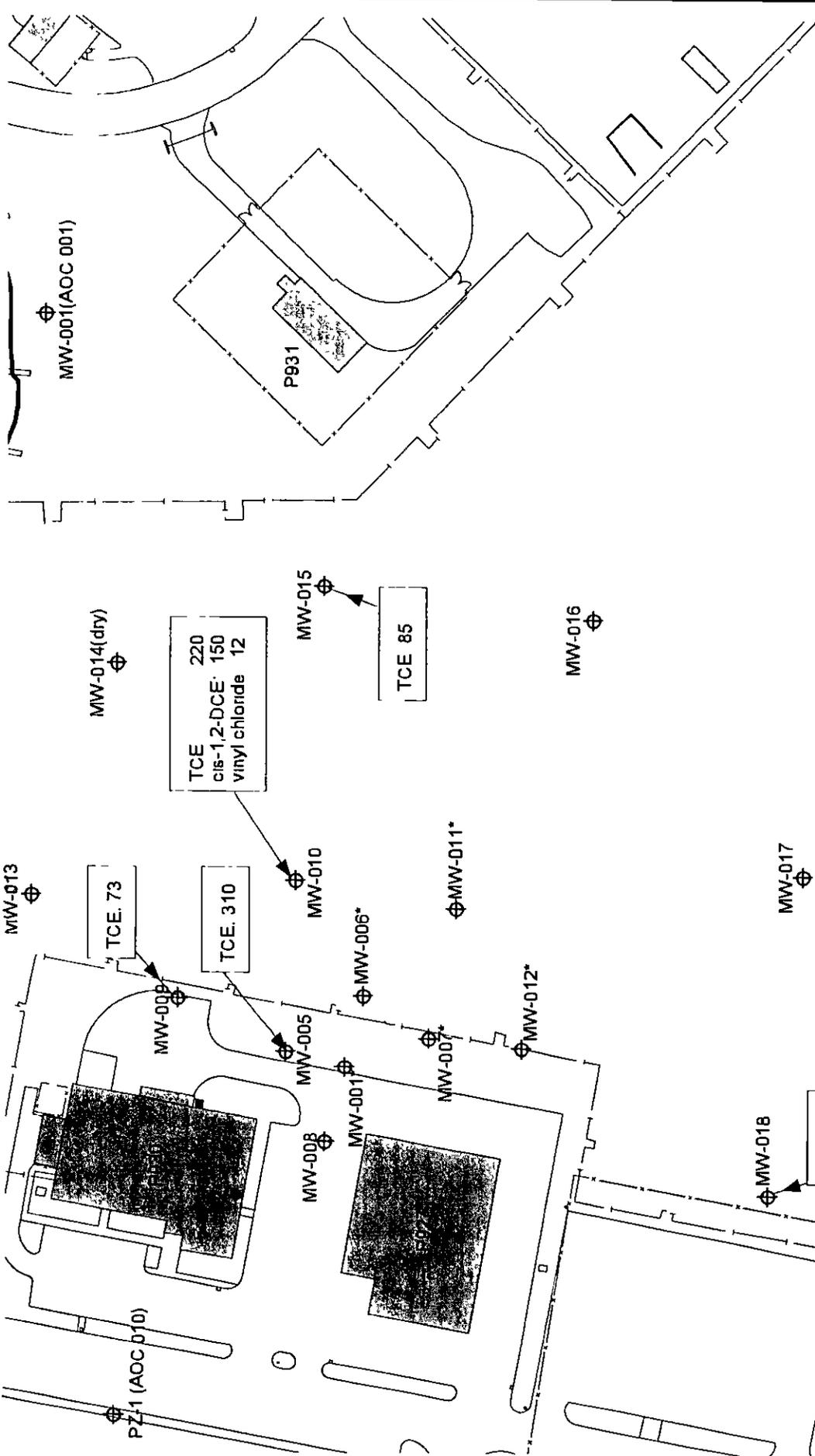
CH2MHILL **FIGURE 2**

SS 003 - Oil Saturated Area
 COC > Tier I Screening Level
 (October, 2000)
 Richards - Gebarur AFB, Kansas City, MO



LEGEND

- ⊕ Monitoring Well Location
- TCE 58 Chemical Concentration in ppb
- P704 Building Number
- P704 Existing Building and Structure
- * Well Not Sampled



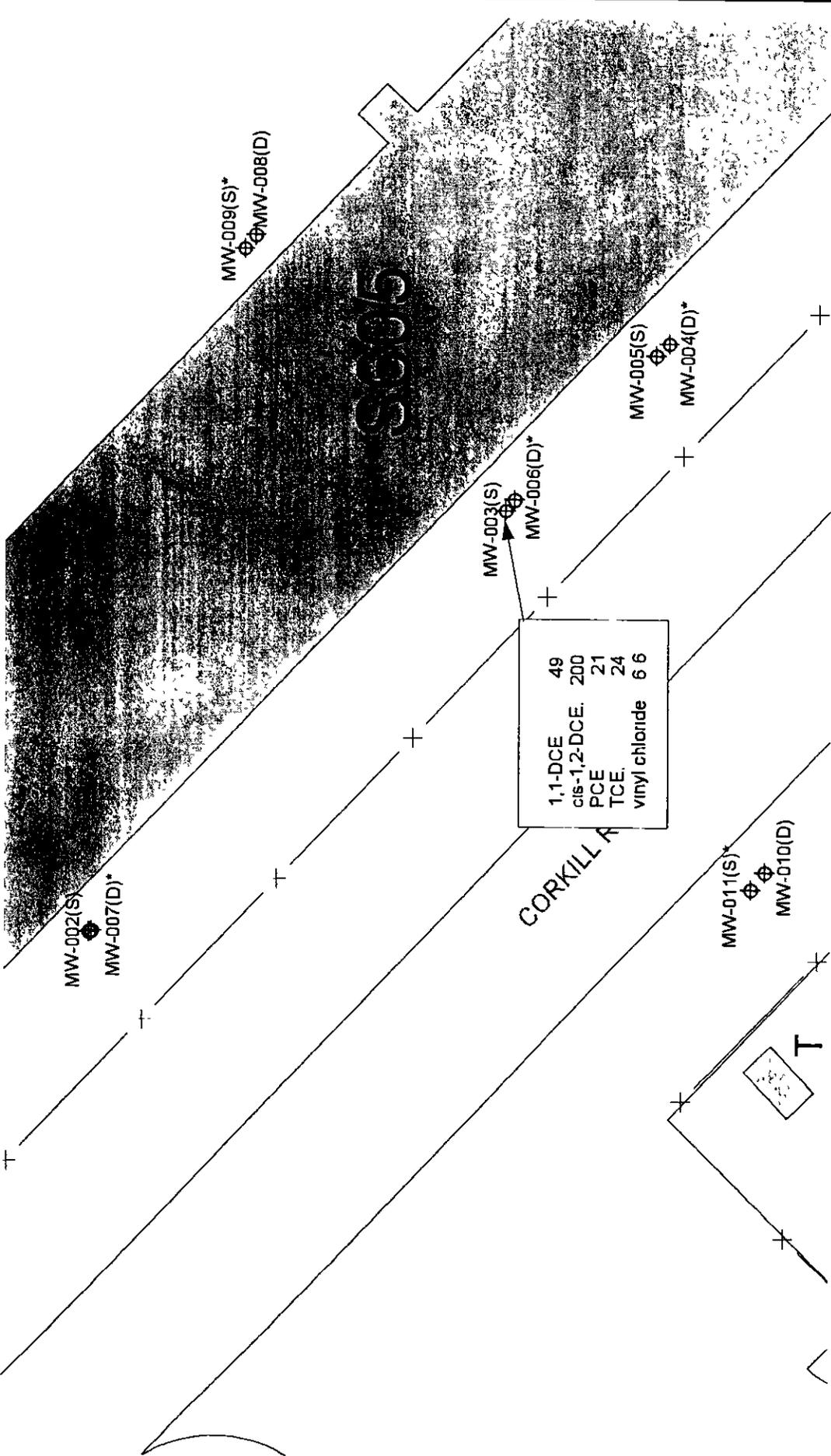
CH2MHILL FIGURE 3

SS 006 - Hazardous Material Storage Area
 COCs > Tier I Screening Levels
 (October, 2000)
 Richards - Gebaur AFB, Kansas City, MO



LEGEND

- Monitoring Well Location
- TCE 85
- Chemical Concentration in ppb
- Building Number
- Existing Building and Structure
- Well Not Sampled



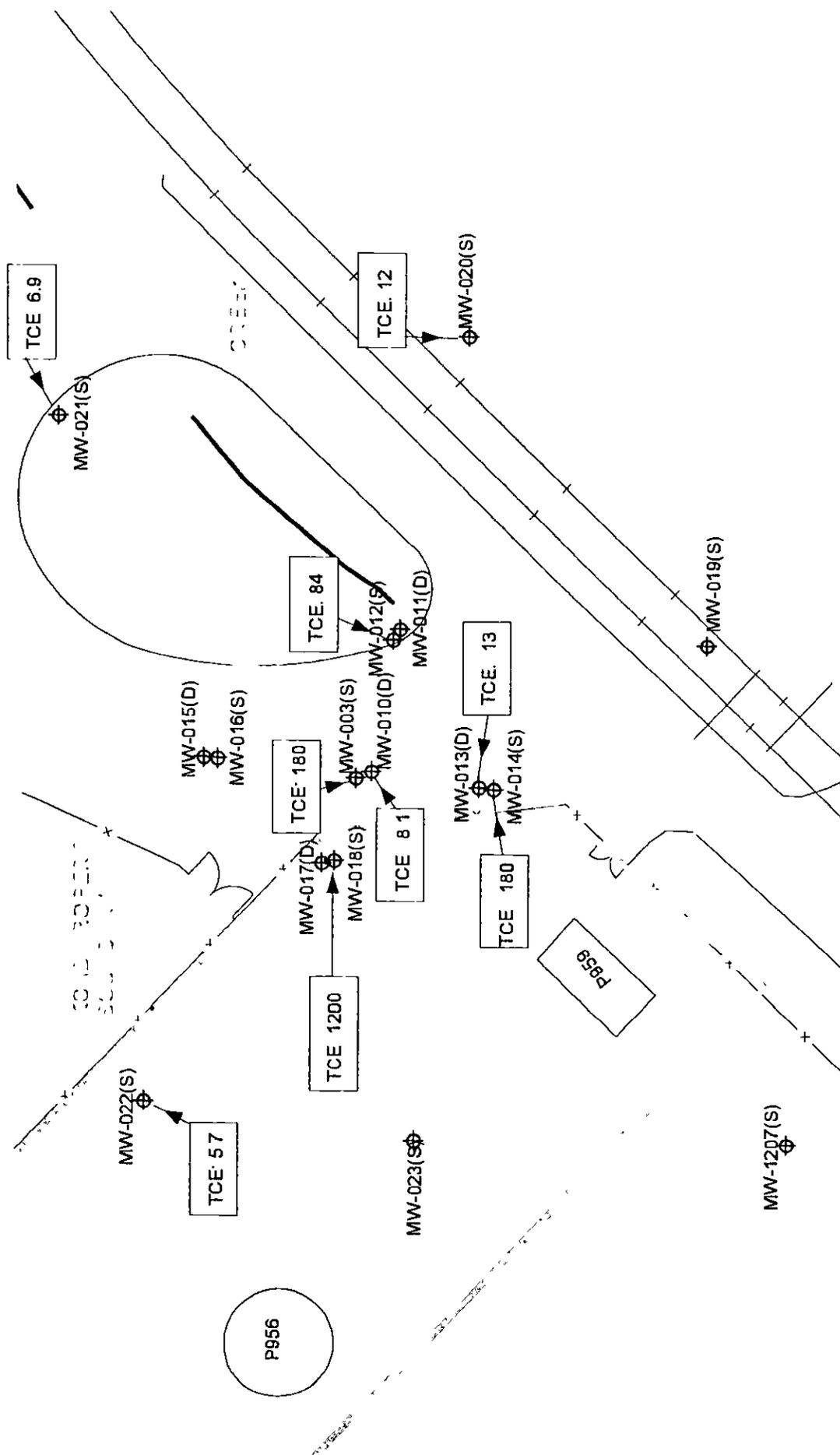
| | |
|----------------|-----|
| 1,1-DCE | 49 |
| cis-1,2-DCE | 200 |
| PCE | 21 |
| TCE | 24 |
| vinyl chloride | 6.6 |

CH2MHILL **FIGURE 4**

SS 009 - Fire Valve Area
 COCs > Tier I Screening Levels
 (October, 2000)
 Richards - Gebaur AFB, Kansas City, MO

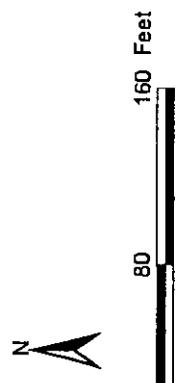


- LEGEND**
- ⊕ Monitoring Well Location
 - ☐ TCE 24
 - ☐ S605 Chemical Concentration in ppb
 - ☐ S605 Building Number
 - ☐ S605 Existing Building and Structure
 - * Well Not Sampled



CH2MHILL **FIGURE 5**

ST 005 - POL Storage Yard
 COC > Tier I Screening Level
 (October, 2000)
 Richards - Gebaur AFB, Kansas City, MO



- LEGEND**
- ⊕ Monitoring Well Location
 - TCE 13 Chemical Concentration in ppb
 - P859 Building Number
 - P859 Demolished Building or Structure